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Time to come back: the effects of export market re-entry and time-out period on innovation

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Abstract

Purpose – The purpose of this paper is to examine how exporters' time-out periods and re-entry to various export areas impact their knowledge stock and capacity to learn from foreign markets.

Design/methodology/approach – This paper introduces the concept of innovation divergent export areas (IDEXAs), which refers to a group of countries with relatively similar average levels of innovation capabilities (intra-area homogeneity), and different from other areas (inter-area heterogeneity), as measured by their R&D expenditures over gross domestic product (GDP). This paper tests the hypotheses on a longitudinal sample of Spanish manufacturing companies that exported to different IDEXAs from 1990 until 2016.

Findings – The findings suggest a positive effect of IDEXA re-entry on new product and process introductions and a negative impact of a time-out period of four or more years for those export areas with higher innovation levels.

Practical implications – Re-internationalization offers exporters the opportunity to reuse the knowledge gained in prior exporting episodes to increase their chances of success. Hence, it is important that managers make sense of the potentially damaging exit experience, to avoid repeating the same mistakes and perform better the next time around.

Originality/value – This study investigates for the first time the effects of re-entry to specific export areas on exporters' capacity to increase their innovation output. Hence, it contributes to the international business literature by examining the performance consequences of companies' re-internationalization, a key and under-researched topic. Furthermore, most studies focus on full withdrawal from foreign markets and ignore the more common microscopic decisions concerning withdrawing from one or more export areas.

Keywords Learning-by-exporting, Innovation divergent export areas, Market re-entry, Time-out period, Organizational learning theory, Dynamic capabilities

Paper type Research paper

Introduction

Export markets [1] provide companies with the opportunity to access new knowledge and to develop organizational capabilities that enable them to become more innovative (Salomon

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and Jin, 2010; Vendrell-Herrero *et al.*, 2024). This phenomenon, named "learning-by-exporting" (LBE) (Rhee *et al.*, 1984), has been the subject of considerable interest in the management literature (Freixanet and Federo, 2022). This is a logical consequence of the importance of internationalization and innovation endeavors in today's highly competitive and knowledge-based economy, with its shortened product life cycles (Chiva *et al.*, 2014; Gupta and Chauhan, 2021).

An overwhelming majority of the LBE literature assumes firms' international expansion is always a linear, forward-moving process (Kafouros *et al.*, 2022). However, companies can exit export markets and remain absent from them for a certain period – a time-out period (Chen, Sousa, and He, 2019) – and then reenter those markets. Although export market exit and re-entry occur very frequently, they have not been examined to the extent that they ought to (Kafouros *et al.*, 2022). Market re-entry is a particularly complex and interesting phenomenon to study as it combines the usual issues involved in foreign market entry (such as gathering information on the level of sophistication of products sold in that market), with the possibility for exporters to exploit the export heritage they gained in prior entries (Chen *et al.*, 2019). However, there is even less literature on foreign market re-entry than market exit (Ganotakis *et al.*, 2022), and it centers mainly on the determinants of market re-entry, leaving the study of re-entry consequences on exporters' evolution and performance a relevant and under-researched area (Kafouros *et al.*, 2022; Sousa *et al.*, 2021).

This study helps fill this gap by focusing on understanding the effects of reentering *innovation divergent export areas* (IDEXAs), a group of countries sharing comparable average levels of innovation capabilities among themselves, yet differing significantly from other regions; and the effects their time-out periods have on technological innovation – i.e. firms' new products and processes (e.g. Haneda and Ito, 2018; Piening and Salge, 2015). Examining the antecedents to these innovation forms is particularly relevant, as they constitute key sources of competitive advantage for companies (Cassiman and Golovko, 2011; Rosenbusch *et al.*, 2011). At the same time, the mechanisms leading to product and process innovation differ significantly. It is generally assumed process innovation increases exporters' margins by reducing firms' average cost of production, while product innovation increases the price customers are willing to pay for improved product features (Freixanet *et al.*, 2020a, 2020b; Golovko and Valentini, 2014).

An interesting theoretical debate arises when considering the effects of market exit because of poor performance (i.e. failure). Some scholars argue that such experiences may have little or even negative impacts on learning outcomes, as managers may prefer to forget these failures and move on (Argote and Miron-Spektor, 2011; Surdu *et al.*, 2019). Conversely, other researchers emphasize the value of export heritage, suggesting that companies can leverage their past experiences (including failures) to enhance their chances of success upon reentering a market (e.g. Chen *et al.*, 2019). To contribute to this debate, our study follows a two-stage approach. First, we draw on the literatures of divestment/re-entry, innovation (e.g. Ancarani *et al.*, 2019; Grappi *et al.*, 2018; Hong *et al.*, 2019) and supranational grouping schemes (Arregle *et al.*, 2013; Flores *et al.*, 2013) to introduce a novel concept, *IDEXAs*, as previously mentioned, a cluster of countries characterized by relatively similar average levels of innovation capabilities within the group but distinct from other regions. As we argue in the theory section, innovation outcomes are contingent upon the innovation capabilities of the exited region.

Second, we build on organizational learning theory (Levitt and March, 1988) and dynamic capabilities perspective (Teece *et al.*, 1997) to hypothesize that reentering an IDEXA will have a positive effect on learning outcomes, particularly in terms of new product and process introductions. This effect arises from the value of export heritage, resource commitment and the motivation embedded in re-entry processes. Still, we also contend that export heritage may deteriorate over time. Therefore, we hypothesize that prolonged time-out periods negatively influence innovation outcomes at the point of re-entry. Additionally, we propose that these effects are heterogeneous across IDEXAs due to variations in their innovation levels. Hence, our research questions are thus formulated as follows: What are the effects of IDEXA re-entry and time-out on product innovation outcomes? How do these decisions impact process innovation outcomes? Do these effects vary depending on the IDEXA?

This paper tests these hypotheses using a longitudinal sample of Spanish manufacturing companies that exported to different global regions from 1990 to 2016. Our data set provides an ideal setting for this study by identifying four IDEXAs: the European Union (EU), Iberoamerica, Organization for Economic Cooperation and Development (OECD) countries and the rest of the world. These regions share similar levels of technological innovation capabilities (intra-area homogeneity) but differ from each other (inter-area heterogeneity) in terms of R&D expenditures as a percentage of GDP (Freixanet *et al.*, 2018, 2020a, 2020b; Salomon and Jin, 2008, 2010). Overall, the empirical findings support our hypotheses, revealing that IDEXA re-entry positively influences both product and process innovation outcomes. Our results also demonstrate that time-out periods exceeding four years negatively affect innovation outcomes, particularly in IDEXAs with higher levels of innovation.

This study offers several relevant contributions for both management academics and practitioners. First, it advances international business (IB) research by introducing countries' innovation capabilities as a novel organizing factor for regional grouping schemes. This new factor affects exporters' learning and innovation outcomes. Therefore, the study responds to calls for theoretically grounded and structurally coherent schemes, complementing fixed physical environment factors with more fluid, symbolic, interactional, institutional and cognitive dimensions (Flores *et al.*, 2013).

Second, the study offers a more fine-grained perspective of the LBE phenomenon (e.g. D'Angelo *et al.*, 2020; Golovko and Valentini, 2014) by considering the influence of export area heterogeneity in the process of assimilating knowledge from abroad and subsequently converting it into different innovation forms (product and process). Third, this paper contributes to the literature on re-internationalization by analyzing the consequences of exit and re-entry across various IDEXAs (Chen *et al.*, 2019; Welch and Welch, 2009). While most studies on de-internationalization and re-internationalization focus on the factors driving these activities, relatively little attention has been paid to their outcomes (Mohr *et al.*, 2020). This gap is particularly pronounced in relation to the impact of re-entry on firm performance, which remains one of the most underexplored areas in the literature (Kafouros *et al.*, 2022). Moreover, most research in this field examines individual countries in isolation (Chen *et al.*, 2019), overlooking the conceptual and methodological advantages of grouping countries into supranational areas based on theoretically relevant classification schemes. This regional perspective enables researchers to analyze how exporters adapt and learn in environments with distinct innovation potential, providing deeper insights into how firms leverage regional innovation systems for capability development. Finally, the conclusions of the study offer novel implications for managers in managing export market time-out periods and re-entry and for policymakers regarding export and innovation–promotion programs.

The remainder of the paper proceeds as follows. First, we discuss the theoretical framework leading up to the hypotheses we propose to test. Then, we describe the sample, the variables and our statistical approach. Next, we present the results of the econometric analyses. Finally, we discuss the results and provide some conclusions, implications for managers and policymakers and directions for future research.

Theory and hypotheses

Organizational learning theory and dynamic capabilities perspective

International business literature frequently draws on organizational learning theory, implicitly or explicitly (Lee *et al.*, 2020; Levitt and March, 1988). This research domain examines the role of knowledge and learning as a prerequisite for expanding internationally (i.e. self-selection effect, Cassiman and Golovko, 2011) or as a result of such expansion (e.g. Salomon and Jin, 2010; Salomon and Shaver, 2005). Among the latter, scholars have been paying increasing attention to the links between exporting – the most frequent internationalization method – and a subsequent increase in innovation and productivity outputs (Kafouros *et al.*, 2022). Proponents of this phenomenon – the so-called LBE effect – contend that exporters obtain new technological knowledge from foreign markets and develop capabilities they can use to improve their products and processes (Golovko and Valentini, 2014; Salomon, 2006). An equally relevant, though largely ignored, topic concerns the ways in which firms unlearn and relearn knowledge and routines when they stop and then resume an exporting activity in one or several export areas, and the consequences of these export interruptions on learning outcomes, such as innovation. Organizational learning theory indicates that the knowledge and routines companies obtain from performing an activity – such as exporting – are kept in their organizational memory (Dodgson, 1993; Ganotakis *et al.*, 2022). However, when firms stop conducting that activity, the associated knowledge and routines gradually become obsolete or are forgotten, so companies follow an "unlearning" process (Levitt and March, 1988).

Complementing organizational learning theory, the dynamic capabilities perspective helps explain how and why some companies perform better than others in contexts of fast changes and uncertainty (Bitencourt *et al.*, 2020), as one may characterize those surrounding international market re-entry. Capabilities are configurations of resources that allow a firm to attain a competitive advantage (Gupta and Chauhan, 2021). Dynamic capabilities are organizational routines through which firms reconfigure their capabilities and alter their resource base to generate new value-creating strategies, thereby adjusting to a shifting environment (Teece *et al.*, 1997). In export markets, companies need to improve their ability to integrate, create and reconfigure internal and external resources to face the quick changes that occur in their competitive environments (Sapienza *et al.*, 2006). As the literature emphasizes, a clear manifestation of dynamic capabilities consists of the routines for new product development through which managers combine their various functional backgrounds and competences to launch new products (Eisenhardt and Martin, 2000). Hence, the dynamic capabilities framework is particularly appropriate for a study linking exports to innovation.

