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Learning by Exporting Under Fast, Short-term Changes: The Moderating Role of Absorptive Capacity and Foreign Collaborative Agreements

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Abstract

What are the consequences for innovation of fast, short-term changes in exporting activity? Building on the learning by exporting literature and using a sample of 880 Italian manufacturing firms over two successive time periods, our study reveals key asymmetries. First, a rapid *increase* in export breadth, but not in export depth, reduces the firm's probability of developing new innovative outputs. Second, no such effects are found in the case of a *decrease* in firms' exporting activity. Third, both absorptive capacity and foreign collaborative agreements facilitate the absorption of the shock occurring when firms experience a rapid increase in export breadth, but not when the rapid increase takes place in export depth. Theoretical and managerial implications emerge from this research.

Key words: *Learning by Exporting; Product Innovation; Absorptive Capacity; Collaborative Agreements.*

1. Introduction

It is widely recognized that exporting and innovation are two interrelated phenomena, driven and influenced by the generation and absorption of knowledge (Cassiman & Golovko, 2011; Esteve-Perez & Rodriguez, 2013; Ganotakis & Love, 2011; Golovko & Valentini, 2011, 2014; Love & Ganotakis, 2013; Love & Roper, 2015). Firms that export are able to gain access to advanced foreign knowledge that, if assimilated effectively, can significantly enhance a firm's *ex-post* innovation (e.g. Golovko & Valentini, 2011; Kafouros, Buckley, Sharp, & Wang, 2008; Love & Ganotakis, 2013; Salomon & Shaver, 2005). This phenomenon of knowledge assimilation from exporting, is known as learning by exporting (hereafter LBE) (Garcia, Avella, & Fernandez, 2012; Love & Ganotakis, 2013; Love & Roper, 2015; Salomon & Jin, 2010).

Existing studies in the area of LBE have made some important contributions regarding how, or under what conditions, international strategy through exporting can enhance a firm's innovative or overall performance (Chang & Chung, 2017). However, despite arguments that internationalization is a dynamic phenomenon (Casillas & Moreno-Menendez, 2014; Mohr & Batsakis, 2017) that can take "different directions and involve different timelines" (Hotho, Lyles, & Easterby-Smith, 2015: p. 91), other than efforts that looked at how starting or stopping exporting activities influences LBE (Love & Ganotakis, 2013), research on the temporal dimension of firms' exporting strategy remains limited (Chiva, Ghauri, & Alegre, 2014; Hotho el al., 2015).

Significant attention has been paid to the time that it takes until a firm starts to export (Autio, Sapienza, & Almeida, 2000; Jones and Coviello, 2005; Kuivalainen, Sundqvist, & Servais, 2007; Meschi, Richard, & Moore, 2017; Sapienza, Autio, George, & Zahra, 2006), whereas the speed of a firm's subsequent export strategy has largely been neglected (Casillas & Acedo, 2013; Coviello, McDougall, & Oviatt, 2011; Fernández-Mesa & Alegre, 2015; Villar, Alegre, & Pla-Barber, 2014). Furthermore, the small number of studies that look at post-entry export speed focus mostly on its determinants (e.g. Hilmersson, Johanson, Lundberg, & Papaioannou, 2017; Hutzschenreuter, Kleindienst, Guenther, & Hammes, 2016), while research on the consequences of speed remains scarce and concentrates principally on general performance effects such as survival, growth and profitability (Hilmersson & Johanson, 2016; Mohr & Batsakis, 2017; Sapienza et al., 2006; Zhou & Wu, 2014). This is despite arguments that changes within firms exporting strategy can occur a long time after the initial entry and that post-entry speed can be critical for firms' ability to successfully assimilate foreign knowledge and reach high levels of innovative performance (Casillas, Moreno, Acedo, Gallego, & Ramos, 2009; Mejri & Umemoto, 2010; Prashantam, 2005; Prashantham & Young, 2011). In this study we address these gaps and our first research purpose is to examine

whether, after initial entry, a rapid short-term change in firms' exporting strategy affects their ability to successfully assimilate knowledge from foreign markets and hence innovate (Casillas, Moreno, & Acedo, 2012; Hilmersson & Johanson, 2016).

Previous literature has acknowledged that firms possessing a greater level of absorptive capacity (internal R&D intensity) are able to learn from foreign markets (Alcácer & Chung, 2011), integrate external knowledge more effectively into organizational routines (Silva, Afonso, & Africano, 2012; Zahra, Ireland, & Hitt, 2000) and, therefore, achieve higher levels of innovative performance (Caloghirou, Kastelli, & Tsakanikas, 2004; Garcia et al., 2012). Learning from foreign markets is suggested to be also influenced by the formation of formal collaborative agreements (Hsieh, Ganotakis, Kafouros, & Wang, 2018). Foreign partners can provide firms with information, advise and support that help them to assimilate knowledge for the development of new products/processes (Belderbos, Carree, & Lokshin, 2004; Erkelens, Van den Hooff, Huysman, & Vlaar, 2015; Hsieh et al., 2018; Tether, 2002; Tsai, 2009; van Beers & Zand, 2014). However, we know very little whether these learning mechanisms still stand in the case of a rapid short-term change in a firm's level of exporting. Therefore, our second research purpose is to analyze whether the firm's level of absorptive capacity and the presence of existing foreign collaborative agreements moderate the learning by exporting relationship when a rapid short-term change occurs in their exporting strategy.

Using a sample of 880 Italian manufacturing firms over two successive time periods, we aim at contributing to the LBE literature within the context of organizational learning (Chiva et al., 2014; Hotho et al., 2015; İpek 2019). Organizational learning theorists have widely acknowledged that when firms experience *continuous* changes within a certain activity, their learning can be impaired. It further postulates that this occurs mainly as a result of the limited time that managers have available to first comprehend a new situation and second to successfully assimilate the routines needed in order to respond to the new external conditions (Huber, 1991; Levitt & March, 1988). By building theoretical arguments (and by testing empirically) we find that firms' ability to learn is not only adversely affected when *consecutive* changes in a certain activity take place, but also when a *single, fast, short-term* strategic change occurs over a specific time period. We also find important asymmetries that arise when firms experience rapid changes in exporting. First, a rapid *increase* in the number of export markets, but not in export intensity, reduces the firm's probability of developing innovative outputs. Second, a rapid *decrease* in the number of export markets does not lead to any effect on innovation. Moreover, following the rapid, short-term change in exporting strategy argument, we offer evidence on the moderating role that specific learning mechanisms

(occurring through absorptive capacity and the presence of previous foreign collaborative agreements) play on the firms' ability to develop new innovative outputs (Bapuji & Crossan, 2004; Dodgson, 1993; Huber, 1991).

We therefore explicitly address three of the research gaps highlighted by İpek (2019) in a recent review of organizational learning in the context of exporting. The first is the need for more analysis of the dynamics and time dimension of organizational learning in exporting, rather than the cross-sectional research typically carried out. The second is an increased emphasis on the effects rather than antecedents of learning by exporting, and specifically on the links between organizational learning, exporting and product innovation. And the third is providing more evidence on the indirect associations between organizational learning in an exporting context and its effects through the inclusion of appropriate moderating variables.

2. Theoretical Framework

Theoretically LBE has its roots in organizational learning theory (hereafter OLT) (e.g. Huber, 1991; Levitt & March, 1988; Nooteboom, 1999) which suggests that firms learn from their activities leading to changes in organizational practices, routines and structures (Nieto & Santamaria, 2007).

Once a firm starts to export, it gains experience about carrying out business in foreign environments which results in the establishment of new mechanisms and routines that are put in place in order to support the exporting process. These routines are important in order for a firm to be able to deal with issues related to liability of foreignness and network outsidership (Casillas & Acedo, 2013; Hilmersson & Johanson, 2016; Johanson & Vahlne, 2009). For example, firms will need to adapt their structure and their way of working by creating new mechanisms in order to be able to accommodate changes in customer demands and to facilitate knowledge transfer (Tse, Yu, & Zhu, 2017) about language, culture, social and business practices (Birkinshaw, 2002; Lahiri, 2010). Changes in routines and the subsequent introduction of new ones are more likely to materialise and be diffused to a greater extent within an organization if export markets are more important for a firm, such as in situations where a firm is a persistent exporter, has a greater level of sales deriving from exporting or it exports to a larger number of markets (Andersson & Lööf, 2009).

However, a rapid expansion into export markets might not allow for the appropriate adoption and adaptation of the organizational routines required for the effective absorption of foreign knowledge. This is because the establishment of new organizational routines requires assimilation time in order for those to be properly integrated within a firm's organizational structure (Huber, 1991; Jian, Beamish, & Makino, 2014; Levitt & March, 1988).

Furthermore, a rapid expansion in a firm's exporting activity could lead to a higher volume of information received from the external environment which might easily stretch a firm's processing capacity beyond its limit. In combination, these two issues might force managers to make ineffective decisions that can lead to lower levels of innovation performance (Hashai, Kafouros, & Buckley, 2018; Klarner & Raisch, 2013; Mohr & Batsakis, 2017).

The OLT further suggests that apart from learning from experience, firms can also learn through internal resources such as, for example, through internal R&D or by carrying out focused activities (i.e., forming inter-organizational agreements) (Bapuji & Crossan, 2004; Dodgson, 1993; Erkelens et al., 2015; Huber, 1991). Internal R&D can assist firms not only in identifying and assimilating knowledge that exists in the external environment, but also in developing new knowledge (Bapuji & Crossan, 2004). This is because it helps defining a firm's cognitive map (frame of reference) or otherwise its interpretation system that in turn determines the level of knowledge that firms can assimilate from their external environment (Cohen & Levinthal, 1990; Huber, 1991; Levitt & March, 1988; Parkhe, 1991). Similarly, focused activities that take place in foreign markets (including the formation of collaborating agreements with foreign partners) can help firms identify, concentrate on and understand the types of knowledge that can complement a firm's internal effort and potentially add more value (Erkelens et al., 2015; Hsieh et al., 2018; van Beers & Zand, 2014).

