
**DETERMINANTS OF EXPORT PERSISTENCE WITH A FOCUS ON
GEOGRAPHICAL LOCATION: A FIRM LEVEL ANALYSIS FOR PORTUGAL**

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Biographic note

Fernando Silva was born in Porto, on October 20th of 1997. He currently lives in Paços de Ferreira. He started his studies in economics while in high school, just before joining bachelor in Economics in Faculdade de Economia do Porto (FEP) at University of Porto in 2015. After graduating in Economics in 2018, he started the Master in Management at FEP, in which he is currently enrolled.

While doing the curricular year of the master, he started an internship in the Contact Office – Enterprise department of Vodafone Portugal. He now works full-time as staff in the Audit and Assurance department of KPMG.

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Abstract

Exports are important not only to companies' performance, but also to countries' economic growth. Research studies have been exploring export intensity and propensity, as well as its determinants. Nevertheless, there are not yet many studies addressing the subject of export strategies, namely the issue of export persistence. Moreover, those few studies which address this topic have not yet mentioned how firm's geographical location aspects impact on export persistence.

The purpose of the present study is to address this gap and to contribute empirically to the literature in this area. To serve this goal, we resorted to Bank of Portugal's Central Balance Sheet Harmonized Panel Data which contains information of 177865 companies operating in Portugal for the period between 2006 and 2017.

Using dynamic random effects panel probit models, the study found evidence of pure and strategic persistence. Additionally, it was found that firms with higher internal competencies, such as employees' average human capital and R&D activities, have a more persistent export behaviour. Technological trajectories do matter for export persistence with firms operating in science based, specialized suppliers, scale intensive, manufacturing supplier dominated, physical networks, and knowledge intensive business services sectors being more export persistent.

In what concerns geographical location, the research concluded unambiguously that agglomerations push export persistence. Additionally, the importance attributed by companies to institutional (universities and R&D organizations) and other (e.g., sectors' associations, conferences) forms of cooperation impacts positively on their export persistence. Finally, no evidence was found that the location in the coastline significantly influences export persistence.

Keywords: Export Persistence; Firms; Location; Agglomeration; Cooperation; Portugal

Resumo

As exportações são importantes, não só para o desempenho das empresas, mas também para o crescimento económico dos países. Os estudos têm explorado temas como a intensidade e propensão de exportação, bem como os seus determinantes. No entanto, são ainda poucos os que abordam as estratégias de exportação, nomeadamente a questão da persistência das exportações. Além disso, os poucos estudos que abordam esta temática ainda não aferiram de que forma os factores relacionados com a geografia afetam a persistência das exportações.

O objetivo deste estudo é abordar esta lacuna científica, contribuindo empiricamente para a literatura desta área. Para cumprir esse objetivo, recorreremos à base de dados harmonizada do Balanço Central do Banco de Portugal, que contém informação de 177865 empresas que operam em Portugal no período entre 2006 e 2017.

Usando modelos probit de painel de efeitos aleatórios dinâmicos, o estudo encontrou evidências de persistência pura e estratégica. Além disso, constatou-se que as empresas com melhores competências internas, como o capital humano médio dos funcionários e as atividades de I&D, têm um comportamento mais persistente de exportação. As trajetórias tecnológicas são importantes fatores mediadores da persistência das exportações, sendo que as empresas dos setores baseados na ciência, fornecedores especializados, redes físicas e setores de serviços intensivos em conhecimento são mais persistentes na exportação.

No que diz respeito à localização geográfica das empresas, a investigação conclui inequivocamente que aglomerações estimulam a persistência das exportações. Adicionalmente, a importância atribuída pelas empresas às formas de cooperação institucional (universidades e organizações de I&D) e outras (por exemplo, associações de setores, conferências) afeta positivamente a persistência de exportações das empresas. Finalmente, a localização das empresas no litoral não se revelou estatisticamente significativo na explicação da persistência das exportações.