Supranational grouping schemes and innovation divergent export areas

The IB literature highlighted the benefits of grouping countries into supranational areas, such as the fact of providing stability and comparability over time (Freixanet and Renart, 2020; Patel *et al.*, 2018). Earlier studies have used a broad range of factors to define those groups. However, the dimensions used often lack any *ex ante* theoretical grounding, thus undermining the validity of concepts, constructs and measurements (Flores *et al.*, 2013). Below, we summarize the main criteria used in prior research, justify the introduction of a novel grouping scheme and later develop the theoretical arguments linking the scheme to our topic.

Geographic proximity is a common and intuitive organizing criterion, as it is easy to observe and measure, typically grouping countries based on shared continental borders (Flores *et al.*, 2013). However, scholars have criticized this approach for perpetuating "myths" about social, institutional and economic similarities among countries (Lewis and Wigen, 1997) and for reflecting the socio-political position of the observer rather than the phenomena the regions aim to classify (Agnew, 1999). Another dimension often used in IB research is broad cultural attributes related to *personal attitudes and beliefs*. Perhaps the best-known example is Hofstede's (2001) study, which grouped 53 countries based on the values and behaviors of IBM managers. In relation to our topic, one might expect some relationship between LBE and cultural characteristics: areas with greater cultural distance would likely require more significant adjustments when entering or reentering them. However, we believe that this factor affects only a relatively small portion of products, mostly consumer goods like food and cultural products. Nonetheless, this constitutes an interesting avenue for future research, which we explore further in the conclusion.

Other factors used in the IB literature concern differences in *legal and political systems*. For instance, La Porta *et al.* (2008) group countries based on the level of protection they offer investors and analyze how foreign direct investment (FDI) varies across regions. While this dimension is closely tied to a firm's willingness to invest in particular areas – and thus relates to FDI – other factors are more likely to influence the development of new products or processes by exporters. One such factor is *trade and investment patterns*. Ohmae's (1985) triad grouping, for example, categorizes Japan, North America and Western Europe (mainly Germany, France and the UK) based on their economic similarities. Groupings such as the OECD and the EU are founded on such economic similarity.

Our paper combines trade, investment and economic development patterns by proposing a grouping dimension closely aligned with these factors: a country's level of innovation capabilities. An extensive body of research highlights the close relationship between a country's innovation capabilities and its potential for trade and economic development. Neoclassical and endogenous growth theories (e.g. Schumpeter, 1911; Mansfield, 1972), along with more recent theoretical and empirical evidence at both macroeconomic (e.g. Bilbao-Osorio and Rodríguez-Pose, 2004; Maradana *et al.*, 2017) and microeconomic levels (e.g. Ayob *et al.*, 2023; Cassiman and Golovko, 2011), underscore the intrinsic connection between innovation and economic growth. In essence, innovation enhances the value of products or reduces their cost, thereby increasing demand. This, in turn, drives higher production, sales and wealth for firms and countries alike. A significant portion of this demand often originates from foreign markets, leading to increased exports (Cassiman and Golovko, 2011; Vendrell-Herrero *et al.*, 2024).

Furthermore, economic research emphasizes a bidirectional causality between innovation and economic development. Economic growth fosters innovation by improving key drivers such as research infrastructure, education systems and access to advanced technologies (Koh, 2006; Maradana *et al.*, 2017). Additionally, trade enhances the quality and efficiency of innovation by expanding the pool of R&D experiments from which the most effective technologies can be selected (Spulber, 2008) and by creating economic and market incentives to refine and improve products (Freixanet and Rialp, 2022). Hence, a country's level of technological capabilities is likely to influence exporters' innovation output and, consequently, reentrants' LBE, as we argue in the theory section. Therefore, our study groups the various host countries to which Spanish firms primarily exported during the study period based on their innovation capabilities, proposing that these countries form four distinct IDEXAs.

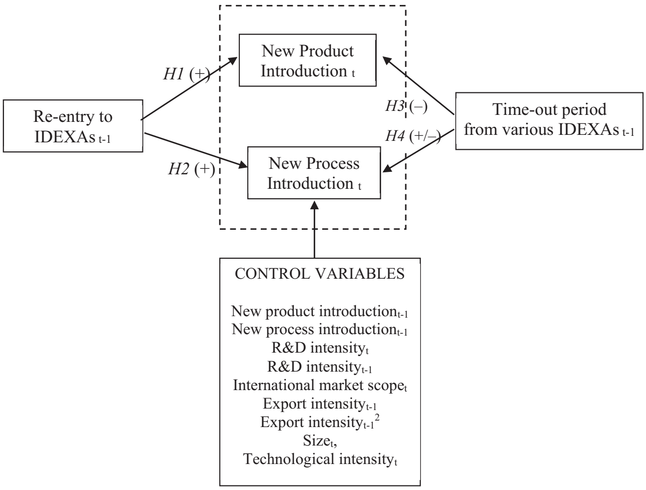
In addition to justifying the theoretical link between this novel supranational grouping scheme and our topic, we follow Flores *et al.* (2013) in *ex post* assessing the quality of our grouping scheme based on its "structural coherence." This refers to the extent to which countries within a regional group share similar innovation capabilities within each IDEXA. Our analysis in the Methodology section demonstrates high levels of structural coherence (intra-area homogeneity and inter-area differences), particularly when considering the countries to which Spanish firms direct their exports – listed in the Appendix of the manuscript. As Flores and colleagues argue, schemes with better structural coherence tend to offer a better fit with IB research models.

Accordingly, in the next subsections, we elaborate hypotheses on the effects of re-entry to and time-out period from IDEXAs on two learning outcomes – i.e. product and process innovation – following our conceptual model presented in Figure 1.

Hypotheses

Re-entry to innovation divergent export areas and product innovation

Reentering export areas provides firms with a twofold learning opportunity. First, entering into a foreign market, either in the case of a *de novo* entry or a re-entry, allows exporters to access technological knowledge and innovation resources from that market that enhance their subsequent innovation output (e.g., Freixanet and Rialp, 2022; Salomon and Jin, 2010; Villar *et al.*, 2020). The LBE literature emphasizes that, while present in international markets, firms may benefit from collaborations with host clients, partners and research centers (Freixanet and Federo, 2022; Salomon and Shaver, 2005). These collaborations allow foreign entrants to leverage host expertise in developing new products and specific ideas and enrich their sources of knowledge and innovation expertise (Golovko and Valentini, 2014; Phene and Almeida, 2008). Exporters may also access better quality or cheaper tangible



Source: Figure by authors

Figure 1. Conceptual model

innovation assets, such as laboratories or materials that enhance their innovation productivity (Freixanet *et al.*, 2020a, 2020b). These benefits are also evident when considering IDEXAs. Within IDEXAs, exporters operate in regions with relatively similar levels of innovation capabilities, which facilitates knowledge spillovers and collaborative synergies. Firms can capitalize on shared innovation ecosystems, accessing specialized expertise, advanced technologies and resources that are collectively nurtured within these areas. As a result, exporters engaging with IDEXAs can enhance their learning outcomes and innovation productivity by leveraging regional innovation strengths and fostering mutually beneficial collaborations. Furthermore, international market entry adds incentives to learn in terms of innovation outputs, by introducing new and often more intense rivalry and by enhancing exporters' capacity to spread their new products across a larger number of countries. This increases firms' prospects of recouping their investment in innovation activities and their potential for attaining economies of scale (Love and Ganotakis, 2013).

Re-entry adds to these general LBE effects by providing exporters with export heritage from previous foreign market experiences [2]. An interesting debate arises when considering the learning effects of exit experiences. On the one side, learning theorists argue that not all experiences are "good teachers," particularly when companies have difficulty interpreting them (March, 2010), in which case they may exert little or even a negative impact on learning outcomes (Argote and Miron-Spektor, 2011). Market exit, caused either by insufficient achievement of goals, managers' dissatisfaction, extreme rivalry or shifts in contextual conditions, is preceded in most cases by poor performance in that market (Javalgi *et al.*, 2011; Lee *et al.*, 2020; Nummela *et al.*, 2016). In these circumstances managers may try to dissociate themselves from failure, move on and forget the experience, thus resulting in a loss of knowledge (Surdu *et al.*, 2019) and the perception that such an experience is not fruitful for innovation.

However, re-internationalization research also suggests that reentrants inherit valuable knowledge from their initial entry. Although managers may not explicitly detect export heritage, it is embedded in the intertemporal relationship between exporters' prior activities and future decisions (Chen *et al.*, 2019). Such international heritage encompasses crucial information on factors such as the technological level of competing products and market requirements (Javalgi *et al.*, 2011). Learning scholars emphasize that acquiring knowledge through experience is a costly process, so reentrants may benefit from knowledge that may be valuable and difficult to acquire by *de novo* entrants, and that may constitute a source of competitive advantage (Surdu *et al.*, 2018). Consequently, we argue that, when firms reenter an IDEXA, they will be willing to use information from previous entries to modify their market strategy. For example, considering that IDEXAs exhibit different levels of innovation capabilities, managers may understand that their earlier poor results in that area were because of a mismatch between a product's technological level and consumers' needs (Nummela *et al.*, 2016) and modify the products accordingly.

Furthermore, internationalizing firms develop routines and reconfigure their resources to deal with novel and changing international contexts (Sapienza *et al.*, 2006). This routinization of organizational process and resource reconfigurations is a learning process that forms specific managerial and marketing capabilities to sustain cross-border expansion (Freixanet and Renart, 2020). LBE is a phenomenon that is strongly reinforced through learning-by-doing: by conducting an exporting activity in a foreign market repeatedly over time, exporters learn how to effectively organize and manage that activity (Tsang, 2002; Vendrell-Herrero *et al.*, 2024). This includes key aspects leading to LBE, such as identifying and exploiting relevant knowledge (Freixanet and Rialp, 2022; Kunisch *et al.*, 2017). These capabilities, developed in earlier entries into a market, are likely to remain relatively stable through time and are unlikely to atrophy rapidly (Love and Máñez, 2019). These benefits also extend to IDEXAs, where firms repeatedly engaging in exporting activities can leverage the shared innovation dynamics of these regions. This reinforces learning-by-doing processes, helping exporters identify and exploit relevant knowledge while maintaining stable capabilities over time.