In addition, firms that form collaborating agreements establish mechanisms and routines in order to support a working platform and coordination processes, creating a shared context to effectively facilitate knowledge transfer (Rothaermel & Deeds, 2006; Sampson, 2005). These complex, highly embedded and knowledge-sharing routines influence transaction costs and ultimately a firm's ability to manage knowledge transfer across firm boundaries (Jiang, Beamish, & Makino, 2014; Kogut & Zander, 1993; Rothaermel & Deeds, 2006) contributing to the firms competitive advantage (Katila & Ahuja, 2002; March, 1991; Zollo & Winter, 2002).

The OLT therefore provides the theoretical base upon which we set the hypotheses on organizational learning, innovation and internationalization included in this study. In the next section we develop an initial hypothesis on the expected learning by exporting relationship (across the different dimensions of export depth and breadth) which serves as a reference for our subsequent hypotheses on the effect of a short-term rapid change in firms exporting strategy on the probability of developing new innovative outputs. Finally, we discuss and hypothesize around the potential moderating role that the firms' level of absorptive capacity and the presence of previous foreign collaborative agreements can play on the learning by exporting relationship when a rapid short-term change occurs in their exporting strategy.

3. Hypotheses Development

3.1 Learning-by-exporting

Exporting ought to be positively linked to innovation. First, by definition, LBE is about learning[1] and innovation embodies a learning outcome: accessing the information and knowledge stocks of trading partners should therefore manifest itself in improved product innovation (Love & Ganotakis, 2013). This is because exporters gain access to information concerning customer needs and receive feedback regarding what they expect from products (Salomon & Shaver, 2005). Firms may also obtain information regarding technological advancements that can be directly applied in the development of new products but also information regarding new or improved product designs and methods of production (Zahra et al., 2000). Finally, exporters can also benefit from production advice embedded in product specifications (Joshi & Sharma, 2004). The different types of information collected in foreign markets may then be incorporated into their knowledge base and applied in their product development process (Salomon & Shaver, 2005).

This LBE effect may be linked not merely to whether or not the firm exports, but also to the intensity (depth) and diversity (breadth) of its exporting operations. Depth in exporting provides opportunities to earn improved margins (Love & Ganotakis, 2013), providing greater incentives to invest in innovation (Aw, Roberts, & Xu, 2008; Salomon & Shaver, 2005). Hitt, Hoskisson and Kim (1997) pointed out that internationalization not only allows firms to enrich their sources of knowledge, but also provides the opportunity to access a greater flow of new ideas from external sources from a greater number of markets, as well as from a wide range of cultural and institutional settings. Breadth in export markets, therefore, exposes firms to more diverse national knowledge bases which allow them to assimilate complementary information from countries that specialise in various scientific and technological domains something that increases the likelihood of making more valuable knowledge combinations (Andersson & Lööf, 2009; Filipescu, Prashantham, Rialp, & Rialp, 2013).

Indeed, existing studies suggest that being able to access knowledge from a wide range of international markets can be beneficial in improving innovation. For example, Smeets & Warzynski (2013) find that for Danish firms, exporting to more distant OECD economies is more strongly associated with productivity than exporting to neighbouring or other EU countries, which may be at least in part due to a learning effect. More generally, Kafouros et al. (2008) demonstrate that a high degree of internationalization improves innovation by positively affecting firm-level innovative capacity and appropriability. They found that only firms with a sufficient degree of

[1] Learning is the process through which organizations change and modify their knowledge and, as a result, maintain or improve their performance (Brown & Duguid, 1991; Huber, 1991).

internationalization – those active in many markets – are able to successfully capture the fruits of innovation. Overall, operating in different markets should enable a flow of diverse types of information not only about the changing needs and requirements of customers (Kafouros et al., 2008), but also about the different types of technological expertise and knowledge that reside there. This in turn enables firms to select and modify the best mix of technology and production methods in order to meet the future expectations of both domestic and foreign based customers (Eriksson, Johanson, Majkgard, & Sharma, 2000).

In addition, the ability of firms to successfully absorb knowledge from foreign markets has been suggested to also depend on a firm's export depth or intensity (Andersson & Lööf, 2009; Tse et al., 2017; Love & Máñez, 2019). Firms that have a greater percentage of their sales derived from exporting are more committed to foreign markets. This makes them more likely to identify and take advantage of new developments and opportunities that can arise there, but also interact and exchange knowledge not only with a greater number of foreign customers and agents, but also at a greater extent, while adopting a more sophisticated supporting structure to enable that (Andersson & Lööf, 2009; Filipescu et al., 2013; Silva et al., 2012). This leads to our first set of hypotheses:

H1a: A positive relationship exists between exporting (in terms of intensity) and the likelihood of innovation in subsequent periods.

H1b: A positive relationship exists between exporting (in terms of the number of exporting countries) and the likelihood of innovation in subsequent periods.

3.2 Rapid export change (increase and decrease) and learning

With regards to how fast firms internationalize and the consequences of that, most of the empirical evidence is carried out in the context of foreign direct investment, and it tends to consider the effects on performance measures such as profitability or productivity (Casillas & Acedo, 2013; Hilmersson et al., 2017; Hutzschenreuter et al., 2016). However, we still know very little about how speed of internationalization via exporting affects the ability of the firm's subsequent innovation.

In line with the stage-based or incremental internationalization perspective (Johanson & Vahlne, 1977, 1990, 2003) that emphasizes experiential knowledge as being critical to a firm's selection of foreign markets, how to enter markets, and the speed to reach those markets (Casillas et al., 2009), we see post-entry export decisions as a cumulative and path dependent process which suggests a gradual and incremental approach (Eriksson et al., 2000; Johanson & Vahlne, 1990, 2003) in order to produce positive learning effects on innovation. This raises the question of whether the speed at

which a firm expands the breadth and depth of its exporting affects its LBE, either positively or negatively.

Although rapid market entry may provide benefits such as first-mover advantage (Mohr & Batsakis, 2017), there are both internal and external reasons to expect rapid change in internationalization to have a detrimental effect on learning from exporting and hence on innovation.

Internally, rapid internationalization may strain the capacity of a firm to assess and absorb new knowledge, and ultimately to effectively apply that knowledge to its new product development effort (Love, Roper, & Vahter, 2014; Rothaermel & Deeds, 2006). Since limited managerial resources constrain firm growth rates (Penrose, 1959), over-reaching the limited capacity of the firm's management by rapid expansion in exporting volume or depth may make it difficult for the firm to fully absorb all the available knowledge coming from the new markets. With rapid internationalization firms may experience problems of knowledge use and diseconomies of time compression (Jiang et al., 2014) – the inefficiencies occurring when things are done quickly – which means that as the time allowed to develop a competence shortens, the costs of developing competences exponentially increase (Dierickx & Cool, 1989). This in turn might lead to reduced LBE and ultimately to a lower capacity to innovate (Hilmersson & Johanson, 2016; Mohr & Batsakis, 2017). In addition, if the number of markets that a firm exports to or the export intensity increase at a rapid rate, over a short period of time firms will be exposed to a more diverse range of knowledge types (derived from different countries and systems of innovation) or to a higher volume of knowledge (Hseih et al., 2017; van Beers & Zand, 2014). In such cases inefficiencies can arise in regards to the development and integration of those routines needed to be adopted in order for the successful accumulation of knowledge to take place. This is because managers will be less able to turn experiences into routines, assimilate those within the organization, and develop capabilities to accompany them (Hilmersson & Johanson, 2016; Mohr & Batsakis, 2017).

Just as learning has a time dimension, so does useful unlearning (or conscious forgetting[2]). Whether regarded as a resource, a capability or merely a process (İpek 2019), the capacity of an organization to unlearn and discard obsolete knowledge and routines forms an important element of organizational adaptation and learning via exporting. For example, Casillas et al. (2010) demonstrate that unlearning previously useful knowledge and routines is a useful mediator between a firm's intention to begin exporting and the exploration of new knowledge for internationalization. The importance of unlearning for product innovation is demonstrated by Akgün et al. (2006);

[2] The difference between organizational unlearning and organizational forgetting is discussed by Klammer and Gueldenberg (2019).

however, the possible time dimension of this process has been relatively little researched (Klammer and Gueldenberg, 2019).

Externally, the firm may struggle to make the necessary relationships with suitable foreign channels and networks and build up the optimal level of market and technological knowledge in a new location. These are time consuming processes that may be compromised by rapid growth (Casillas & Moreno-Menéndez, 2014). As a result, the quality of new knowledge available to the firm may be sub-optimal, again leading to less of the useful knowledge on customers and technology on which learning by export depends.

Indeed, a few studies have indicated that possible problems can arise because of a fast expansion in exporting activities. For instance, by using very detailed data on Argentine exports at the firm-destination-year level, Albornoz, Calvo Pardo, Corcos and Ornelas (2012) hint at possible problems with the pattern that export expansion may take. They found that firms that do not drop out of exporting early tend to increase both the range of markets to which they export and the intensity with which they do so. As indicated in hypotheses 1 above, this access to new markets and sources of information should help improve innovation. But Albornoz et al. (2012) also found that this intensive and extensive growth effect does not apply to firms that start exporting simultaneously to multiple markets, suggesting that rapidly moving into a number of new markets is difficult to sustain in exporting terms. This is because firms exporting in increasingly diverse markets or increasing their export intensity have to deal with a large volume of new and dissimilar information. When this expansion occurs rapidly, this information volume may exceed the organization's cognitive limits and/or capacity to process information effectively (Huber, 1991). Firms can thus experience a hampered learning process with a subsequent negative effect on their innovation effort. Our expectation is therefore that firms exporting quickly, in a short period of time, to multiple new markets or increasing their export intensity and so experiencing abnormal changes in market diversification and volume of foreign sales, will undergo a negative effect on their learning process, and thus on their innovation output (Ganotakis & Love, 2012). We therefore hypothesize:

H2a: A rapid increase in the intensity of firm exports will have a negative effect on the likelihood of innovation.