Palavras-chave: Persistência das exportações; Empresas; Localização; Aglomerações; Cooperação; Portugal

1. Introduction

Exports contribute to increase job opportunities and positively impacts on countries and regions' economic growth by encouraging organizations to better use production resources and be more competitive in the world markets (Gokmenoglu, Sehnaz, & Taspinar, 2015; Neves, Teixeira, & Silva, 2016).

At the level of the company, the relationship between exports performance and economic/financial competitiveness runs both ways (Neves et al., 2016). Voluminous empirical literature has already addressed the importance of exports to companies' performance (de Matteis, Pietrovito, & Pozzolo, 2019; Giovannetti, Ricchiuti, & Velucchi, 2013), as well as the determinants of export propensity and intensity (Farole & Winkler, 2014; Kang, 2016).

The latter set of studies have considered a myriad of factors that affect companies' export propensity or performance, namely: productivity (Brakman, Garretsen, van Maarseveen, & Zwaneveld, 2020; Cole, Elliott, & Virakul, 2010), size (Brakman et al., 2020; Zhang & Liu, 2012), ownership (Brakman et al., 2020; Cole et al., 2010), innovation (López-Bazo & Motellón, 2018), economies of scale (Farole & Winkler, 2014), and location (Brache & Felzensztein, 2019; Brakman et al., 2020; Fabling, Grimes, & Sanderson, 2013; Giovannetti et al., 2013; Naudé & Matthee, 2010) or agglomeration economies (Kang, 2016). Nevertheless, they overlooked the strategic behaviour of companies regarding exports (Love & Máñez, 2019). Specifically, extant empirical literature has not yet addressed how export strategic behaviour, namely, not exporting, exporting in an intermittent way, or being a persistent exporter is affected by companies' geographical location.

Geographical location is likely to impact on export propensity and performance on the basis of regions' distance to international market (de Matteis et al., 2019), institutions quality/density (de Matteis et al., 2019), agglomeration economies and spillovers (Farole & Winkler, 2014; Kang, 2016), innovation dynamics (López-Bazo & Motellón, 2018), and physical infrastructures (Fabling et al., 2013; Farole & Winkler, 2014). Although some studies demonstrated that companies located in the core regions are more prone to export and succeed in international markets (de Matteis et al., 2019; Farole & Winkler, 2014), none of such studies addressed the issue of export strategic behaviour, namely persistence.

Unlike intermittent export operations, a persistent export activity generates mechanisms that lead the company to a routine based on learning new knowledge (Love & Máñez, 2019)

boosted by the effect of learning-by-doing and thus enhancing productivity (Iandolo & Ferragina, 2019). Additionally, it often involves sunk costs because leaving the target export market implies a depreciation of experience and sales volume (Timoshenko, 2015).

The limited literature on export persistence has so far addressed firm-related characteristics (Blum, Claro, & Horstmann, 2013; Love & Máñez, 2019) and demand-related factors as determinants of this export behaviour. None of the referred studies addressed the role of geographical location related factors in explaining companies' export persistence. However, the important role of location has been studied in other papers about export propensity (Cole et al., 2010; Giovannetti et al., 2013) and export intensity (Brache & Felzensztein, 2019; de Matteis et al., 2019; López-Bazo & Motellón, 2018).

Thus, the present study aims at fill in the above-mentioned literature gap by empirically analysing the extent to which geographical location influences companies export behaviour, that is, companies' persistence in exports.

To undertake such endeavour, we resort to Bank of Portugal's Central Balance Sheet Harmonized Panel Data, which encompasses 177865 companies operating in Portugal in the period 2006-2017. In methodological terms, we resort to quantitative, econometric models, most notably dynamic probit panel data regressions.

The dissertation is organized as follows: Section 2 presents a theoretical background followed by a discussion of the empirical studies about variables of exporting; This is followed in Section 3 by a description of the data set and the econometric model to be employed in the study, and the results are presented in Section 4; The last section encloses a short discussion and some concluding remarks, as well as limitations of the present study and paths for future research.