Besides, the consensus in the IB literature is that a clear link exists between prior general knowledge and experience in exporting activities, and the willingness to commit more resources in a foreign market, even if that experience was acquired in other international markets (e.g. Johanson and Vahlne, 1977; Surdu *et al.*, 2019). This is because understanding how to effectively develop internationalization activities gives firms the confidence necessary to increase their commitment to foreign markets over time (Sapienza *et al.*, 2006; Zeng *et al.*, 2013). Hence, we expect reentrants to benefit by developing their capability and knowledge regarding international business techniques from their experience acquired not only in previous entries in the same market but also in other locations.

In summary, although reentrants may experience an unwillingness to learn from negative entry experiences, the new information and innovation incentives from international expansion, together with the knowledge and capabilities acquired in previous entries, will lead exporters to improve their products when reentering IDEXAs. Therefore, the following hypothesis has been proposed:

H1. Re-entry to IDEXAs will have a positive effect on new product introduction.

Re-entry to innovation divergent export areas and process innovation

In addition to knowledge about products, exporters may obtain information from foreign markets on new or more efficient production processes (Golovko and Valentini, 2014). Both new product and process introductions may increase a company's price-cost margin on its production. However, it is generally assumed product innovation improves product features or extends exporters' offerings, making it preferable to those of other companies with comparable price levels or enabling exporters to increase their prices. Instead, new process introduction increases firms' efficiency and productivity, thus decreasing their average production costs (Boone, 2000; Freixanet *et al.*, 2020a, 2020b). These cost savings allow exporters to reduce their prices or to increase their margins, thus producing an economic surplus they may invest in more effective entry strategies. Furthermore, research shows that new process introduction, other than contributing to firm performance, reinforces new product introduction (Piening and Salge, 2015), thereby increasing the efficiency and returns of innovation activities. New process introduction, by reducing the cost of new products, may improve their contribution margins, thereby increasing the benefits exporters may obtain from new product introduction. Consequently, we may expect reentrants to develop new processes that complement product innovation. In sum, we propose that the inflows of technological knowledge from an IDEXA, together with reentrants' motivation to foster cost competitiveness, will lead them to increase new process introduction. Hence, the following hypothesis has been proposed:

H2. Re-entry to IDEXAs will have a positive effect on new process introduction.

Time-out period and learning-by-exporting

Export heritage cannot be expected to be everlasting. As resources decay if unused (Dixit, 1989), the innovation resources obtained from prior exporting endeavors in exited IDEXAs may become obsolete or inaccessible during a growing time-out period (Chen *et al.*, 2019).

This is likely to occur both for the innovation knowledge and the capabilities developed in previous exporting episodes.

Technological knowledge may be subject to quite rapid decay during time-out periods (Love and Máñez, 2019). The technologies that may be incorporated into products or used to manufacture them, such as products' materials, design or labeling (for example, the use of safe or environmentally friendly production inputs or processes), change frequently (e.g. Iizuka and Ikeda, 2021), thus forcing exporters to modify their product structure. Therefore, after a long absence from an IDEXA, the information gathered earlier on the area's technologies, may no longer be usable for the development of new products or processes (Welch and Welch, 2009).

Although organizational capabilities and routines pertaining to specific exporting activities may take longer to decay than technological knowledge, in the long term they may also be subject to organizational forgetfulness and atrophy (Mariano *et al.*, 2018). The benefit of cumulative task performances is likely to deteriorate gradually, thus decreasing learning effectiveness and reducing the likelihood that new entries will lead to new learning outcomes (Love and Máñez, 2019; Souchon *et al.*, 2012).

Furthermore, long absences may also decrease managers' perceived value of the information and capabilities developed during prior exporting activities (Chen *et al.*, 2019). If managers perceive a specific international heritage as something belonging to a bygone age, then they will not be willing to use this unique resource to develop new products and processes.

Thus far we have argued for a negative influence of a long time-out period on innovation. However, research also suggests that a long time-out period could also positively impact innovation by enabling exporters to have more time to prepare for re-entry (Levitas and Chi, 2010). Internationalizing firms face the uncertainty that surrounds working in a novel institutional and market context (Freixanet, 2022), which reduces their capacity to predict and adapt to future contingencies (Ahi *et al.*, 2022). During a time-out period, exporters remain open to the re-entry decision but wait for the right moment to return. Extending that period may have a positive value under uncertainty, as it enables exporters to gather information, and thus better prepare for re-entry (Chen *et al.*, 2019). However, allocating firms' resources, such as time from export managers and budgets for surveys or cross-border trips, to update market data for future reentries, diverts them from enhancing their present performance in the current exporting areas. Indeed, much of the motivation for identifying and exploiting knowledge obtained from abroad is based on better competition in current markets (Freixanet and Federo, 2023). Following this rationale, we may anticipate that most absent exporters do not dedicate significant resources to prepare for uncertain future innovations at the expense of current profits. Consequently, technological knowledge, a key input for new product and process introduction activities (Golovko and Valentini, 2014), will tend to become increasingly obsolete and specific organizational capabilities will likely atrophy during a longer time-out period, making it unlikely that having more time to prepare for re-entry will enable exporters to effectively increase innovation outputs.

Furthermore, delaying the re-entry to an IDEXA for an extended period of time points to a lack of strategic importance in that area for the firm (Javalgi *et al.*, 2011). A firm that relies on specific exporting areas for its long-term performance, can be expected to make adjustments and efforts to return as soon as possible to those areas. In this regard, we propose that long absences might be associated with relatively lower levels of interest in an IDEXA. There is an apparent consensus in the IB literature on the relationship between the strategic importance of foreign markets and the willingness of exporters to invest resources when operating in them (Johansson and Vahlne, 1977; Surdu *et al.*, 2019). Hence, we anticipate that long delays may be associated with lower commitment and motivation to significantly invest in innovation targeted to increase competitiveness in those exporting areas (Eriksson and Chetty, 2003).

To sum up, we expect that a long time-out period from an IDEXA will dissipate the effect of export heritage accumulated from previous exporting activities in that area, rendering it obsolete for use to engage in innovation activities and will be associated with lower motivation to invest in those activities. Thus, we propose that a long absence from a previously entered IDEXA will have a negative effect on exporters' innovation outputs upon re-entry:

H3. A long time-out period from a previously entered IDEXA will negatively affect new product and process introduction upon re-entry.

The value and consequent depreciation of a firm's export heritage during a time-out period, are likely to be influenced directly by economic and market-level factors surrounding an exporting area (Surdu *et al.*, 2018). We emphasize the importance of the levels of innovation of the host market and consider that IDEXAs with higher innovation levels show higher export heritage and thus technological knowledge might depreciate at a faster rate.

The quantity and quality of information, and the development of capabilities for innovation depend on the frequency and complexity of the innovation efforts (Trott, 2017) which, in turn, are influenced by the aggregated innovation levels of competitors in an IDEXA (Porter, 1997; Younge and Tong, 2018). Abundant research shows that the extent and importance of a firm's innovation activities are directly contingent upon these factors. For example, Salomon (2006) finds that firms exporting to more developed markets exhibit more process innovations than those that do not; Chiarvesio *et al.* (2015) suggest Italian firms are made to develop eco-friendly products because of the EU's high environmental standards. Case-based evidence also points to a similar direction. For example, Matex International Ltd, a Singapore-based specialty chemicals and dye manufacturer, was motivated to become highly innovative in developing more environmentally friendly and cutting-edge dyes and dyeing processes under the stricter environmental laws in some of its export markets (Goh and Lim, 2020). These differences in the technological requirements between home and host markets typically translate into more efforts and investments for firms in innovation outcomes. Consequently, firms in IDEXAs with less innovation will be likely to hold lower export heritage in terms of innovation knowledge and capabilities. In other words, these firms will have less to "unlearn" as they will not have been required to develop the same level of innovative efforts (Surdu and Narula, 2021).

Furthermore, the rate of changes in technological knowledge is likely to be higher in IDEXAs with higher base innovation levels (Hekkert *et al.*, 2007; Mercan and Goktas, 2011). That is, in the IDEXAs that devote more efforts to innovation activities, the evolution of innovation outputs is likely to be more pronounced than in those areas that invest less in those activities. This may then contribute to a more pronounced obsolescence of the export heritage of reentrants from those IDEXAs. Hence, the general improvements in those host areas' technologies that occurred during the time-out period may render firms' products and processes obsolete or no longer competitive in the new context (Zeng *et al.*, 2013). To sum up, we expect exporters reentering IDEXAs with higher innovation levels to experience more effects of a long time-out period in their product and process innovation knowledge and skills, given the higher value and rate of depreciation of their export heritage. Therefore, the following hypothesis has been proposed:

H4. The negative effects of a long time-out period on the likelihood of new product and process introduction will vary depending on the IDEXA, with greater impact for areas with higher innovation levels.

Method

Data

In this study, we use a data set based on the Survey on Business Strategies (SBS). This survey has been developed by the Spanish Ministry of Industry and the SEPI Foundation and includes an unbalanced panel of a sample of Spanish firms with 10 or more employees in the manufacturing industry from 1990 to 2016. Sample selection is carried out using stratified, proportional and systematic sampling with a random seed. The SEPI Foundation has applied all its efforts to "minimize the deterioration of the initial sample due to either a reduction of the firms' collaboration with the survey, or their dropping from the sample itself. In the first case, firms are reminded of the important social contribution of their participation in the survey; in the second, new firms are incorporated in the panel to avoid reductions in population coverage across industries and size-segments" [3].

The SBS data set includes a range of key information: characteristics of the firms and their activities, customers and suppliers, costs and prices, markets, technological activities and innovation, foreign trade and employment and accounting data (SEPI, 2021). Given that our research question and hypotheses focus on the influence of re-entry into a previously exited exporting area and time-out period on innovation outcomes, we use a subset of the SBS panel data set. Table 1 shows all observations of exporters across the years. In Spain, very few firms (less than 0.3% of the sample) have conducted FDI, which enables us to focus on exports without the confounding effects of other internationalization entry modes (Freixanet and Rialp, 2022).

Variables

Dependent variables

New product introduction. Following D'Angelo *et al.* (2020), Haneda and Ito (2018) and Love and Máñez (2019) and considering Robinson *et al.* (2022), we proxy product innovation by measuring new product introductions and using a binary variable, which indicates whether the company has introduced new products during the year: (1 = one new product introduction or more, 0 = no new product introductions). This variable is termed *product innovation* in our SBS data set.

New process introduction. The introduction of new processes – termed process innovation in SBS – indicates changes in the ways companies create and deliver products and services, and these ways may encompass firms' technological and administrative processes and internal organizational factors (Golovko and Valentini, 2014; Piening and Salge, 2015). We employ a categorical variable that indicates whether a firm has implemented any new processes in the year under analysis (1 = yes; 0 = no).