H2b: A rapid increase in the number of countries to which a firm exports will have a negative effect on the likelihood of innovation.

Almost all the literature on internationalization speed examines only the effects of rapid *increase* in aspects of internationalization (e.g. Casillas & Acedo, 2013; Hilmersson & Johanson, 2016; Hilmersson et al., 2017; Hutzschenreuter et al., 2016; Mohr & Batsakis, 2017). The underlying assumption of such analysis, to the extent that the issue is considered at all, appears to be that speed of *decrease* in internationalization is symmetrical to that of speed of increase in its effect on firm performance. This in turn implies that any negative effects on LBE and hence on innovation from rapid increases in export (market) growth would be offset by equal and opposite positive effects of rapid reductions in the levels of internationalization. However, this appears never to have been tested empirically and there are conceptual reasons for doubting whether this symmetry would in fact occur. Indeed, there are good reasons for expecting asymmetry in terms of learning and unlearning effects of speed of export expansion and of export reduction.

Taken together, hypotheses 1 and 2 above suggest that there is a trade-off in rapid export expansion: firms rapidly gain knowledge from new markets, but their ability to successfully turn this into LBE may be compromised by issues of knowledge absorption, time compression diseconomies, difficulties in the rapid development and integration of knowledge assimilation routines. But equally rapid de-internationalization may not result in an equal and opposite effect: this is because of hysteresis, the tendency for effects to persist after the initial causes giving rise to the effects are removed. This is especially evident in firm-level exporting activity. For example, Impullitti, Irarrazabal and Opromolla (2013) showed that the presence of sunk export entry costs gives rise to hysteresis in export market participation. A firm will enter into the export market once it achieves a given size, reflecting its efficiency, but may keep exporting even after its efficiency has fallen below its initial entry level.

This can also apply when a firm reduces its exporting presence across different dimensions. For instance, while a rapid withdrawal from a number of markets may mean that knowledge gained from operating in those markets is retained at least in the short term, it is unlikely that the problems of assimilating knowledge and developing suitable routines will rapidly diminish as the number of export markets rapidly declines. In particular, it takes time to unlearn routines which have begun to take root in terms of exporting activity (Casillas et al., 2009; 2010), and reallocating resources away from market expansion and back towards innovation cannot occur instantaneously. Even where a firm decides to pause the expansion to new markets in order to devote resources to absorbing the knowledge that has already been gained from previous expansion, there will inevitably be a period of adjustment and unlearning of exporting related routines as the knowledge absorption process takes place. Moreover, if the period of stability in export activities is too short, managers will not

have the time to learn from past exporting experience, or if it is too long, inertia will arise in the sense that managers might forget prior exporting routines which can reduce a firm's learning effectiveness when re-entering foreign markets (Klarner & Raisch, 2013). For these reasons we expect the effect of a rapid increase and that of a rapid fall in the level of internationalization to have asymmetric effects on LBE and hence on innovation[3]:

H3a: A rapid decrease in the intensity of firm exports will have no effect on the likelihood of innovation.

H3b: A rapid decrease in the number of countries to which a firm exports will have no effect on the likelihood of innovation.

3.3 Moderating effects of absorptive capacity and foreign collaboration

As mentioned in the development of hypothesis 2a, while a rapid growth in the number of markets and export intensity may help firms to extend their range of learning about language, culture, social and business practice (Birkinshaw, 2002; Lahiri, 2010) as well as foreign based technological and marketing knowledge, it may also lead to difficulties in absorbing such external knowledge (Yeoh, 2004). This can be partially caused by managerial capacity and costs as well as information processing difficulties associated with absorbing knowledge at a fast rate (Hilmersson & Johanson, 2016; Schmidt & Sofka, 2009).

Nevertheless, firms are heterogeneous in their ownership of internal but also in their external resources and capabilities (Barney, 1991), and LBE is also expected to be affected by firms' heterogeneous resource endowments (Garcia et al., 2012). For instance, once ventures begin operating intensively outside their borders, knowledge derived from external partners such as suppliers, users, and customers has been identified as one of the most important means by which internationalizing firms recognize opportunities (Casillas & Acedo, 2013; Casillas et al., 2009; Johanson & Kalinic, 2016; Silva et al., 2012) and gain foreign market knowledge (Erkelens et al., 2015; Hsieh et al., 2018; Miotti & Sachwald, 2003; Tether & Tajar, 2008; van Beers & Zand, 2014).

Evidence also suggests that previously acquired skills can serve as a platform into other markets and that the ability to innovate rests on the recombination of such set of previous capabilities (Zander & Kogut, 1995: p. 87). Therefore, by leveraging upon previous foreign collaboration

[3] Note that our null hypothesis in Hypotheses 3a and 3b implies that there is no nontrivial effect, as opposed to a *nil* hypothesis i.e. one in which the value to be nullified is precisely zero. For a further discussion of this point, and the relative unimportance of nil hypotheses in management research, see Cashen and Geiger (2004).

agreements, firms that experience rapid change across different export dimensions, should be able to reduce time compression diseconomies as well as information overload and managerial capacity issues allowing management to take more efficient decisions. In addition, the existence of mechanisms designed to implement foreign collaborations and the transfer of knowledge (Hsieh et al., 2018) can reduce the need for introducing new routines during a period of rapid internationalization as firms can use those existing mechanisms for knowledge transmission, reducing therefore costs and managerial burden.

However, "the international generation of knowledge requires also extensive R&D efforts to be carried out internally" (Castellani & Zanfei, 2007: p. 161). Along those lines Yeoh (2004) observed that unless the company knows how to deploy the learning it has acquired, the spillovers gained from internationalization activities may not necessarily translate into greater profits for the company. Internal firm capabilities, such as R&D intensity, and the technological cognitive maps that a firm possesses can affect its ability to scan, identify and absorb the types of knowledge that can be of most value (Cohen & Levinthal, 1990; Garcia et al., 2012; Love & Ganotakis, 2013; Zahra & George, 2002). For instance, Aw et al. (2008) predicted that the learning effect is dependent on a positive interaction with R&D, an investment made to absorb and assimilate knowledge from overseas contacts. Burpitt and Rondinelli (2000) argued that firms with a greater learning orientation will be more likely to intend to continue or further expand exporting.

Our expectation therefore is that not all exporters are equally equipped to enter multiple markets or to effectively absorb more intense knowledge when they experience rapid growth in exporting. Therefore, we hypothesize that firms that possess greater absorptive capacity (e.g. Cohen & Levinthal, 1990; Zahra & George, 2002) before the increase in exporting activities and have previous foreign collaborations (e.g. Zander & Kogut, 1995) should obtain greater benefits when short term rapid internationalization takes place. This is because such firms should be able to understand and decode foreign knowledge more quickly, something that reduces issues related to information overload and limited managerial capacity, whilst also reducing the need for the development of additional organizational routines for the transfer of knowledge. Therefore, having high levels of internal knowledge or experience in setting foreign collaboration agreements serve as a set of capabilities (Hilmersson & Johanson, 2016) to implement a learning platform that can potentially moderate (alleviate) the organization's cognitive limits and absorb the difficulties in knowledge transferring in case of rapid change in post-entry export expansion. We therefore hypothesize:

H4a: Firm-level absorptive capacity moderates (alleviates) the negative effect of rapid export growth on subsequent innovation.

H4b: Foreign collaboration moderates (alleviates) the negative effect of rapid export growth on subsequent innovation.

4. Data and Methodology

4.1 Data

The basis of our empirical investigation are two waves (ninth and tenth) of the Italian 'Survey of Manufacturing Firms' collected by Capitalia (now UniCredit, the largest Italian bank by assets). The surveys took place in 2004 and 2007 (the data refers to the end of 2003 and 2006 respectively) thus permitting a time lag between the dependent and independent variables to be incorporated in the analysis. The data, collected by the bank via questionnaire, is based on a stratified random sample of manufacturing firms with more than 10 employees. Out of all firms, 880 firms were common to both waves of the dataset (2001-2003 and 2004-2006). The reliability of the data was verified in a number of ways. First, the answers that respondents gave were matched with the firms' financial reports at the bank. Second, survey responses were further triangulated with data held by the AIDA database (part of the Bureau Van Dijk) and the CEBI database (originally set up by the Association of Italian Chambers of Commerce). This triangulating procedure increased data reliability and overcame the methodological limitations of using self-reported surveys. Third, these datasets have been used by previous scholars (e.g. D'Angelo, Majocchi, & Buck, 2016; Laursen, Masciarelli, & Prencipe, 2012; Hall, Lotti, & Mairesse, 2009), confirming the advantages of archival data claimed by Barnes, Dang, Leavitt, Guarana and Uhlmann (2018) for micro-organizational research.

4.2 Variables and Measures

Dependent variable: We capture the outcome of learning by taking into account whether a firm introduced a significantly improved or radical new product into the market from the start of 2004 until the end of 2006, i.e. the tenth wave of the survey. This is an established measure of innovation (e.g. Golovko & Valentini, 2014; Roper & Arvanitis, 2012; Roper, Du, & Love, 2008).

The LBE effect is about the "effective flow, absorption, and conversion of subsequent knowledge that is acquired from exporting" (Tse et al., 2017: p. 2119). Indeed, a number of studies covering different time periods and countries have found evidence of a positive link running from exporting to innovation at the firm level (Bratti & Felice, 2012; Damijan, Kostevc, & Polanec,

2010; Golovko & Valentini, 2011; 2014; Love & Ganotakis, 2013; Salomon & Shaver, 2005; Salomon & Jin, 2008, 2010; Tse et al., 2017).