2. Revision of literature on export determinants with a focus on geographical related factors

2.1. Theoretical approaches explaining export performance and export strategic behaviour

The theoretical framework used in this study is based on the strategic tripod (Gao, Murray, Kotabe, & Lu, 2009; Peng, Sun, Pinkham, & Chen, 2009), which encompasses three main dimensions for understanding firms' performance, including export strategies: 1) firm specific resources and capabilities; 2) industry characteristics; and 3) institutional characteristics.

The strategic tripod benefits and comprehends several key theoretical approaches which helps to understand firm's export performance and behaviour (Gao et al., 2009; Peng et al., 2009). It emerges as a way of summarizing the factors affecting export performance coming from a vast fragmented literature (Aaby & Slater, 1989; Gao et al., 2009). Internal factors are based on firm's resources and capabilities and external factors are based on and supported by industrial organization theory (Gao et al., 2009). In many studies, institutional background has been neglected, but these institutions can diverge considerably with location, and so, it can be considered as a third leg of this strategy (Peng et al., 2009).

Addressing firms' resources and capabilities, the theory of the firm (Penrose, 1960) and the resource-based theory (Barney, 1991) establish that the competitiveness of a firm is determined by their own controllable tangible and intangible resources. According to theory of the firm (Penrose, 1960), a company is an aggregation of productive resources that can be combined in different ways that can make the company different from its competitors (Burvill, Jones-Evans, & Rowlands, 2018). Barney (1991) in the resource-based view considers three different types of firm's resources: physical capital; human capital; and organization capital. The physical capital resources are tangible assets such as, firm's facilities, innovations, firm's location and access to materials (Barney, 1991). The human capital resources are related to people in the organization, which includes its experience, training, networks and intelligence (Barney, 1991). Lastly, organization capital resources are related to the organization as whole, which means, for instance, working environment and organization structure (Barney, 1991). Notwithstanding, such resources must be rare, valuable, difficult to imitate and non-substitutable in order to generate a potential competitive advantage against

competitors (Barney, 1991; Joyce & Winch, 2004). Importantly, such resources determine both firm's competitive advantage and export performance (Chen, Sousa, & He, 2016).

Technological developments significantly boost demand in innovation and are an essential element for being competitive in the market. Investment in R&D activities bring new knowledge into the companies, which is itself the base to new innovations (Love & Roper, 2015). Nevertheless, firms' innovation capacity is intrinsic connected with firms' structure and human resources, since they must be capable to receive new knowledge (Savino, Petruzzelli & Albino, 2017; Love & Roper, 2015).

Despite commonly used, the resource-based theory assumes that product markets are stable and constant, and that resources are unique and non-transferred (Chen et al., 2016). The dynamic capability theory seeks to overcome this limitation by approaching more complex environments (Burvill et al., 2018). Dynamic capabilities view introduces the ability of companies to involve, create and readapt to internal and external changes (Teece, Pisano, & Shuen, 1997) by sustaining competitiveness through rearrange resources, foresee and take advantages from opportunities and threats (Cao, Duan, & El Banna, 2019). In this context, past routines and decisions which provided firms with knowledge helps firms to understand the firm context (Cao et al., 2019; Eisenhardt & Martin, 2000). Logically, this better understanding gives firms the ability to a better strategic decision-making (Cao et al., 2019).

The organizational learning theory explains the association concerning previous organizational operations and the organization's future behaviour and performances (Chen et al., 2016). In other words, this means that past operations allow firms to learn from that and adapt their actions in the future. In export activities, firms learn from previous exporting spells by adding more understanding of export strategies, surrounding conditions, such as customer and markets, and how that affects the export performance (Chen et al., 2016). Therefore, such knowledge influences current strategic decisions, and so, it affects future export performance (Chen et al., 2016; Lages, Jap, & Griffith, 2008). The Uppsala internationalization model, in a sense, relates to this theory since it suggests a progressive internationalization of companies (Johanson & Vahlne, 1977; Johanson & Wiedersheim, 1975).