Independent variables

IDEXA re-entry. To build our IDEXA re-entry variable, following Casillas *et al.* (2012), we use information on firms' exports to various groups of host countries. The SBS data set distinguishes between the following four major IDEXAs worldwide: EU, Iberoamerica, OECD and the rest of the world. To avoid repetition of countries, SBS reports that the OECD group does not include members from the EU and Iberoamerica, and the rest of the world does not include members in the previous three groups.

Table 1. Number of exporting firms per year

Year	No. of observations (when dependent variable is new product introduction)	No. of observations (when dependent variable is new process introduction)
1991	1117	1163
1992	1184	1224
1993	1117	1151
1994	1082	1102
1995	1112	1126
1996	1049	1071
1997	1044	1065
1998	1123	1127
1999	1060	1067
2000	1051	1060
2001	1089	1100
2002	1057	1067
2003	981	976
2004	990	975
2005	928	930
2006	1237	1256
2007	1340	1329
2008	1359	1328
2009	1347	1312
2010	1383	1350
2011	1387	1361
2012	1245	1227
2013	1296	1281
2014	1188	1179
2015	1111	1093
2016	1035	1017
Total	*29909*	*29937*

Source: Table by authors

Following Flores *et al.* (2013), we verify the quality of our proposed grouping scheme by analyzing *ex post* its level of structural coherence. To do this we estimate the level of inter-area differences and intra-area homogeneity on the innovation levels among the four areas. We follow Salomon and Jin (2008, 2010) among others to proxy countries' innovation capabilities by the ratio of countries' R&D expenditures over gross domestic product provided by the World Bank's world development indicators, in the year 2016. We find that the OECD innovation level (mean = 2.54, SD = 1.16) is significantly higher than that of the EU (mean = 1.54, SD = 0.89), Iberoamerica (mean = 0.35, SD = 0.32) and the rest of the world (mean = 0.48, SD = 0.50). Additionally, the EU innovation level is significantly higher than that of Iberoamerica and the rest of the world. Therefore, these areas show structural coherence based on the ratio of R&D expenditure over GDP. The only exception is Iberoamerica, which – when compared to the rest of the world's area – shows no significant differences in its average innovation levels. Furthermore, the Appendix details the countries within each area where Spanish firms center their exports. When considering those countries, the results are even clearer as to inter-area differences and intra-area homogeneity: OECD innovation level (mean = 2.21, SD = 0.78), EU (mean = 1.95, SD = 0.78), Iberoamerica (mean = 0.74, SD = 0.46) and the rest of the world (mean = 1.21, SD = 0.62). Figure A1 in the Appendix provides a visual image of the levels of within-area similarity and between-group dissimilarity.

The information on firms' exports to each area is available every four years. To have yearly data for these variables, we assigned the same value to each year within a four-year period. More precisely, we used the information on exports to each area and proceeded as follows. First, we reviewed the exporting trajectory of each firm in the data set from 1991 to 2016. We created categories to indicate when the firm started to export to each of the four IDEXAs indicated above, if the business never exported to each IDEXA, when the firm stopped exporting to a particular IDEXA, whether the firm never stopped exporting to a particular IDEXA and when the firm reentered a particular IDEXA after stopping exports to that area. Second, we created the variable IDEXA re-entry for each area. Specifically, in Step 2 we measured IDEXA re-entry as a time-invariant binary variable for a given firm, where 1 indicates the firm initially exported, then stopped exporting and then started to reexport to a particular IDEXA and 0 otherwise. In Step 2, we had four binary variables, one for each IDEXA. Third, we summed up all four new binary variables from Step 2 and obtained values ranging from 0 to 4. Fourth, we converted the resulting variable from Step three into a binary variable, where 1 indicates the firm initially exported, then stopped exporting and then started to reexport to at least one IDEXA and 0 otherwise. The last step is our measure of IDEXA re-entry.

Re-entry to host IDEXAs. We measure re-entry to each IDEXA using four binary variables, one for each area. We use binary variables created in the second step followed above for creating the IDEXA re-entry variable. To provide an example, the variable *re-entry in the EU* is a binary variable where 1 indicates the firm initially exported, then stopped exporting and later reexported to the EU and 0 otherwise. We followed the same process for the other IDEXAs under analysis (i.e. Iberoamerica, OECD and the rest of the world).

Time-out period to host IDEXAs. We measured the time-out period as the number of years it took a firm to reenter an IDEXA after having stopped exporting to such an area. We repeated this calculation for the four areas under analysis. We used the exporting trajectory of each firm in the data set from 1991 to 2016. Specifically, we focused on when the firm started to export to each of the four areas indicated earlier and when the firm reentered a particular area after having stopped exporting to that area. We only measured the time-out of those firms with re-entry data.

Control variables

The introduction of new products and processes may be influenced by a number of internal and external variables in the firm. Based on prior research (e.g. Haneda and Ito, 2018; Piening and Salge, 2015; Tsinopoulos *et al.*, 2018), we identified the following control variables.

New product introductions (t − 1). Past new product introductions are commonly assumed to be a strong predictor of future new product introductions (e.g. Piening and Salge, 2015). Therefore, we control for whether the company has introduced new products during the previous year of analysis.

New process introductions (t − 1). Based on analogous reasoning to new product introductions (e.g. Piening and Salge, 2015), we control for whether the company has implemented any new or significantly improved processes in the previous year under analysis. In this way, we also account for the temporal effects of new process introductions.

R&D intensity. In line with current research explaining process and product innovation, we also control for R&D intensity which we measure as a firm's R&D expenditures divided by total sales (Freixanet and Rialp, 2022; Haneda and Ito, 2018).

R&D intensity ($t-1$). To account for the temporal effects of R&D intensity, we also include its lagged values (Golovko and Valentini, 2014; Liang *et al.*, 2013).

International market scope. Consistent with Patel *et al.* (2018), Hitt *et al.* (1997) and Filipescu *et al.* (2013), we include the number of foreign markets as a control variable.

Firm size. We control for firm size, as it is traditionally seen as a key precursor of innovation (e.g. Piening and Salge, 2015; Tsinopoulos *et al.*, 2018). We measure firm size by the total number of employees at the firm at the end of a given year.

Export intensity. Previous research has shown that export intensity has a significant effect on the introduction of new products and processes (e.g. Kafouros *et al.*, 2008; Xie and Li, 2017). We measure a firm's export intensity through the percentage of international sales over total turnover (Katsikeas *et al.*, 2000).

Export intensity (squared). Previous research has identified non-linear effects of export intensity on innovation (Freixanet and Rialp, 2022; Xie and Li, 2017), thus making it potentially necessary to control for squared export intensity.

Technological intensity. We also control by the sector's technological intensity, which has a potential effect on a firm's introduction of new products and processes (Piening and Salge, 2015). This is based on the classification by the OECD/Eurostat (2018), which divides sectors into four categories, low, medium-low, medium-high and high, according to direct R&D intensity, and R&D embodied in intermediate and investment goods, similar to what previous authors used (Filipescu *et al.*, 2013).

Year. Finally, we control for economy-wide effects as captured by dummy variables for each year under analysis.

Statistical approach

Considering the dichotomous nature of our dependent variables and the structure of our data, we implement a panel data logit model with robust standard errors. We use the following general equation:

$$y_{it} = \alpha_i + \beta' z_{it} + \gamma' r_{it-1} + u_{it},\ i = 1, \ldots N;\ t = 1, \ldots T$$

where y_{it} is the introduction of new products or processes, α_i is an individual-specific and time-invariant effect, z_{it} is a (column) vector of exogenous variables at time t, β' is a (row) vector of unknown regression coefficients, r_{it-1} is a (column) vector of exogenous variables at time $t-1$, γ' is a (row) vector of unknown regression coefficients, and u_{it} is a disturbance term assumed uncorrelated across individuals and over time for an individual.

Hence, following our hypotheses, we first specify Model 1, to explain variations in the introduction of new products and processes. Our main independent variable, in Model 1, is IDEXA re-entry. We also include the control variables that might influence a firm's new product and process introductions as noted above: innovation ($t-1$), R&D intensity, R&D intensity ($t-1$), international market scope, export intensity, export intensity (squared), firm size, technological intensity and year. The specifications of the two estimated models are the following:

(M1) New product introduction$_{it}$ = f(new product introduction$_{it-1}$, R&D intensity$_{it}$, R&D intensity$_{it-1}$, international market scope$_{it}$, export intensity$_{it-1}$, export intensity$_{it-1}{}^{2}$, size$_{it}$, technological intensity$_{it}$, IDEXA re-entry$_{it-1}$, year)

(M1) New process introduction$_{it}$ = f(new process introduction$_{it-1}$, R&D intensity$_{it}$, R&D intensity$_{it-1}$, international market scope$_{it}$, export intensity$_{it-1}$, export intensity$_{it-1}{}^{2}$, size$_{it}$, technological intensity$_{it}$, IDEXA re-entry$_{it-1}$, year)

Secondly, instead of using the overall IDEXA re-entry, we specified re-entry to each area:

(M2 − M5) New product introduction$_{it}$ = f(new product introduction$_{it-1}$, R&D intensity$_{it}$, R&D intensity$_{it-1}$, international market scope$_{it}$, export intensity$_{it-1}$, export intensity$_{it-1}^{2}$, size$_{it}$, technological intensity$_{it}$, re-entry to EU$_{it-1}$//re-entry to Iberoamerica$_{it-1}$ // re-entry to OECD$_{it-1}$ // re-entry to rest of the world$_{it-1}$, year)

(M2 − M5) New process introduction$_{it}$ = f(new process introduction$_{it-1}$, R&D intensity$_{it}$, R&D intensity$_{it-1}$, international market scope$_{it}$, export intensity$_{it-1}$, export intensity$_{it-1}^{2}$, size$_{it}$, technological intensity$_{it}$, re-entry to EU$_{it-1}$//re-entry to Iberoamerica$_{it-1}$//re-entry to OECD$_{it-1}$//re-entry to rest of the world$_{it-1}$, year)

Thirdly, to analyze the influence of the time-out period in an exporting area after having stopped exporting to such an area, we specified time-out period as follows:

(M6 − M9) New product introduction$_{it}$ = f(new product introduction$_{it-1}$, R&D intensity$_{it}$, R&D intensity$_{it-1}$, international market scope$_{it}$, export intensity$_{it-1}$, export intensity$_{it-1}^{2}$, size$_{it}$, technological intensity$_{it}$, time-out to EU$_{it-1}$//time-out to Iberoamerica$_{it-1}$//time-out to OECD$_{it-1}$// time-out to rest of the world$_{it-1}$, year)

(M6 − M9) New process introduction$_{it}$ = f(new process introduction$_{it-1}$, R&D intensity$_{it}$, R&D intensity$_{it-1}$, international market scope$_{it}$, export intensity$_{it-1}$, export intensity$_{it-1}^{2}$, size$_{it}$, technological intensity$_{it}$, time-out to EU$_{it-1}$//time-out to Iberoamerica$_{it-1}$//time-out to OECD$_{it-1}$// time-out to rest of the world$_{it-1}$, year)

We estimated logit models with random effects and robust standard errors. The likelihood-ratio test of rho equal 0 demonstrated that random estimation was better than pooled estimation, and the Hausman test also proved that random effects were better than fixed effects estimation. Furthermore, we had to use random effects because some of the variables are time-invariant (e.g. IDEXA re-entry), and thus fixed-effects estimation is not possible.