Independent variables: All independent variables come from the ninth wave of the survey, i.e. 2001-2003. We measure a firm's exporting activity at the end of 2003 across a number of dimensions: (1) whether a firm has exported – a measure of export propensity (Lopez-Rodriguez & Garcia-Rodriguez, 2005; Nassimbeni, 2001); (2) percentage of sales from exporting – a measure of export intensity (Gemunden, 1991; Ganotakis & Love, 2012); and (3) number of countries that a firm exports to – a measure of export breadth (Lu & Beamish, 2001; Zahra & George, 2002; Oh, 2009).

With reference to the change variables, we adopt the measure of speed as used in physics where speed is defined as an object's change of position over a specific period of time. Along those lines, we define speed of exporting as the degree of change in a firm's exporting activity over a certain period of time (Casillas & Acedo, 2013; Hilmersson & Johanson, 2016). More specifically, we measure the speed of change across the different dimensions of exporting (intensity and breadth) by considering the relative change over a three-year period (e.g. the difference between breadth in 2006 and 2003 divided by breadth in 2003; the difference between export intensity in 2006 and 2003 divided by export intensity in 2003)[4]. In this study we concentrate on short-term speed for several reasons. First, previous studies have measured the increase in internationalization by considering, for instance, the number of countries that a firm exports to, or the number of countries where a firm has set up foreign subsidiaries at a specific point in time, divided by the years since a firm's first international expansion took place, or since the firm's incorporation date (Johanson & Kalinic, 2016; Hilmersson & Johanson, 2016; Mohr & Batsakis, 2017). These average measures assume that internationalization is a constant process. However, firms do not internationalize at a constant speed because episodes of instability, de-internationalization and retraction might occur (Benito & Welsh, 1997; Benito, Petersen, & Welsh, 2009; Love & Ganotakis, 2013) over a short time period.

Second, we use a relative measure of speed given that the speed by which a firm increases either the number of export countries or the intensity of export sales depends on its past market, institutional and general internationalization knowledge (Casillas & Moreno-Menendez, 2014; Eriksson, Johanson, Majkgard, & Sharma, 1997). Unlike the first two types of knowledge, internationalization knowledge is transferable from country to country, reducing therefore not only

[4] For the 5% of companies that started exporting in 2003 we used the value of 0.1 for the two exporting dimensions in 2003. Please note that results in their entirety remain the same when absolute growth (the difference between breadth in 2006 and 2003 and the difference between export intensity in 2006 and 2003) is used instead.

the need for further learning but also the costs of new market entry. Firms that export to a larger number of countries before a further increase in country breadth takes place, have been found to possess a higher level of internationalization experience, which allows for an easier market expansion in relation to firms that export to a smaller number of countries (Casillas & Moreno-Menendez, 2014; Hilmersson & Johanson, 2016).

Similarly, firms with considerable levels of export intensity possess higher levels of country specific market and institutional knowledge. Those types of knowledge allow firms to restructure capabilities (Zander & Kogut, 1995) that assist in the identification of opportunities that, in turn, can lead to an easier increase in the levels of export intensity (Johanson & Kalinic, 2016; Yeoh, 2004). Firms that are able to recognize opportunities and exploit them, are also more likely to accelerate their internationalization process (Casillas & Moreno-Menendez, 2014). Given therefore that the existing levels of export breadth and intensity can play a role in future expansion levels, it is important to take those into account and therefore focus on the relative change across those dimensions.

Third, given that change can be positive or negative (increase or decrease in exporting strategy), we created two different variables for each direction of change and for each dimension of exporting. For instance, for the case of change in export markets, we created an initial variable that captures increase in the number of markets. This variable assumes positive values when an increase in export markets takes place and zero for no change or for the case of negative change. A second variable captures decrease in the number of export markets. It takes negative values when a decrease takes place and zero for the case of an increase or when no change takes place. By including both those variables in the same model we are able to estimate the effect that positive or negative change has on the probability to innovate in relation to no change taking place.

Moderating variables: We measure a firm's absorptive capacity by considering the level of internal R&D over the volume of sales at the end of 2003 (Cohen & Levinthal, 1990; Ganotakis & Love, 2012; Tsai, 2001), and the presence of foreign collaboration by using a dummy variable depending on whether a firm has formed foreign collaborations or not (Hsieh et al., 2018), again at the end of 2003.

Control variables: In order to clearly identify learning by exporting effects more effectively, we control for other than exporting methods through which firms can gain knowledge from foreign markets. These include whether firms have production facilities abroad, whether they have acquired foreign patents, whether they have purchased technical services from foreign firms, whether they are foreign owned and finally whether a firm received governmental support for exporting. In

addition, we control for whether a firm started to export in 2006 (i.e. did not export in 2003, but did in 2006), whether a firm was a consistent exporter between 2003 and 2006 and finally whether a firm stopped exporting in 2006 (but was exporting in 2003). We account for those scenarios in all the models that include the change in exporting activities. We do so in order to control more effectively for the state of firms' exporting activity at the beginning of the change period because firms, under each one of those scenarios, face a different set of difficulties in regards to their exporting effort (Love & Ganotakis, 2013). For instance, firms that start to export have to deal with more challenges and higher levels of uncertainty and therefore with a higher liability of foreignness (Zaheer, 1995). Such firms will therefore need more time to absorb and use market, institutional and general internationalization knowledge (Eriksson et al., 1997, 2000; Vermeulen & Barkema, 2002). On the other hand, evidence suggests that a firm with consistent presence in foreign markets might find it easier to reconfigure its capabilities in order to take advantage of international opportunities (Hilmersson & Johanson, 2016); whilst a complete exit from exporting, will deprive a firm from access to foreign based knowledge (Love & Ganotakis, 2013).

Finally, we control for a range of a firm's internal and external factors that can have an effect on its innovative performance. These include the level of external R&D intensity, whether a firm introduced a new process for the development of products, the amount of expenditure allocated to training specifically for the development of new products divided by the level of sales, and finally expenditure in new equipment divided by the number of employees. All those variables have 2003 as their reference year. Table 1 presents a summary of the definitions of the variables used together with their descriptive statistics, whereas the correlations between the main variables are provided in Table 2.

****Insert Table 1 and 2 here****

4.3 Methods

We adopt a number of Probit models in order to estimate the effect that each variable has on the probability of developing an innovative product. Probit models have been used in a number of papers that estimate the probability of firms commercializing innovative products (e.g. Pellegrino & Savona, 2017; Roper & Hewitt-Dundas, 2017). In addition, because we test two pairs of asymmetric hypotheses (2a, 2b, 3a and 3b), in the models that examine change in exporting activities we include two variables that capture an increase and then a decrease in the number of export markets or export intensity. No change across those two exporting dimensions is kept as the base category. This

approach (spline regression) has been used in a number of studies (Davis et al., 2019; Harris and Bromiley, 2007; Kuusela et al., 2017; Mishina et al., 2010) that investigate asymmetric hypotheses of this type (albeit within a different context) and examine whether the slope of a regression line differs above and below a certain threshold.

At this stage we have to acknowledge and take into account the issue of endogeneity that can arise, because of the possibility of unobserved variables affecting both firms' exporting activity as well as their innovative effort (Love & Ganotakis, 2013). Despite using lags for all independent variables we still need to test for whether endogeneity is present in the models (Chang & Chung, 2017). We did so by carrying out a number of Smith-Blundell tests for each exporting dimension, after identifying two appropriate (both theoretically and econometrically) instruments. Although a Smith-Blundell test is similar to a Hausmann test, it is more appropriate in our case because it takes into account the non-linear nature of our dependent variable (whether a firm has introduced an innovative product) and hence unlike a Hausman test, there is no need to make an assumption about the distribution of the error term of the dependent variable (Baum, 1999; Grogger, 1990). This type of endogeneity test has been used in a number of studies that examine the relationship between exporting and innovation, especially in cases where probit (or tobit) models were used (Ganotakis and Love, 2011 Harris and Li, 2008; Love and Ganotakis, 2013).

The first instrument that we considered corresponds to whether a firm used accounting, transport and insurance services abroad and the second on whether a firm used IT applications such as emails, the internet and whether it has a website (excluding for e-commerce activities). Both of those variables are related to the potential endogenous variables that capture exporting activity while they are not expected to have any effect on firms' innovative performance. The usage of transport and insurance services abroad can improve the ease with which firms transfer products to a foreign country, whereas accounting services allows firms to gain a better understanding of taxation issues abroad, reducing therefore uncertainty regarding anticipated profits.

The second instrument, the usage of the aforementioned IT applications, can also assist firms' exporting effort by increasing awareness about a firm and its products to foreign customers and by enabling communication when it comes to resolving order related enquires. However, both of those variables are not expected to directly lead to the development of innovative products because the information received through the usage of such foreign services and IT applications is not of a detailed technological or commercial nature that can be used for the development of innovative products.

The endogeneity tests showed that across all cases we were unable to reject the initial

hypothesis of exogeneity. In more detail, the Smith-Blundell tests were as follows: (1) whether firms exported (p-value = 0.524), (2) export intensity (p-value = 0.517), (3) number of export markets (p-value = 0.417). Hence, simple Probit models rather than an instrumental variables technique were used.

Finally, in order to test the suitability of those instruments, we followed recent suggestions (Semadeni et al., 2014) and carried out over-identification, under-identification as well as weak instrument tests. In all those models, the instruments passed the aforementioned tests[5].

5. Results

Table 3 presents the models in which we examine the effect that different dimensions of firms' exporting have on their ability to introduce innovative products in the market.

****Insert Table 3 here****

In Model 1, we consider whether firms were exporters or not, in Model 2 and 3 we consider the percentage of sales from exporting and the number (breadth) of export markets respectively. We first find that whether firms export (Model 1) increases the chances of developing an innovative product in a subsequent period. In addition and in line with hypotheses 1a and 1b, both the depth or intensity measured by the percentage of sales from exporting (Model 2) and the breadth in export markets (Model 3) are positive and significant (all at the 5% level).