According to Uppsala internationalization model, firms start with no export activity, going on to export only nearest and similar markets, and evolving to more distant and different markets. After that, firms may establish a foreign sales subsidiary and then start their own

production overseas (Johanson & Vahlne, 1977; Johanson & Wiedersheim, 1975). This underpins a path-dependence in the nature of internationalization since previous accumulated knowledge (learning effect) will impact on future export strategies (Ayllón & Radicic, 2019).

Based on the above, we conjecture that:

H1: Firms with higher competencies (education, training, R&D) tend to be more persistent in exports.

Beyond firm's resources, the external market and environmental forces determine exporting firm's competitive advantage (Chen et al., 2016) and export persistence (Araujo, Mion, & Ornelas, 2016).

In what relates to industry/ market characteristics, the industry-based view states that the industry structure influences firm's strategy, which directly and indirectly impacts on its performance (structure-conduct-performance paradigm) (Gao et al., 2009; Porter, 1980, 1985). This theory establishes that is possible to gain competitive advantages by focusing on external factors of the market. So, external environment forces a firm to adapt in order to thrive (Collis, 1991). Therefore, industry factors are determinants in explaining export strategy behaviour (Gao et al., 2009).

This view brings to light the concept of sector technological trajectories. As different sectors have different environments, when deciding which innovations to invest, firms will not consider all possibilities with an equal weight since they are more aware of innovation related to its business and the knowledge is limited (Pavitt, 1984; Rosenberg, 1976). Moreover, a large part of knowledge is difficult to transmit and its particular to each firm experience (Pavitt, 1984). In other words, knowledge is hardly transmissible, individual to each firm, cumulative from previous experiences (Love & Máñez, 2019) and it differs in source and direction from sector to sector (Pavitt, 1984). Given this scenario, future technological trajectories of sectors are decidedly constrained. So, different trajectories are justified by sectoral differences in three characteristics: technology's source, firms' needs and means of appropriating benefits (Pavitt, 1984). Firms can be grouped according to their technological trajectory into 4 main categories (de Jong & Marsili, 2006; Pavitt, 1984): supplier dominated;

production intensive (scale intensive and specialized suppliers) (de Jong & Marsili, 2006; Pavitt, 1984); science based, and resource intensive (de Jong & Marsili, 2006).

Firms that operate in supplier dominated industries are usually the conventional manufacturers, the agriculture and housebuilding firms. These are small and with low capabilities of absorbing new knowledge (Pavitt, 1984), so they innovate in line with their supplier, mostly representing innovation of processes (de Jong & Marsili, 2006). This suggest that these firms have low level of sunk costs, as well as low levels of organizational learning.

Firms that operate in production intensive industries can be divided in two different sub-categories: scale intensive and specialized suppliers. Scale intensive innovate from their own experience of the production process (Pavitt, 1984). Usually by having a better task partition and by simplifying them. Through their understanding of the process, they will work out increases on productivity (Pavitt, 1984). Specialized supplier firms, innovation levels are high (de Jong & Marsili, 2006) once their competitiveness is dependent on product's design and features for specific firm's needs (Pavitt, 1984). High levels of organizational learning can be linked to both categories of production intensive firms. Although, specialized suppliers invest more in order to innovate and keep their competitiveness, which will generate higher sunk costs.

Firms that operate in science-based sectors are known for their high investment in R&D and can be found in the chemical and the electronic sectors (Pavitt, 1984). They detent a high amount of innovation specialists who help them innovate in products and processes (de Jong & Marsili, 2006). These firms usually have stable relations with universities and research institutes (de Jong & Marsili, 2006), and have a higher number of patents associated to them as a protection to the investments made in R&D, once some innovations are easily imitated (Pavitt, 1984). Easily these firms will have large amounts of funds invested in R&D, which denotates sunk costs.