To address possible estimation bias due to endogeneity, we took advantage of the yearly panel structure of our data and controlled for time-invariant unobserved firm heterogeneity. Likewise, we avoided simultaneity and reverse causality problems because the dependent variables were measured in period t, while IDEXA re-entry or time-out variables were measured in the period $t - 1$, which renders the model dynamic (Barge-Gil and López, 2014; Mairesse and Mohnen, 2010). Furthermore, with the aim of considering the persistence of both types of innovations, which may create serial correlation in the data, we included the one-year lagged value of the dependent variables (Gurbuz *et al.*, 2017).

Results

Sample and descriptive statistics

From the companies in the sample, an average 25.6% introduced new products and an average 38.4% implemented new processes. Table 2 displays the descriptive statistics, and Table 3 shows bivariate correlations. To evaluate the impact of these correlations, we tested for the variance of inflation (VIF) resulting in a maximum value lower than 10, which indicates the absence of multicollinearity (Baum, 2006).

Hypotheses tests

The results of the estimated logit panel model presented in Table 4 indicate consistency with the proposed arguments referring to new product introduction. IDEXA re-entry s significantly increases the probability of introducing new products (coefficient = 0.198***; odds ratio = 1.22, $p < 0.000$; c.i. [1.101, 1.351]). As for the control variables, in line with

Table 2. Descriptive statistics

Variable	Descriptives (when dependent variable is new product introduction)			Descriptives (when dependent variable is new process introduction)		
	Mean	SD	N	Mean	SD	N
New product introduction	0.256	0.437	29009			
New product introduction$_{it-1}$	0.264	0.441	29009			
New process introduction				0.384	0.486	29937
New process introduction$_{it-1}$				0.388	0.487	29937
R&D expenditures	2056377	36700000	29009	2131343	36600000	29937
R&D expenditures$_{it-1}$	1641880	29900000	29009	1686237	29600000	29937
International market scope	1.058	1.139	29009	1.063	1.141	29937
Number of employees	301.182	818.912	29009	320.720	885.776	29937
Export intensity$_{it-1}$	0.262	0.283	29009	0.262	0.283	29937
Export intensity$_{it-1}$squared	0.149	0.251	29009	0.149	0.250	29937
Medium technological intensity	0.251	0.434	29009	0.250	0.433	29937
High technological intensity	0.333	0.471	29009	0.336	0.472	29937
IDEXA re-entry$_{it-1}$	0.292	0.292	29009	0.291	0.291	29937
Re-entry to EU$_{it-1}$	0.064	0.064	29009	0.064	0.064	29937
Re-entry to Iberoamerica$_{it-1}$	0.176	0.176	29009	0.175	0.175	29937
Re-entry to OECD$_{it-1}$	0.068	0.068	29009	0.068	0.068	29937
Re-entry to Others$_{it-1}$	0.047	0.047	29009	0.047	0.047	29937
Time-out to EU$_{it-1}$	5.858	3.232	2471	5.831	3.202	2554
Time-out to Iberoamerica$_{it-1}$	4.999	1.825	1265	5.002	1.835	1330
Time-out to OECD$_{it-1}$	5.366	2.624	3925	5.358	2.609	4081
Time-out to Others$_{it-1}$	5.334	2.779	4543	5.334	2.769	4737

Source: Table by authors

Table 3. Correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	N
1 New product introduction	1.000																	29009
2 New product introduction$_{it-1}$	0.584	1.000																29009
3 New process introduction	0.330	0.245	1.000															29009
4 New process introduction$_{it-1}$	0.245	0.334	0.520	1.000														29009
5. R&D expenditures	0.025	0.030	0.048	0.048	1.000													29009
6 R&D expenditures$_{it-1}$	0.035	0.025	0.045	0.045	0.540	1.000												29009
7 International market scope	0.145	0.142	0.119	0.122	0.062	0.061	1.000											29009
8 Number of employees	0.130	0.122	0.148	0.145	0.313	0.306	0.150	1.000										29009
9 Export intensity$_{it-1}$	0.073	0.083	0.103	0.107	0.053	0.047	0.487	0.122	1.000									29009
10 Export intensity$_{it-1}$ Squared	0.041	0.050	0.080	0.084	0.047	0.038	0.381	0.092	0.913	1.000								29009
11 Medium technological intensity	−0.090	−0.087	−0.009	−0.005	−0.023	−0.023	−0.008	−0.027	0.028	0.018	1.000							29009
12 High technological intensity	0.144	0.145	0.093	0.090	0.065	0.064	0.153	0.131	0.202	0.171	−0.409	1.000						29009
13 IDEXA re-entry$_{it-1}$	0.056	0.067	0.052	0.062	0.049	0.045	0.172	0.051	0.221	0.162	0.025	0.082	1.000					29009
14 Re-entry to EU$_{it-1}$	−0.012	−0.012	−0.007	−0.005	0.008	0.004	−0.051	−0.012	−0.070	−0.055	0.013	−0.020	0.406	1.000				29009
15 Re-entry to Iberoamerica$_{it-1}$	0.068	0.082	0.056	0.067	0.046	0.038	0.197	0.046	0.252	0.193	0.014	0.093	0.719	−0.037	1.000			29009
16 Re-entry to OECD$_{it-1}$	0.042	0.043	0.030	0.027	0.024	0.023	0.094	0.035	0.139	0.097	0.007	0.058	0.420	0.088	0.106	1.000		29009
17 Re-entry to Others$_{it-1}$	0.019	0.021	0.027	0.025	0.063	0.063	0.082	0.088	0.080	0.052	0.027	0.017	0.347	0.066	0.142	0.123	1.000	29009
18 Time-out to EU$_{it-1}$	−0.112	−0.112	−0.075	−0.070	0.032	0.029	−0.191	0.036	−0.079	−0.014	0.041	−0.017	−0.201	−0.214	−0.100	−0.074	−0.042	2471
19 Time-out to Iberoamerica$_{it-1}$	0.047	0.047	0.052	0.051	0.125	0.120	0.066	0.124	0.062	0.094	−0.004	0.063	0.074	−0.044	−0.086	0.074	0.150	1265
20 Time-out to OECD$_{it-1}$	−0.066	−0.074	−0.055	−0.060	−0.003	−0.004	−0.028	0.021	−0.053	−0.012	−0.059	0.016	−0.067	0.072	−0.040	−0.108	0.017	3925
21 Time-out to Others$_{it-1}$	−0.048	−0.051	0.007	0.005	0.005	−0.001	−0.035	0.017	0.091	0.141	0.012	0.098	−0.142	−0.023	−0.090	−0.057	−0.114	4543

Notes: From variables 1–17, correlations greater than or equal to |0.021| are significant at $p < 0.001$, and correlations greater than or equal to |0.012| are significant at $p < 0.05$; for variable 18, correlations greater than or equal to |0.0423| are significant at $p < 0.05$, and correlations greater than or equal to |0.0362| are significant at $p < 0.10$; for variable 19, correlations greater than or equal to |0.062| are significant at $p < 0.05$, and correlations greater than or equal to |0.0468| are significant at $p < 0.10$; for variable 20, correlations greater than or equal to |0.0397| are significant at $p < 0.05$, and correlations greater than or equal to |0.0276| are significant at $p < 0.10$; for variable 21, correlations greater than or equal to |0.0346| are significant at $p < 0.05$
Source: Table by authors

Table 4. New product introduction as dependent variable (coefficients)

Variables	Parameters	M1	M2	M3	M4	M5
IDEXA re-entry$_{it-1}$	Coefficient	*0.198*				
	Robust std. Err.	0.052				
	p-value	0.000				
Re-entry to EU$_{it-1}$	Coefficient		−0.021			
	Robust std. Err.		0.094			
	p-value		0.823			
Re-entry to Iberoamerica$_{it-1}$	Coefficient			0.347		
	Robust std. Err.			0.067		
	p-value			0.000		
Re-entry to OECD$_{it-1}$	Coefficient				0.139	
	Robust std. Err.				0.092	
	p-value				0.129	
Re-entry to Others$_{it-1}$	Coefficient					0.110
	Robust std. Err.					0.113
	p-value					0.980
New product introduction$_{it-1}$	Coefficient	2.116	2.115	2.116	2.115	2.115
	Robust std. Err.	0.055	0.055	0.055	0.055	0.055
	p-value	0.000	0.000	0.000	0.000	0.000
R&D expenditures	Coefficient	0.000	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000	0.000
	p-value	0.076	0.086	0.073	0.075	0.080
R&D expenditures$_{it-1}$	Coefficient	0.000	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000	0.000
	p-value	0.023	0.022	0.023	0.022	0.021
International market scope	Coefficient	0.164	0.166	0.161	0.166	0.166
	Robust std. Err.	0.026	0.026	0.026	0.026	0.026
	p-value	0.000	0.000	0.000	0.000	0.000
Number of employees	Coefficient	0.000	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000	0.000
	p-value	0.000	0.000	0.000	0.000	0.000
Export intensity$_{it-1}$	Coefficient	0.721	0.830	0.685	0.799	0.821
	Robust std. Err.	0.309	0.309	0.309	0.309	0.309
	p-value	0.020	0.007	0.026	0.010	0.008
Export intensity$_{it-1}$ squared	Coefficient	−0.794	−0.882	−0.782	−0.857	−0.873
	Robust std. Err.	0.351	0.352	0.350	0.351	0.352
	p-value	0.024	0.012	0.025	0.015	0.013
Medium technological intensity	Coefficient	−0.207	−0.199	−0.209	−0.200	−0.200
	Robust std. Err.	0.081	0.082	0.081	0.082	0.082
	p-value	0.011	0.015	0.010	0.014	0.014
High technological intensity	Coefficient	0.453	0.468	0.443	0.466	0.468
	Robust std. Err.	0.074	0.074	0.074	0.074	0.074
	p-value	0.000	0.000	0.000	0.000	0.000
Constant	Coefficient	−1.970	−1.999	−1.959	−1.991	−1.995
	Robust std. Err.	0.102	0.102	0.102	0.102	0.102
	p-value	0.000	0.000	0.000	0.000	0.000

Source: Table by authors

previous studies (e.g., Freixanet and Rialp, 2021; Kafouros *et al.*, 2008), international market scope and firm size have positive and significant coefficients (coefficient = 0.164***; odds ratio = 1.178, $p < 0.000$; c.i. [1.12, 1.239]; coefficient = 0.0002***; odds ratio = 1.0002, $p < 0.000$; c.i. [1.0001, 1.0003]). Export intensity has an inverted U-shape effect (a positive and significant sign for the variable and significant and negative for the square of the variable: coefficient = 0.721**; odds ratio = 2.056, $p < 0.02$; c.i. [1.122, 3.766]; coefficient = −0.794**; odds ratio = 0.452, $p < 0.026$; c.i. [0.227, 0.899]).