****Insert Table 4 here****

Table 4 presents the results regarding how the change in firms' exporting strategy, across the two dimensions considered in this study, affect their innovation performance. In Model 4 we include the results regarding the change in export intensity, and in Model 5 those for the change in the number of markets. We include two variables for change, one that captures *increase* (positive

[5] For the over-identification test that investigates whether the instruments are valid/exogenous (uncorrelated with the error term) the null hypothesis of valid instruments was not rejected for all cases (p-values: 0.3211, 0.1752 and 0.1749). The null hypothesis of the under-identification test, on whether the instruments are not correlated with the potentially endogenous regressors was rejected for all those models (p-value 0.00 for all cases). Finally, the hypothesis of weak instruments (weak identification test) was rejected at all critical values for the models concerning the number of export markets and percentage of sales from exports, whereas for the case of the model that includes the dummy variable of whether a firm has exported, the weak instruments hypothesis was rejected up to the critical value that corresponds to the 10% level.

change) and a second for *decrease* (negative change). Overall, results across the models provide support for hypotheses 2b but not for hypothesis 2a. A rapid increase in the number of markets (H2b) significantly reduces the probability of innovating (at the 1% level). On the other hand, an increase in the percentage of sales from exporting (H2a) does not appear to significantly reduce the probability of innovation. Finally, neither of the variables that capture the decrease across the two different exporting dimensions have a significant effect on a firm's innovative performance, providing support for hypothesis 3a and 3b. There is thus marked asymmetry in the effects of rapid increase and rapid decrease in exporting on subsequent innovation.

In Table 5 and 6, we present the models in which we examine how the relationship that exists between an increase in firms' export activity (across different dimensions) and innovative performance changes depending on the firms' internal capabilities (internal R&D) and previous foreign collaborative agreements. Since we expect a decrease in exporting to have no effect on innovation (H3a and H3b), nor do we have any *a priori* reason to expect this to change depending on the firm's absorptive capacity, we do not test whether there are moderating effects on the impact of decreases in exporting. However, we kept controlling for this to estimate the effect that positive or negative change has on the probability to innovate in relation to no change taking place.

****Insert Table 5 and 6 here****

In Table 5, Model 6 presents the results for the increase in export intensity, and Model 7 for increase in breadth. As in Table 4, Model 7 of Table 5 shows that an increase in the number of markets reduces significantly the probability of a firm introducing an innovative product in a subsequent period. In addition, Model 7 shows that the negative effect that the increase in the number of markets has on the probability to innovate reduces (becomes smaller) as the level of internal R&D intensity increases (at the 5% level). Model 6 shows that, although the coefficients of the interaction between internal R&D and the increase in the percentage of sales are positive, they are non-significant. Our findings therefore provide some support for hypothesis 4a. Results specifically show that high levels of internal capabilities can alleviate the negative effects of a rapid increase in the number of markets. Therefore, hypothesis 4a is supported for the case of export breadth and only with reference to an *increase*. This means that existing internal capabilities allow firms to absorb the shock of a rapid increase in the number of export markets.

Finally, Table 6 presents the models that examine the interaction between a positive increase across the different dimensions of exporting and the presence of existing foreign collaborative

agreements. As for the case of absorptive capacity (internal R&D intensity), collaborating with foreign partners alleviates (lessens) (at the 10% level) the negative effect that a rapid increase in the number of export markets has on the probability to introduce an innovative product (Model 9). Nevertheless, it has no influence when a firm experiences an increase in export intensity (Model 8). Again therefore, hypothesis 4b is supported for the case of export breadth and only with reference to an *increase*.

Because we are using a non-linear model, some extra care is required when interpreting the interaction coefficients (Zelner, 2009). We therefore estimated marginal effects for the increase in the number of export markets and export intensity variables at different values of the two moderators. Results are presented in Figures 1 and 2 for the case of the number of export markets and Figures 3 and 4 for the case of export intensity. Figure 1 shows that at lower values of R&D intensity (up to the average R&D intensity in our sample of 0.75%), there is a negative and significant relationship between an increase in export markets and innovative performance[6]. It is also evident from Figure 1 that firms with an R&D intensity of between 1% and 6%, are able to alleviate this negative effect given that at those values, an increase in the number of export markets has no significant effect (negative or positive) on innovative performance. Finally, firms that have an R&D intensity of around 6% or more, are able to actually benefit from a rapid increase in the number of export markets (positive and significant relationship at the 10% level of significance[7]).

For the case of the second moderating variable, Figure 2 shows that firms that experience rapid increase in the number of foreign markets and have not formed collaborative agreements abroad are less likely to innovative at a subsequent period (1% level of significance). On the other hand, the formation of foreign collaborative agreements has a positive (albeit not significant) effect on innovative performance.

Finally, Figure 3 shows that across different values of R&D intensity, an increase in exporting intensity has no significant effect on innovative performance and Figure 4 shows that having formed foreign collaborative agreements prior to increasing export intensity, has no impact on innovative performance either.

Therefore, results from this additional exercise provide further support and are in line with the arguments that we present in the paper regarding how a firm's R&D intensity and the formation of foreign collaborating agreements change the effect that an increase in export activities (number of markets) has on innovative performance. Firms that have formed foreign collaborative agreements

[6] At the 1% significance level for R&D intensity values between 0% and 0.25%; and at the 5% significance level for R&D intensity values between 0.5% and 0.75%.
[7] p-values around 0.075 across all values of the R&D intensity variable of 6% and above.

and those with above average levels of R&D intensity are able to reduce (alleviate) the negative effect that a rapid increase in export markets has on innovative performance (significant negative effect becomes non-significant). Finally, some evidence exist that firms with very high levels of R&D intensity can actually benefit from a rapid increase in export markets.

****Insert Figures 1 and 2 here****

****Insert Figures 3 and 4 here****

6. Discussion

Building on the LBE literature rooted in the OLT, in this paper we examine organizational learning in the context of exporting (İpek, 2019) by looking at the relationship between a *single, fast, short-term* change firm's exporting strategy and innovation. We do so by putting emphasis on the temporal dimension of exporting (Casillas & Moreno-Menendez, 2014; Hilmersson & Johanson, 2016) and specifically by looking at how, after initial entry, short-term changes across different exporting dimensions may influence the firm's ability to learn and develop innovative products. Thus, emphasizing the *effects rather than the antecedents* of learning by exporting (İpek, 2019) we aim at contributing to the complex system relationship between organizational learning, innovation and internationalization (Chiva et al., 2014).

Our analysis shows that the speed by which firms increase the number of export markets in a short period of time exerts an adverse effect on the probability of innovating. However, a similar increase in export intensity does not influence the chances of innovating.

Generally, when a rapid increase in a firm's exporting activities takes place, unused resources are unlikely to suffice in order to address the demands of rapid internationalization. This in turn leads to diseconomies of time compression and a disproportionate rise in costs (Hilmersson & Johanson, 2016; Mohr & Batsakis, 2017). In addition, managers have less time available to develop and integrate the routines needed to absorb external knowledge, share that knowledge across different functions within the firm and integrate it with existing capabilities. Finally, under conditions of fast internationalization, managers need to make decisions quicker which gives rise to inefficiencies and suboptimal decision making (Mohr & Batsakis, 2017; Casillas & Acedo, 2013).

Our findings suggest that those issues become more prominent when an increase in the breadth of export markets takes place rather than for the case of export depth or intensity. We believe that this is because the negative consequences of speed are more likely to occur when firms have to deal with heterogeneous types of knowledge. In more detail, assimilating external knowledge into a

firm's internal product development process becomes more difficult when firms increase the number of export markets because they will have to integrate more diverse types of knowledge derived from different institutional and cultural environments, different regulations and customer preferences (Gunawan & Rose, 2014; Johanson & Kalinic, 2016). Therefore, when firms enter many countries over a short period of time, they are exposed to multiple and diverse challenges generated from increased levels of liability of foreignness (Casillas & Acedo, 2013; Hilmersson & Johanson, 2016) and outsidership (Johanson & Vahlne, 2009).

On the contrary, when firms increase their export intensity, on average, they tend to do so after they have accumulated a certain amount of experience in a certain market and therefore after the perception of risk about expanding exporting activities in that market is reduced (Eriksson et al., 2000; Johanson & Vahlne, 2003). This process is simpler in relation to when a rapid increase in the number of exporting markets takes place, because the increase in export sales, in the majority of the cases, tends to take place in markets that a firm already has a presence in. Although therefore firms still need to deal with an increase in the volume of information received over a short period of time, the type of information tends to be less complicated and more homogeneous. Indeed, in our study from those firms that increased their export intensity 54.5% did so in one country and a further 27.5% increased their export intensity in just two countries. Moreover, from those firms that experienced an increase in export intensity, 86.5% were consistent exporters (only 13.5% started to export). Finally, from the consistent exporters 52% increased their intensity in one market, 28% in two and 20% in three or more. Those statistics in combination show that in the vast majority of cases, firms tend to increase their intensity in markets that they have already exported to in a previous time period.

Our findings also suggest that, despite the negative consequences on innovation that firms with low levels of R&D intensity experience when they enter many countries over a short period of time, higher (above average) levels of R&D intensity allow firms to reduce these negative effects (Castellani & Zanfei, 2007).

This can be because managers of firms that possess high levels of knowledge are better in identifying the types of foreign knowledge that can potentially add more value to the firm (Garcia et al., 2012) and are able to integrate those more effectively into their new product development process (Kotabe, Jiang, & Murray, 2011). This in turn can reduce the disruption in the innovative process that can be caused from trying to incorporate a considerable amount of diverse technological knowledge, with the knowledge that a firm already possesses. Finally, very high

levels of R&D intensity, can allow firms to even benefit from a rapid increase in the number of export markets.

Furthermore, results showed that previous foreign collaboration agreements are also useful in alleviating the negative effects of a rapid increase in export markets. This can be because though the experience in establishing collaborative agreements firms can speed up the learning process about new customers, regulations, social and business practices (Birkinshaw, 2002; Hsieh et al., 2018; Lahiri, 2010). This can reduce managerial effort related to dealing with the increased levels of liability of foreignness (Casillas & Acedo, 2013; Hilmersson & Johanson, 2016), screening new opportunities, gaining access to new knowledge that resides abroad and incorporating this into the new product development process. These results highlight the importance of recognizing the indirect effect of moderating variables (absorptive capacity and foreign collaborative agreements) between organizational learning and innovation in an exporting context (İpek, 2019).

Moreover, it was found that a short term *decrease* in export breadth does not have a symmetric effect on a firm's innovative output in relation to the effect that an increase in export breadth has. We suggest that this is because of hysteresis effects in exporting, which means that while a rapid withdrawal from markets may allow a firm to retain knowledge gained from operating abroad at least in the short term, the problems of assimilating knowledge and developing suitable routines does not rapidly diminish or be quickly unlearned (Klammer & Gueldenberg, 2019) as the export activities rapidly decline. Removing the cause of an effect (e.g. a rapid decrease in international strategy through exporting) does not automatically reverse its effects. While hysteresis effects have been observed with respect to exporting previously, this is usually in the context of sunk costs, efficiency and market entry (Impullitti et al., 2013).

Finally, we found that firms that started to export as well as those that were consistent exporters were more likely to innovate at a subsequent period. On the other hand, completely stopping exporting activities did not appear, overall, to have an effect on innovative performance. These results suggest that when firms no longer export, not only do they lose access to foreign based knowledge (Love and Ganotakis, 2013) but also that the foreign knowledge that they possessed via previous exporting activities depreciates in value (over the period that we consider in this study). Moreover, despite prior arguments (Hilmersson & Johanson, 2016) that consistent exporters because of their experience should be more efficient in managing the assimilation of foreign knowledge in relation to de novo exporters, Wald tests showed that in 3 out of 6 models, de novo exporters are significantly more likely to innovate in relation to consistent exporters. A reason for this can be that on average, foreign knowledge is more novel (and therefore more useful in

developing new or significantly improved products) to firms that start to export in relation to consistent exporters that might have already been exposed to various forms of the same knowledge over a period of time.

7. Conclusions, implications and limitations

Firms are likely to access foreign knowledge when exporting (Ketterer, 2017). If this knowledge is effectively assimilated, it can significantly enhance *ex-post* innovation (e.g. Golovko & Valentini, 2011; Kafouros et al., 2008; Love & Ganotakis, 2013; Salomon & Shaver, 2005). This effect, also known as learning by exporting (LBE), has, however, rarely been considered under the temporal dimension of firms' exporting strategy (Hotho el al., 2015). Most of the literature on organizational learning in exporting has focused on the process of knowledge acquisition and learning during the pre-exporting phase or the initial phase of internationalization (Casillas et al., 2010; Casillas, Barbero, & Sapienza, 2015; D'Angelo & Presutti, 2019). In a recent review, İpek (2019) remarked that organizational learning, exporting and innovation are interrelated and should be studied contemporaneously due to the complexity of these relationships (Chiva et al., 2014).

After initial entry, a firm's subsequent export strategy may change and this may be critical for the firm's ability to successfully assimilate foreign knowledge and reach high levels of innovative outputs (Casillas et al., 2009; Mejri & Umemoto, 2010; Prashantam, 2005; Prashantham & Young, 2011). This last aspect has largely been neglected by extant literature (Casillas & Acedo, 2013; Coviello et al., 2011; Fernández-Mesa & Alegre, 2015; Villar, Alegre, & Pla-Barber, 2014). In this paper we have demonstrated the potentially compromising temporal effect of rapid short-term changes in exporting on the ability of firms to learn and thus innovate. While previous studies have established the connection between LBE and subsequent innovation (e.g. Golovko & Valentini, 2011, 2014; Love & Ganotakis, 2013), the effect that a *single, fast, short-term* strategic change in exporting can have on the dynamics of learning by exporting and product innovation has not previously been investigated. In this regard our study enriches OLT within the context of exporting (İpek, 2019) by developing the premise that it is not only continuous changes in a certain activity that can reduce a firm's ability to learn, as the theory implicitly assumes (Huber, 1991; Levitt & March, 1988), but that a firm's learning ability can also be impaired when firms experience a single, short-term and fast change in a certain activity. This reinforces the importance of studying firms' exporting strategy along a temporal dimension (Hotho el al., 2015).

Furthermore, our research reports the existence of important asymmetries that arise when firms experience rapid changes in exporting. First, a rapid *increase* in the number of export markets, but

not in export intensity, reduces the firm's probability of developing innovative outputs. Second, a rapid *decrease* in the number of export markets does not lead to the opposite effect (of a similar magnitude), in relation to the effect resulting from an equal increase in the number of markets. This aspect emphasizes the importance of studying the effects rather than the antecedents of learning by exporting when investigating the links between organizational learning, exporting and product innovation (İpek, 2019). Finally, we also find that both absorptive capacity and previous collaborative agreements helps firms to absorb the complexity arising when the number of markets rapidly increases. Previous studies reported that firms with high levels of export breadth have problems in dealing with more diverse types of cultures, customers, institutions and rules (Kafouros & Forsans, 2012; Zhang, Ko, & Lee, 2013). Our study supports earlier findings and reinforces the view of Eriksson et al. (1997) that firms are able to transfer general internationalization experiential knowledge and capabilities from country to country. This means that managers can use some of their existing mechanisms and routines (in the form of internal R&D and previous collaborative agreements) in order to deal with information overload issues arising when internationalizing through exporting, especially when they rapidly increase the number of countries they are present in a short period of time. In this regard our study provides evidence on the specific indirect organizational learning mechanisms (occurring through absorptive capacity and the presence of previous foreign collaborative agreements) affecting the links between exporting and product innovation (İpek, 2019) when a *single, fast, short-term* strategic change in exporting occurs in export breadth terms.

The managerial implications of this research arise principally from the findings on the effects of rapid short-term increases in export market breadth on innovation, and how to alleviate this. In a competitive environment where resource allocation is essential for firms' survival and growth, it is important to recognize that firms face a trade-off in terms of how quickly they want to expand their exporting activity and the negative consequences this may have for future innovation. In other words, how much are firms prepared to allow rapid increase in internationalization through exporting to blunt their capacity for innovation?

Equally important is the message that this trade-off can to some extent be alleviated by firms' investment in internal absorptive capacity, particularly internal R&D, and external foreign based collaborative agreements. The positive effect of internal R&D is well known in relation to its role for assimilation and absorption of outside knowledge (Cohen & Levithal, 1990). Our results indicate that this absorptive capacity effect has a further dimension, in moderating the negative effect of rapid short-term export markets expansive strategy on innovation. Furthermore, managers

can also alleviate this negative effect by leveraging experience in dealing with foreign-based partners who may provide additional skills in the knowledge assimilation process (Hsieh et al., 2018; van Beers & Zand, 2014) when exporting rapidly in different markets. Finally, our research gives another important message: firms and managers deciding for a rapid withdrawal, but not a complete exit from export markets, are able to keep the knowledge gained from operating abroad at least in the short term, as the latter does not rapidly diminish as the export activities promptly decline. This is particularly relevant in a time characterized by unsettling political and economic situations around the world (e.g., Trump's trade policy, Brexit, Italy's economic outlook). From a theoretical perspective, the possibility of an organization and its managers to unlearn and discard obsolete knowledge and routines is an important element of organizational adaptation and learning via exporting that deserves further investigations (Klammer & Gueldenberg, 2019), possibly along the time dimension of internationalization and in relation to entry modes other than exporting, as well as different geographic markets and sectors (Hashai, 2011; Ketterer, 2017).

As with all empirical research, our analysis is subject to a number of limitations. The data are obtained from firm-based surveys in a single country, and relate only to manufacturing establishments. Since Italy is a relatively large, open economy, it seems plausible that the results obtained from the analysis will be applicable to other, similar economies. The restriction to manufacturing may also have implications for the analysis. For example, there is evidence that service firms are able to reap performance benefits from internationalization earlier than manufacturing firms (Contractor, Kumar, & Kundo, 2007; Love, Roper, & Bryson, 2011), and specifically that service sector firms are able to experience of LBE effects on innovation at an earlier (entry) stage of the internationalization process than are manufacturing firms (Love and Mansury, 2009). Therefore, although learning by doing effects are more evident in labour intensive sectors, we cannot discount the possibility that service sector firms will also experience a significantly different effect of rapid export expansion or decline on their innovation performance, or that R&D and/or collaborative agreements will not have the moderating effect on this relationship found for manufacturing firms. Furthermore, while we have the benefit of a balanced firm-level dataset, our observations are restricted to two time periods. A lengthier panel of firms would allow us to examine in more detail the nature of the the learning by exporting relationship following a rapid short-term change in their exporting strategy, and to determine the time profile of this relationship. Additionally, bringing in the regionalization debate (e.g., Rugman & Verbeke, 2004) distinguishing regional *vs* global export intensity and/or export breadth could add additional insights to the theoretical framework of internationalization processes and LBE. Also, being able to

isolate the formation of new collaborative agreements in foreign markets and to distinguish whether they are in the same regional area could add insights to the organizational learning literature. Finally, as we have suggested that there is asymmetry in the effects of rapid increases and decreases in internationalisation strategy through exporting, these hysteresis effects in exporting should be further developed conceptually and tested empirically.