When we replace the variable overall IDEXA re-entry with re-entry to each IDEXA (M2-M5 in Table 4), we observe that re-entry to Iberoamerica increases the probability of introducing new products (coefficient = 0.347***; odds ratio = 1.415, $p < 0.000$; c.i. [1.241, 1.613], while in the other areas of the world under analysis re-entry does not have a significant effect [4].

The results of the estimated logit panel model presented in Table 5 (Model 1) also indicate consistency with the proposed arguments referring to new process introduction: IDEXA re-entry increases the probability of implementing new processes (coefficient = 0.078*, odds ratio = 1.081**, $p < 0.078$; c.i. [0.991, 1.179]). In Model 5, we can also observe the influence of control variables. Previous year's new process introduction, research and development, international market scope, firm size, export intensity and sectorial high technological intensity also affect new process introduction.

Table 5 (M2 – M5) shows the effect of re-entry to host IDEXAs on new process introduction. Re-entry to Iberoamerica significantly increases the probability of implementing new processes (Iberoamerica coefficient = 0.115**, odds ratio = 1.122**, $p < 0.038$; c.i. [1.007, 1.250]). Finally, re-entry to the other areas does not have a significant effect on new process introduction.

In reference to the effects of the years of absence in each group of countries, the time-out to reenter the EU has a negative effect on new product introduction (Table 6, M6 to M9). In other words, the higher the number of years to reenter into EU, the lower the probability of introducing new products (coefficient = −0.082**, odds ratio = 0.922**, $p < 0.046$; c.i. [0.851, 0.998]). A similar effect is observed for the effect of time-out to OECD: the higher the number of years for reentering OECD countries, the lower the probability of introducing new products (coefficient = −0.076**, odds ratio = 0.927**, $p < 0.031$; c.i. [0.865, 0.993]). No significant effects are observed in the other areas.

Related to the new process introduction (Table 7, M6 to M9), we observe similar patterns as in new product introduction models. Time-out to EU and OECD countries has negative effects on new process introduction. In other words, the higher the number of years for reentering into the EU or OCED areas, the lower the probability of implementing new processes (EU coefficient = −0.056**, odds ratio = 0.945**, $p < 0.036$; c.i. [0.897, 0.996]; OECD coefficient = −0.04*, odds ratio = 0.961*, $p < 0.084$; c.i. [0.918, 1.005]).

Considering our arguments as to the gradual loss of knowledge and capabilities during the period of absence from an IDEXA, we also investigate whether the effects would be different comparing a short and a long-term time-out period. The estimates (not reported in Tables), show that it is after 4 years (measured as a binary variable, where 1 = more than 4 years and 0 = four years or less), that the time-out period has clearer negative effects on the introduction of new products and processes. In particular, time-out to EU (coefficient = −0.439*, odds ratio = 0.645, $p < 0.083$; c.i. [0.392, 1.059]) or OECD (coefficient = −0.379*, odds ratio = 0.684, $p < 0.035$; c.i. [0.481, 0.974]) negatively affects new product introduction. Time-out to EU also negatively affects new process introduction (EU coefficient = −0.426**, odds ratio = 0.653**, $p < 0.048$; c.i. [0.428, 0.996]).

Summary of hypotheses support

To sum up, the results show that, overall, re-entry significantly increases the probability of new product and process introductions, and thus provide support for *H1* and *H2*. We also observed that the higher the number of years for re-entry negatively affects new products

Table 5. New process introduction as dependent variable (coefficients)

Variables	Parameters	M1	M2	M3	M4	M5
IDEXA re-entry $_{it-1}$	Coefficient	*0.078*				
	Robust std. Err.	0.044				
	p-value	0.078				
Re-entry to EU$_{it-1}$	Coefficient		0.011			
	Robust std. Err.		0.077			
	p-value		0.889			
Re-entry to Iberoamerica$_{it-1}$	Coefficient			0.115		
	Robust std. Err.			0.055		
	p-value			0.038		
Re-entry to OECD$_{it-1}$	Coefficient				0.131	
	Robust std. Err.				0.082	
	p-value				0.111	
Re-entry to others$_{it-1}$	Coefficient					0.116
	Robust std. Err.					0.098
	p-value					0.235
New process introduction$_{it-1}$	Coefficient	1.907	1.907	1.907	1.907	1.907
	Robust std. Err.	0.040	0.040	0.040	0.040	0.040
	p-value	0.000	0.000	0.000	0.000	0.000
R&D expenditures	Coefficient	0.000	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000	0.000
	p-value	0.090	0.086	0.091	0.088	0.092
R&D expenditures$_{it-1}$	Coefficient	0.000	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000	0.000
	p-value	0.393	0.427	0.412	0.401	0.410
International market scope	Coefficient	0.078	0.079	0.077	0.079	0.079
	Robust std. Err.	0.020	0.021	0.020	0.020	0.020
	p-value	0.000	0.000	0.000	0.000	0.000
Number of employees	Coefficient	0.000	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000	0.000
	p-value	0.000	0.000	0.000	0.000	0.000
Export intensity$_{it-1}$	Coeff.	0.347	0.376	0.341	0.357	0.368
	Robust std. Err.	0.150	0.152	0.151	0.151	0.152
	p-value	0.021	0.014	0.024	0.018	0.015
Export intensity$_{it-1}$ squared	Coefficient	−0.149	−0.164	−0.148	−0.155	−0.159
	Robust std. Err.	0.138	0.142	0.138	0.140	0.141
	p-value	0.279	0.249	0.284	0.266	0.257
Medium technological intensity	Coefficient	0.081	0.084	0.081	0.083	0.083
	Robust std. Err.	0.059	0.059	0.059	0.059	0.059
	p-value	0.167	0.155	0.167	0.158	0.160
High technological intensity	Coefficient	0.223	0.228	0.221	0.226	0.228
	Robust std. Err.	0.055	0.055	0.055	0.055	0.055
	p-value	0.000	0.000	0.000	0.000	0.000
Constant	Coefficient	−1.125	−1.133	−1.123	−1.128	−1.129
	Robust std. Err.	0.083	0.084	0.083	0.083	0.083
	p-value	0.000	0.000	0.000	0.000	0.000

Source: Table by authors

and processes introductions. Hence, time-out negatively affects these outcomes, in support of *H3*. In particular, the findings show that a time-out period from EU and OECD areas negatively affects the introduction of new products and processes, which provide support for *H4*.

Table 6. Time-out and new product introduction (coefficients)

Variables	Parameters	M6	M7	M8	M9
Time-out to EU$_{it-1}$	Coefficient	*−0.082*			
	Robust std. Err.	0.041			
	P-value	0.046			
Time-out to Iberoamerica$_{it-1}$	Coefficient		*−0.035*		
	Robust std. Err.		0.103		
	P-value		0.735		
Time-out to OECD$_{it-1}$	Coefficient			*−0.076*	
	Robust std. Err.			0.035	
	P-value			0.031	
Time-out to Others$_{it-1}$	Coefficient				*−0.043*
	Robust std. Err.				0.030
	P-value				0.149
New product introduction$_{it-1}$	Coefficient	2.254	2.030	2.360	2.164
	Robust std. Err.	0.187	0.225	0.121	0.125
	P-value	0.000	0.000	0.000	0.000
R&D expenditures	Coefficient	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000
	P-value	0.572	0.492	0.141	0.021
R&D expenditures$_{it-1}$	Coefficient	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000
	P-value	0.339	0.366	0.439	0.074
International market scope	Coefficient	0.110	−0.139	0.105	0.067
	Robust std. Err.	0.088	0.120	0.055	0.062
	P-value	0.212	0.247	0.058	0.274
Number of employees	Coefficient	0.001	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000
	P-value	0.073	0.100	0.077	0.000
Export intensity$_{it-1}$	Coefficient	1.964	−1.297	0.305	−0.592
	Robust std. Err.	0.932	1.515	0.782	0.721
	P-value	0.035	0.392	0.697	0.412
Export intensity$_{it-1}$ Squared	Coefficient	−1.719	1.528	−0.814	0.303
	Robust std. Err.	1.163	1.463	0.876	0.765
	P-value	0.139	0.297	0.353	0.692
Medium technological intensity	Coefficient	−0.420	0.268	−0.624	−0.093
	Robust std. Err.	0.287	0.449	0.207	0.226
	P-value	0.144	0.551	0.003	0.682
High technological intensity	Coefficient	0.405	0.749	0.017	0.444
	Robust std. Err.	0.253	0.497	0.191	0.214
	P-value	0.109	0.132	0.927	0.038
Constant	Coefficient	−2.303	−0.837	−0.707	−1.122
	Robust std. Err.	0.471	0.722	0.332	0.306
	P-value	0.000	0.246	0.033	0.000

Source: Table by authors

Robustness checks

To make sure our results are stable; we perform the following additional tests. First, since the introduction of new products may take longer than one year, we have re-tested our models using higher order lags (Lag 2 to Lag 6) of new product introductions. We found that these lags are significant, and the effects of our independent variables remain the same as when we used only Lag 1.