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Table 1 Summary statistics and variables description

Variable description	Mean	S.D.
Innovation variables		
Innovation performance – Whether a firm introduced a radically new or significantly improved product between 2004 and 2006 (0/1)	.663	.472
Exporting dimensions		
Exporting (0/1) – Whether a firm exported in 2003	.817	.386
Export intensity – Percentage of sales from exporting (%) at the end of 2003	36.1	30.5
Export breadth – Number of countries a firm exported to at the end of 2003	2.73	2.31
Start – Whether a firm doesn't export in 2003 but exports in 2006	.05	.218
Stop – Whether a firm exports in 2003 but doesn't in 2006	.122	.325
Consistent – Whether a firm exports in both 2003 and 2006	.693	.461
Change in export intensity – The difference between percentage of sales from exporting in 2006 and 2003 divided by percentage of export sales in 2003		
Increase in export intensity – Assumes positive values for the case of increase in export intensity and zero for the case of negative change and when no change takes place.	1.23	5.818
Decrease in export intensity – Assumes negative values for the case of decrease in export intensity and zero for the case of negative change and when no change takes place.	-0.157	0.322
Change in export breadth – The difference between the number of markets a firm exports to in 2006 and 2003 divided by the number of markets in 2003		
Increase in export breadth – Assumes positive values for the case of increase in export breadth and zero for the case of negative change and when no change takes place.	0.164	0.504
Decrease in export breadth – Assumes negative values for the case of decrease in export breadth and zero for the case of negative change and when no change takes place.	-0.289	0.367
Other international activities		
Foreign production – Whether a firm owned production facilities abroad in 2003 (0/1)	.091	.287
Foreign agreement – Whether a firm formed a foreign collaborative agreement in 2003 (0/1)	.197	.398
Foreign patent – Whether a firm purchased a patent from a foreign firm in 2003 (0/1)	.027	.162
Foreign services – Whether a firm purchased technological services from a foreign firm in 2003 (0/1)	.017	.129
Foreign owned – Whether a firm was foreign owned in 2003 (0/1)	.084	.278
Internal firm resources		
Internal R&D – Expenditure in internal R&D divided by the amount of sales at the end of 2003 (%)	.751	2.217
External R&D – Expenditure in external R&D divided by the amount of sales at the end of 2003 (%)	.021	0.188
Firm size – Number of employees at the end of 2003	177.4	371.34
Firm age – Number of years since incorporation at the end of 2003	33.22	21.14
Export assistance – Whether a firm received governmental assistance for exporting (0/1)	0.099	0.29
New process – Whether a firm introduced a process for new products at the end of 2003 (0/1)	0.073	0.348
Expenditure for training – Amount spent for the training of employees for the introduction of innovative products divided by amount of sales at the end of 2003 (%)	.333	1.171
Expenditure for equipment – Amount spent for the purchasing of equipment divided by amount of employees at the end of 2003 in thousands of euros (%)	7.223	12.7

Table 2 Correlations table for main exporting variables

	Product Innovation	Exporter	Percentage (%) of sales	Breadth (# of markets)	Increase % sales	Decrease % sales	Increase breadth	Decrease breadth	Start	Stop	Consistent
Product Innovation	1.000										
Exporter	0.132**	1.000									
Percentage (%) of sales	0.107**	0.562**	1.000								
Breadth (# of markets)	0.148**	0.575**	0.575**	1.000							
Increase % sales	0.034	-0.270**	-0.225**	-0.190**	1.000						
Decrease % sales	-0.012	-0.254**	-0.007	-0.058	0.115**	1.000					
Increase breadth	0.009	-0.231**	-0.156**	-0.231**	0.622**	0.148**	1.000				
Decrease breadth	-0.074	-0.421**	-0.241**	-0.529**	0.158**	0.582**	0.306**	1.000			
Start	0.029	-0.488**	-0.274**	-0.279**	0.610**	0.124**	0.614**	0.205	1.000		
Stop	0.009	0.175**	-0.044	0.009	-0.079*	-0.673**	-0.120**	-0.584**	-0.086*	1.000	
Consistent	0.105**	0.714**	0.512**	0.480**	-0.172**	0.398**	-0.113**	0.051	-0.349**	-0.555**	1.000

Note: Significance level (** p<0.01, * p<0.05)

Table 3 Learning effects across different dimensions of exporting

VARIABLES	Model 1	Model 2	Model 3
Exporter (0/1)	0.151**		
	(0.0720)		
H1a: Percentage of sales		0.00170**	
		(0.000809)	
H1b: Number of markets			0.0230**
			(0.0107)
Internal R&D	0.023*	0.019*	0.017*
	(0.013)	(0.011)	(0.009)
External R&D	0.004*	0.004	0.004
	(0.003)	(0.0026)	(0.0026)
Foreign production	0.0953	0.108	0.109
	(0.0782)	(0.0766)	(0.0772)
Foreign agreement	0.0229	0.0452	0.0311
	(0.0545)	(0.0512)	(0.0530)
Foreign owned	-0.148	-0.181	-0.153
	(0.111)	(0.110)	(0.111)
Foreign patent	0.142	0.148	0.142
	(0.103)	(0.0991)	(0.107)
Foreign services	0.136	0.149	0.124
	(0.118)	(0.113)	(0.124)
Firm size	9.34e-05	0.000114	8.16e-05
	(0.000143)	(0.000142)	(0.000140)
Firm age	-0.000872	-0.000847	-0.00101
	(0.00109)	(0.00110)	(0.00111)
New process	0.513***	0.511***	0.506***
	(0.0351)	(0.0350)	(0.0355)
Expenditure for training	0.027	0.021	0.022
	(0.025)	(0.026)	(0.025)
Expenditure for equipment	3.04e-06*	2.39e-06*	3.14e-06*
	(1.89e-06)	(1.87e-06)	(1.84e-06)
Export assistance	-0.0523	-0.0535	-0.0525
	(0.0742)	(0.0747)	(0.0753)
Log-Likelihood/R square	-215.08 / 30.21%	-215.02 / 30.09%	-213.59 / 29.87%
Observations	481	480	476

Note: standard errors in parentheses, coefficients are marginal effects (*** p<0.01, ** p<0.05, * p<0.1)

Table 4 Change across different dimensions of exporting

VARIABLES	Model 4	Model 5
H2a: Increase in percentage of sales	-0.00561	
	(0.00663)	
H3a: Decrease in percentage of sales	0.0608	
	(0.147)	
H2b: Increase in number of markets		-0.164***
		(0.0606)
H3b: Decrease in number of markets		0.00426
		(0.0927)
Start	0.198*	0.245***
	(0.0657)	(0.0384)
Stop	0.208	0.175
	(0.0886)	(0.0813)
Consistent	0.160*	0.172*
	(0.0890)	(0.0961)
Internal R&D	0.022**	0.019*
	(0.011)	(0.01)
External R&D	0.0034	0.0037
	(0.0025)	(0.0024)
Foreign production	0.0742	0.0685
	(0.0833)	(0.0846)
Foreign agreement	0.0164	0.0169
	(0.0546)	(0.0555)
Foreign owned	-0.165	-0.161
	(0.113)	(0.115)
Foreign patent	0.167	0.179
	(0.0926)	(0.0891)
Foreign services	0.166	0.152
	(0.0997)	(0.112)
Firm size	0.000136	0.000155
	(0.000148)	(0.000152)
Firm age	-0.000779	-0.000635
	(0.00113)	(0.00113)
New process	0.506***	0.513***
	(0.0359)	(0.0355)
Expenditure for training	0.023	0.021
	(0.024)	(0.024)
Expenditure for equipment	4.03e-06**	3.97e-06*
	(2.00e-06)	(2.09e-06)
Export assistance	-0.0678	-0.0806
	(0.0743)	(0.0757)
Log-Likelihood / R square	-206.3 / 32.51%	-202.18 / 33.11%
Observations	477	472

Note: Standard errors in parentheses, coefficients are marginal effects (*** p<0.01, ** p<0.05, * p<0.1)

Table 5 Moderating effect of internal R&D on change

VARIABLES	Model 6	Model 7
Increase in percentage of sales	-0.00652	
	(0.00648)	
Decrease in percentage of sales	0.0476	
	(0.148)	
Increase in number of markets		-0.195***
		(0.0626)
Decrease in number of markets		0.00187
		(0.0912)
H4a: Internal RD x Increase in percentage of sales	0.0069	
	(0.008)	
H4a: Internal RD x Increase in number of markets		0.105**
		(0.046)
Start	0.197*	0.241***
	(0.0665)	(0.0367)
Stop	0.203	0.172
	(0.0920)	(0.0789)
Consistent	0.159*	0.178**
	(0.0892)	(0.0961)
Internal R&D	0.019*	0.016*
	(0.011)	(0.009)
External R&D	0.0034	0.0039
	(0.002)	(0.002)
Foreign production	0.0698	0.0687
	(0.0831)	(0.0813)
Foreign agreement	0.0102	0.0185
	(0.0546)	(0.0555)
Foreign owned	-0.159	-0.158
	(0.113)	(0.117)
Foreign patent	0.170	0.165
	(0.0905)	(0.0928)
Foreign services	0.165	0.158
	(0.0996)	(0.106)
Firm size	0.000138	0.000159
	(0.000147)	(0.000154)
Firm age	-0.000791	-0.000609
	(0.00113)	(0.00113)
New process	0.507***	0.512***
	(0.0359)	(0.0356)
Expenditure for training	0.025	0.017
	(0.024)	(0.023)
Expenditure for equipment	4.09e-06**	3.80e-06*
	(2.02e-06)	(2.05e-06)
Export assistance	-0.0698	-0.0859
	(0.0742)	(0.0751)
Log-Likelihood / R square	-205.98 / 32.61%	-201.2 / 33.56%
Observations	477	472

Note: Standard errors in parentheses, coefficients are marginal effects (*** p<0.01, ** p<0.05, * p<0.1)