Table 7. Time-out and new process introduction (coefficients)

Variables	Parameters	M6	M7	M8	M9
Time-out to EU$_{it-1}$	Coefficient	−0.056			
	Robust std. Err.	0.027			
	p-value	0.036			
Time-out to Iberoamerica$_{it-1}$	Coefficient		*0.015*		
	Robust std. Err.		0.069		
	p-value		0.822		
Time-out to OECD$_{it-1}$	Coefficient			*−0.040*	
	Robust std. Err.			0.023	
	p-value			0.084	
Time-out to Others$_{it-1}$	Coefficient				*−0.007*
	Robust std. Err.				0.026
	p-value				0.785
New process introduction$_{it-1}$	Coefficient	1.850	2.205	2.046	1.868
	Robust std. Err.	0.150	0.177	0.111	0.088
	p-value	0.000	0.000	0.000	0.000
R&D expenditures	Coefficient	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000
	p-value	0.984	0.717	0.236	0.532
R&D expenditures$_{it-1}$	Coefficient	0.000	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000
	p-value	0.214	0.889	0.870	0.158
International market scope	Coefficient	0.035	−0.076	−0.049	0.030
	Robust std. Err.	0.076	0.080	0.051	0.048
	p-value	0.646	0.342	0.337	0.540
Number of employees	Coefficient	0.001	0.000	0.000	0.000
	Robust std. Err.	0.000	0.000	0.000	0.000
	p-value	0.040	0.161	0.008	0.000
Export intensity$_{it-1}$	Coefficient	−0.299	−1.182	0.994	0.264
	Robust std. Err.	0.878	1.230	0.669	0.642
	p-value	0.733	0.336	0.137	0.681
Export intensity$_{it-1}$ squared	Coefficient	0.316	1.180	−1.365	0.102
	Robust std. Err.	1.031	1.399	0.775	0.734
	p-value	0.759	0.399	0.078	0.890
Medium technological intensity	Coefficient	0.109	0.653	−0.051	0.024
	Robust std. Err.	0.215	0.319	0.174	0.158
	p-value	0.612	0.041	0.771	0.881
High technological intensity	Coefficient	0.445	0.484	0.422	0.161
	Robust std. Err.	0.240	0.342	0.152	0.149
	p-value	0.063	0.157	0.006	0.279
Constant	Coefficient	−0.877	−0.650	−0.726	−0.869
	Robust std. Err.	0.329	0.681	0.293	0.256
	p-value	0.008	0.339	0.013	0.001

Source: Table by authors

Second, as prior research suggests (e.g. Gurbuz *et al.*, 2017), to explain variables characterized by high persistency it is necessary to include the one-year lagged value, which renders the model dynamic. However, this also might create a serial correlation. To make sure that serial correlation is not a problem in our models, we used panel data generalized least squares as a robustness check. This allows to control for heteroscedasticity (p(h)) and autocorrelation (c(ar1)). We re-estimated two models: re-entry and re-entry to Iberoamerica (because these are the variables significantly affecting new product and process introductions).

The estimated coefficients of these two variables are positive and significant as in the original estimation.

Third, exporting to other IDEXAs might affect new product and process introductions. We included exporting to other IDEXAs as control variables instead of international market scope. More specifically, we re-run all our models replacing international market scope with binary variables of exporting to other IDEXAs. Our robustness results show that the effect of re-entry to Iberoamerica on new product and process introductions remains significant as in our original models. Results also show that the effects of time-out to EU and OECD on new product and process introductions remain significant as in our main models. These results corroborate our main findings after including a new set of control variables.

Finally, we re-run all our models replacing technological intensity (as this is a grouping of industries) with industry dummy variables. Our results show that the effects of overall re-entry and re-entry to Iberoamerica on new product and process introductions remain significant as in our original models. Additional results also indicate that the effects of time-out to EU and OECD on new product introductions and time-out to EU on new process introductions remain significant as in our main models. These results also corroborate our original findings.

Discussion and conclusion

This paper examines the influence of international re-entry and time-out period on exporters' innovation, thus addressing a relevant and largely ignored research domain (Freixanet and Federo, 2023; Sousa *et al.*, 2021). More specifically, the paper examines the impact of re-entry to and time-out period from "Innovation Divergent Export Areas" (IDEXAs) on the introduction of new products and processes. Hence, our study brings new light into the important debate of the loss and re-use of knowledge as a result of processes of market exit and market re-entry (Chen *et al.*, 2019; Kafouros *et al.*, 2021; Surdu *et al.*, 2019). To examine these complex relationships, we conducted a longitudinal analysis for the period 1990–2016 over a sample of Spanish exporting firms, which provides several interesting findings.

Contributions to the learning-by-exporting literature and theory

First, the results support and extend the LBE hypothesis by showing that, despite learning arguments as to a potential loss of knowledge following market withdrawal and thus its non-re-use when coming back (Surdu *et al.*, 2019), in our study LBE does occur upon international re-entry, when firms reenter IDEXAs. Furthermore, the findings reveal that reentrants use both the introduction of new products and processes as sources of competitive advantage, which is in line with the arguments from prior LBE literature as to the benefits of both innovation forms (Golovko and Valentini, 2014) and their complementarity (Freixanet and Federo, 2022; Piening and Salge, 2015). Future studies should consider grouping schemes such as IDEXAs as a potential explanation of how LBE occurs.

Second, the results show that time-out period from IDEXAs negatively influences the introduction of new products and processes. This finding complements previous statements as to a depreciation of export heritage during the period of absence from a market (e.g. Chen *et al.*, 2019). Furthermore, our estimates show that this occurs more clearly after four years, thus supporting the argument of the decay of innovation capabilities, and the obsolescence of information, occurring mainly in the long-term.

More interestingly, the paper's fine-grained analyses show heterogeneity across areas in the impact of the time-out period on the introduction of new products and processes, with a significant impact on re-entry to the EU and OECD areas. This is consistent with our arguments that exporters reentering in IDEXAs with higher innovation levels, experience more of the negative effects of a long time-out period in their product and process innovation knowledge and skills, given the higher value and rate of depreciation of their export heritages.

Third, besides extending and qualifying prior empirical research on international business and innovation, our findings also have relevant implications for theory. The results suggest that learning and the build-up of capabilities should not be analyzed only as a cumulative process that leads to the buildup of knowledge, as the literature on gradual and incremental internationalization and learning would imply (Freixanet and Renart, 2020; Johanson and Vahlne, 1977; Roper and Love, 2002). Instead, the knowledge and the specific organizational capabilities developed when conducting exporting activities in an area may become obsolete and atrophy after an extended period of absence (more than 4 years according to our results). Besides, the results suggest that the "experience-based learning" described in organizational learning theory (Surdu *et al.*, 2018; Vendrell-Herrero *et al.*, 2024), enables exporters to compensate for the decay in knowledge during a short or medium period of absence (4 years or less) when reentering an IDEXA.

Implications for management and public policy

Innovation has become a major source of competitiveness in the present dynamic economy with shorter product life cycles. Most companies, and particularly small- and medium-sized enterprises, operate under high resource constraints to invest in innovation activities. Hence, it is important that managers leverage any innovation input, and thus make purposeful efforts to detect and assimilate the new knowledge from abroad, by adding a learning agenda to their international sales activities (Filipescu *et al.*, 2013). In times of de-internationalization, when companies need to find alternatives sources of growth (Ansoff, 1965), leveraging the knowledge assets from foreign markets can be vital for companies to reinforce their innovation-based expansion (Kafouros *et al.*, 2022). Furthermore, re-internationalization offers exporters the opportunity to reuse the experience and knowledge gained in prior exporting episodes to more easily overcome the liability of foreignness and increase their chances of success. Hence, it is important that managers make sense of the potentially damaging exit experience, overcome the negative feelings associated with failed internationalization, to avoid repeating the same mistakes and perform better the next time around (Javalgi *et al.*, 2011; Surdu *et al.*, 2019).

The findings of this paper also have implications for public policy. The study brings new support to the need for collaboration between export and innovation promotion agencies advanced in previous studies (Freixanet *et al.*, 2020a, 2020b), given that not only foreign re-entry results in innovations, but also longer time-out periods decrease innovation. Relatedly, export promotion programs have been designed solely to help companies to expand abroad, but not to help them to manage international market withdrawal and re-entry into IDEXAs. It is important that export agencies help exporters to view market exit not only as a failure to be forgotten, but that these agencies dedicate at least some training sessions to teach exporters to collect and understand the knowledge gained from market exit, and to update it during their time-out period, so they may reuse it upon re-entry (Aguzzoli *et al.*, 2021).

Limitations and directions for further research

This study offers a number of new insights, but it also has several limitations that may provide fruitful directions for future research. First, our paper introduces supranational innovation capabilities as a new organizing factor to group countries, which we believe is particularly relevant in the context of the internationalization-innovation link. However, future studies could explore how our results may differ when using other grouping factors, such as cultural differences between home and host countries. This factor is likely to influence the innovation levels of firms exporting consumer products like food or fashion goods. Second, while considering world regions or areas has advantages from a methodological perspective (e.g. Casillas *et al.*, 2012; Patel *et al.*, 2018), future empirical studies could benefit from data sets that offer information on firm-level exports disaggregated for individual countries to provide additional insights and even finer-grained specifications. Third, our study analyzes manufacturers and exporting as the prevalent entry mode of internationalization. While this enhances sample homogeneity and the generalizability of the results, it leaves other activities and strategies unexplored. For instance, service companies and other entry methods, such as technology transfer, joint ventures, acquisitions and FDI may offer different effects.

Finally, future studies should tackle the issue of the industry effect on learning by-exporting. In our robustness checks, we found that the industries where the exporting firms compete have different effects on new product and process introductions. For instance, exporters in industries such as food products and tobacco, chemical and pharmaceutical products and machinery and electrical equipment have positive effects on both new product and process introductions. An interesting avenue for further research would consist of theorizing and explaining the industry variance on the various LBE effects.

Notes

1. Whenever we use the term "export market," we refer to regions or areas located outside firms' home countries, where the manufacturers in our study export, exit and subsequently reenter.
2. Consistent with the theoretical objectives of this paper, the term "export heritage" is used to refer specifically to the technological knowledge derived from exporters' experiences when navigating varying innovation capabilities across different IDEXAs. It does not pertain to knowledge related to other aspects, such as the cultural, legal or political characteristics of the regions exited. Addressing these aspects would require the use of national or other supranational grouping schemes.
3. For more information, see www.fundacionsepi.es/investigacion/esee/en/spresentacion.asp
4. We also analyzed, through Granger causality tests, the influence of new product and process introduction leading to re-entry. In particular, we test the Granger causality of new product and process introductions affecting overall IDEXA re-entry and re-entry to Iberoamerica (because these are the variables significantly affecting new product and process introduction). We found that the effect of new product introduction in a previous period ($t-1$) is not significant neither on re-entry ($chi^2 = 1.89$, p-value = 0.1693) nor on re-entry to Iberoamerica ($chi^2 = 3.74$, p-value = 0.0531). Additionally, we also found that the effect of new process introduction in a previous period ($t-1$) is not significant neither on re-entry ($chi^2 = 0.08$, p-value = 0.7792) nor on re-entry to Iberoamerica ($chi^2 = 0.59$, p-value = 0.4418). Based on these results, we can confirm the causality in the direction from market re-entry to new product and process introduction as we propose.

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Appendix

Table A1. Spanish exports by destination

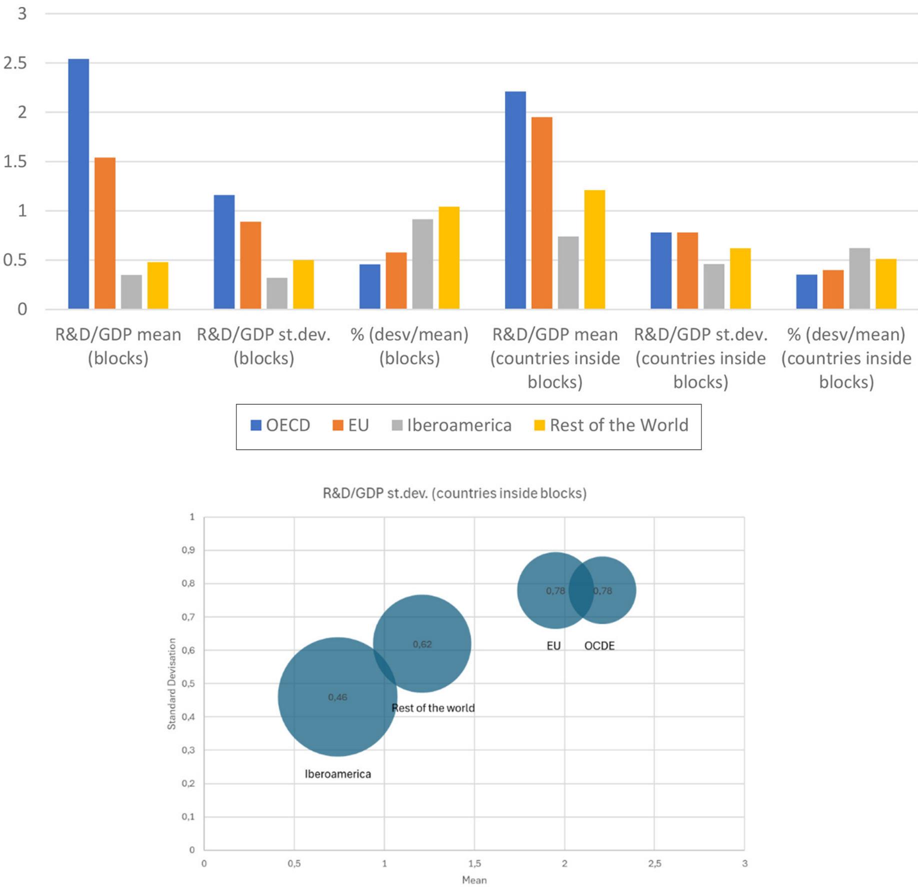
Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Andorra	0.7	0.7	0.6	0.6	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Angola	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Argelia	1.0	1.0	1.0	1.2	1.1	1.0	0.7	0.6	0.6	0.5	0.0	0.4	0.6	0.6	0.6	0.8	0.6	0.7	1.1	1.3	1.1	1.1	1.5	1.6	1.5	1.3	1.1	0.9	1.2	1.0	0.7	0.6
Argentina	0.0	0.4	0.7	0.9	1.2	1.0	1.2	1.3	1.1	0.9	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.8	0.6	0.5	0.5	0.6	0.7	1.0	1.0	0.6	0.6	0.0	0.6	0.0	0.0	0.0	0.0
Austria	0.7	0.7	0.8	0.9	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.0	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.9	0.8
Belgium	2.9	2.9	3.0	2.9	2.9	2.9	2.8	2.7	2.8	2.7	2.7	2.9	2.7	3.0	3.0	2.8	2.9	2.8	3.0	2.8	2.9	2.9	2.8	2.6	2.5	2.7	3.2	3.0	2.9	2.8	2.9	4.6
Brazil	0.3	0.0	0.0	0.0	0.5	0.9	0.9	1.3	1.2	1.1	1.0	1.0	0.8	0.6	0.7	0.7	0.7	0.7	0.9	0.8	1.1	1.2	1.2	1.5	1.3	1.1	0.9	0.9	0.8	0.9	0.8	0.8
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada	0.6	0.6	0.5	0.6	0.6	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.5	0.5	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.6
Chile	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
China	0.5	0.5	0.4	1.0	1.0	0.9	0.6	0.5	0.5	0.4	0.0	0.5	0.6	0.8	0.8	1.0	1.0	1.1	1.1	1.2	1.4	1.5	1.7	1.7	1.7	1.7	1.9	2.1	2.1	2.3	3.0	2.7
Cuba	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Czech Republic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.8	0.7	0.7	0.7	0.8	0.9	0.9	0.8	0.9	0.9	0.9
Denmark	0.5	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.8	0.7	0.8	0.6	0.5	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.8	0.7
Egypt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Finland	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
France	19.4	19.1	19.0	17.8	19.2	19.5	19.2	18.0	19.4	19.4	19.3	19.5	19.1	19.2	19.4	19.2	18.7	18.8	18.3	19.4	18.5	17.4	16.3	16.2	15.8	15.6	15.3	15.1	14.8	15.3	16.3	16.2
Germany	12.6	15.1	14.6	13.7	13.4	14.5	13.9	12.9	13.6	13.1	12.3	11.8	11.5	12.0	11.6	11.4	10.9	10.8	10.5	11.3	10.7	10.4	10.6	10.2	10.4	10.9	11.5	11.2	10.7	10.7	11.3	10.4
Greece	0.7	0.7	0.7	0.8	0.9	1.0	0.9	1.0	0.9	1.0	1.1	1.1	1.2	1.2	1.2	1.1	1.1	1.2	1.4	1.1	0.9	0.7	0.6	0.6	0.8	0.8	0.7	0.8	1.0	0.9	0.7	0.8
Holland	4.3	3.9	3.9	3.2	3.7	3.2	3.1	3.6	3.5	3.7	3.7	3.5	3.2	3.4	3.3	3.1	3.3	3.3	3.2	3.1	3.2	3.0	3.1	2.9	3.2	3.1	3.2	3.4	3.5	3.3	3.6	3.8
Hong Kong	0.3	0.4	0.4	0.6	0.6	0.5	0.6	0.8	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.0	0.5	0.6	0.6	0.6	0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6
India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iran	0.5	0.6	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(*continued*)

Table A1. continued

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Ireland	0.3	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.5	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.0	0.6	0.6	0.7	0.7
Israel	0.0	0.0	0.4	0.5	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Italy	10.0	10.8	10.2	8.6	8.8	8.6	8.3	9.6	9.2	8.9	8.7	9.0	9.4	9.7	9.0	8.4	8.5	8.9	8.1	8.5	9.0	8.2	7.5	6.9	7.1	7.3	7.8	7.8	7.8	7.9	8.0	8.6
Japan	0.9	0.8	0.7	0.8	1.2	1.2	1.1	1.1	0.9	1.1	1.0	0.9	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.9	0.9	1.1	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Liberia	0.0	0.4	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marrocco	1.1	0.9	1.0	1.2	0.8	0.8	0.7	0.8	1.0	1.1	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.9	1.9	1.8	1.9	2.3	2.3	2.4	2.4	2.7	2.8	2.8	2.8	2.7	3.0
Mexico	1.0	1.0	1.3	1.8	1.8	0.6	0.5	0.9	1.1	1.2	1.2	1.5	1.7	1.6	1.5	1.7	1.8	1.7	1.4	1.5	1.4	1.3	1.4	1.4	1.4	1.7	1.6	1.6	1.6	1.4	1.2	1.3
Norway	0.5	0.0	0.7	0.7	0.0	0.6	0.0	0.0	0.6	0.6	0.6	0.0	0.0	0.0	0.5	0.7	0.7	0.8	0.5	0.5	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Panama	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poland	0.0	0.0	0.0	0.0	0.5	0.0	0.6	0.8	0.9	0.8	0.8	0.9	1.0	1.0	1.0	1.0	1.1	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.9	1.9	2.1	2.0	2.2	2.3	2.4
Portugal	5.8	6.2	7.0	6.8	7.5	7.9	8.4	8.7	9.4	9.6	9.5	10.2	10.2	9.6	9.8	9.6	8.9	8.7	9.1	9.2	9.0	8.2	7.1	7.2	7.3	7.1	6.9	7.1	7.3	7.5	7.8	8.3
Romania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.0	0.6	0.0	0.7	0.8	0.9	1.0	1.0	1.5	1.4	0.8	0.8
Russia	0.0	0.0	0.0	0.5	0.0	0.0	0.6	0.8	0.6	0.0	0.5	0.6	0.6	0.6	0.6	0.7	0.9	1.1	1.5	0.9	1.0	1.2	1.3	1.2	1.1	0.7	0.6	0.7	0.7	0.7	0.7	0.7
Saudi Arabia	0.6	0.6	0.7	0.7	0.7	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.4	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.6	0.7	1.0	0.9	1.2	0.9	0.8	0.8	0.6	0.6	0.6
Singapore	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Korea	0.0	0.6	0.0	0.5	0.7	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.7	0.6	0.6	0.7	0.8	0.6	0.6
South Sudan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	0.9	1.0	0.9	1.1	0.7	0.9	0.9	1.0	1.1	1.1	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	1.0	0.9
Switzerland	1.5	1.4	1.3	1.2	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.6	1.5	1.3	1.3	1.6	1.8	1.9	2.0	1.8	1.5	1.5	1.5	1.5	1.4	1.7	1.9	1.8
Thailand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkey	0.5	0.4	0.5	0.7	0.5	0.7	0.9	1.2	1.2	1.2	1.7	0.9	1.1	1.3	1.8	1.7	1.6	1.6	1.6	1.7	1.9	2.0	2.1	2.0	2.1	2.0	2.0	2.0	1.6	1.5	1.6	1.7
UAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.5	0.0	0.6	0.6	0.5	0.0	0.7	0.8	0.7	0.7	0.7	0.6	0.0	0.6	0.6	0.0
United Kingdom	8.4	7.1	7.0	7.5	7.6	7.3	7.8	8.0	8.4	8.3	8.2	9.0	9.7	9.4	9.0	8.4	8.0	7.7	7.1	6.3	6.3	6.6	6.3	6.9	7.0	7.3	7.9	6.9	6.9	6.8	6.5	5.9
United States	5.5	4.7	4.5	4.5	4.6	3.9	4.0	4.6	4.2	4.6	4.9	4.3	4.3	4.1	3.9	4.1	4.4	4.0	3.9	3.5	3.4	3.6	3.9	3.7	4.4	4.5	4.3	4.4	4.4	4.6	4.5	4.6
Venezuela	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	83.1	83.8	83.7	82.7	84.7	83.7	83.3	86.2	87.8	87.6	86.7	86.9	86.8	87.5	87.3	86.3	85.6	85.4	84.6	85.2	84.1	83.0	81.4	81.3	81.8	82.9	84.0	83.2	82.8	83.5	85.6	86.8

Source: Table by authors



Source: Figure by authors

Figure A1. Variability in innovation capabilities among IDEXAs

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