Table 6 Moderating effect of commercial collaborations on change

VARIABLES	Model 8	Model 9
Increase in percentage of sales	-0.00512	
	(0.00669)	
Decrease in percentage of sales	0.0666	
	(0.148)	
Increase in number of markets		-0.210***
		(0.0670)
Decrease in number of markets		0.0123
		(0.0913)
H4b: Increase in percentage of sales x foreign agreement	-0.0130	
	(0.0424)	
H4b: Increase in number of markets x foreign agreement		0.246*
		(0.150)
Start	0.197*	0.248***
	(0.0664)	(0.0338)
Stop	0.210	0.173
	(0.0878)	(0.0794)
Consistent	0.160*	0.164*
	(0.0890)	(0.0963)
Internal R&D	0.023**	0.018*
	(0.011)	(0.011)
External R&D	0.0034	0.004*
	(0.0025)	(0.0024)
Foreign production	0.0779	0.0468
	(0.0787)	(0.0875)
Foreign agreement	0.0235	0.00634
	(0.0563)	(0.0589)
Foreign owned	-0.168	-0.145
	(0.113)	(0.116)
Foreign patent	0.166	0.187
	(0.0934)	(0.0779)
Foreign services	0.166	0.150
	(0.0991)	(0.106)
Firm size	0.000135	0.000195
	(0.000148)	(0.000152)
Firm age	-0.000777	-0.000757
	(0.00113)	(0.00114)
New process	0.506***	0.516***
	(0.0359)	(0.0355)
Expenditure for training	0.023	0.022
	(0.024)	(0.024)
Expenditure for equipment	4.01e-06**	4.48e-06**
	(1.98e-06)	(2.24e-06)
Export assistance	-0.0668	-0.103
	(0.0743)	(0.0738)
Log-Likelihood / R square	-206.23 / 32.53%	-198.79 / 34.23%
Observations	477	472

Note: Robust standard errors in parentheses, coefficients are marginal effects (*** p<0.01, ** p<0.05, * p<0.1)

Figure 1 Marginal effects of increase in export markets at different values of R&D intensity (90% confidence level)

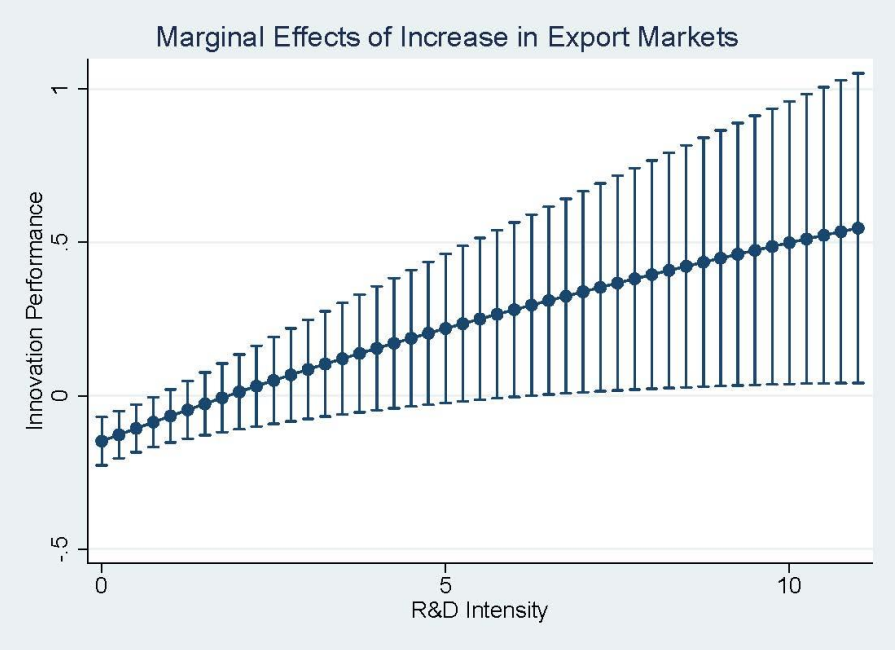

Figure 2 Marginal effects of increase in export markets depending on whether firms have formed collaborative agreements (90% confidence level)

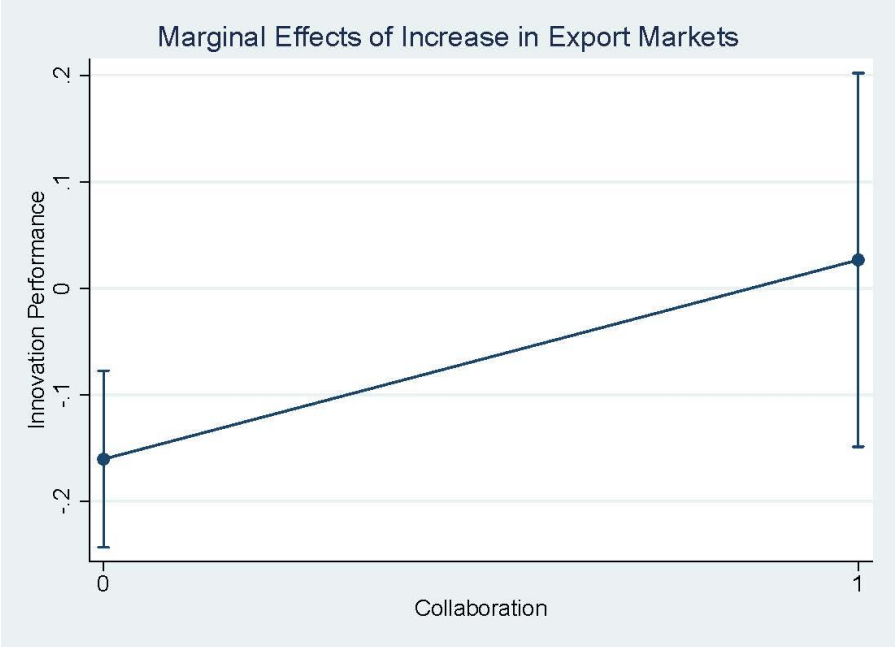

Figure 3 Marginal effects of increase in export intensity at different values of R&D intensity (90% confidence level)

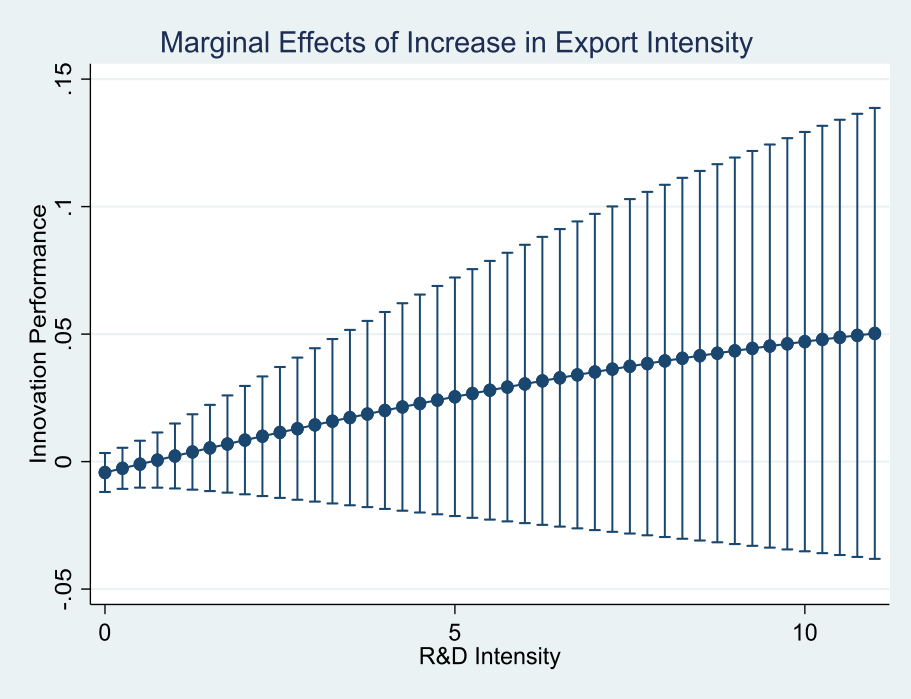
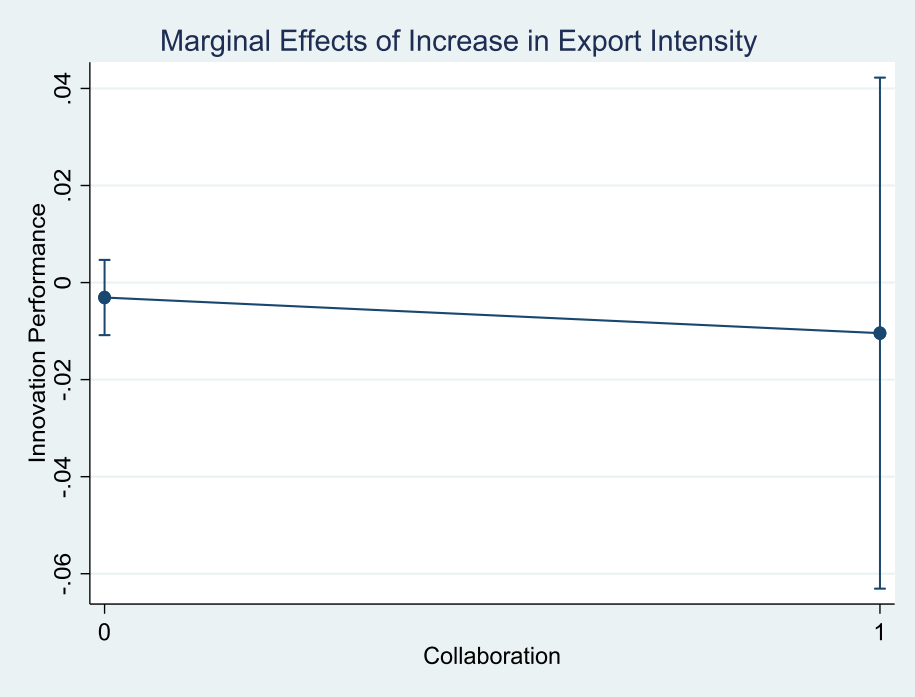
Figure 4 Marginal effects of increase in export markets depending on whether firms have formed collaborative agreements (90% confidence level)