Resource-intensive companies have some similarities with supplier dominated firms, but less dependent of supplier and with higher degree of innovation absorption (de Jong & Marsili, 2006). They tend to innovate both in product as in processes instead of an emphasis on innovation process (de Jong & Marsili, 2006). The singularity of these firms is that they limit the amount to spend in innovations, which will reflect on their controlled sunk costs.

The relation between these technological trajectories and export behaviour cannot be easy to interpret. On one hand, as mentioned above, organizational learning impacts on export

persistence by conditioning future decisions according their accumulated knowledge (Chen et al., 2016). So, firms with routines-based activities and with considerable accumulated knowledge resulting from the above-mentioned technological trajectories will be associated with more persistent export behaviour. On the other hand, sunk costs will have an influence on export behaviour since firms have interest in monetizing these types of costs. Therefore, firms with large amounts of sunk costs will be more persistent in exports.

Based on the above, we conjecture that:

H2: Firms operating in science based, specialized suppliers or scale intensive sectors tend to be more persistent in exports.

The institutional-based view focuses on the institutional environment and indicates that institutional forces strictly influence firms' strategic decisions, and therefore, their performance (Gao et al., 2009). These institutions are independent from the companies and compelled by a geographic delimitation (Pinho & Martins, 2010). The importance of this issue to export persistence comes from the fact that in regions endowed with better institutions firms tend to export more and for a longer time span (Araujo et al., 2016).

Despite the importance of institutional context to firms, location per se also is important when studying exports. The effects of location on this matter comes from agglomeration of industries (Kang, 2016), cooperation of firms with institutions and other partners, such as costumers or competitors (Brache & Felzensztein, 2019), and sunk costs (Cole et al., 2010).

Agglomerations can affect firm's productivity and respective demands (Brache & Felzensztein, 2019) through three different ways. According to theory (Marshall, 1920), agglomerations allow firms to reduce costs since they place stakeholders closer, attract and develop better relations with labour force ('labour market pooling') and promote knowledge sharing through knowledge spillovers (Brache & Felzensztein, 2019). Notwithstanding these benefits, a high level of agglomeration may bring some negative externalities since it may rise price of resources because there will be more firms competing for the same resources (Kang, 2016). Thus, export performance and persistence are contingent to the net effect emerging from these two forces (Brache & Felzensztein, 2019).

Cooperation can be understood as the act of merge resources or capabilities (cooperate) of two different entities in order to pursue opportunity that would be unattainable (Brache &

Felzensztein, 2019). The results of cooperation are based on knowledge sharing. In order to increase these effects, firm's location and agglomeration are important because as agglomeration spreads, the externalities from cooperation increase (Brache & Felzensztein, 2019). The impact of this in export will depend on the cost-benefit ratio of cooperation. If spillovers outperform cooperation costs, then firms will benefit from cooperation (Nowak, 2012).

New trade theories introduce insights about export strategic decisions in a spatial context in which considerations about firm's location influence export intensity (Venables, 2019). This will depend on variety of conditions, such the extent of firm heterogeneity and the degree of sunk entry costs (Tybout, 2008).

Therefore, firms' exports when entering in overseas markets entails sunk costs and fixed costs in order to keep exporting (Altuzarra, Bustillo, & Rodríguez, 2016; Greenaway & Kneller, 2007). Sunk costs are related to create distribution networks, efforts to promote the products in the new markets, collecting data and knowledge about the new market (Lawless, 2010) or even R&D expenses which will allow a firm to become more competitive by improving products quality. Fixed costs are necessary to keep the relations with international markets such as transport and service costs and marketing costs (Cole et al., 2010).

However, sunk costs are also linked to companies' location (Cole et al., 2010) because, on one hand, firm's innovation is dependent on firm's location (López-Bazo & Motellón, 2018), and, on the other hand, firm's location will dictate the costs related with transportation. Firms located closer to overseas market will be in advantage since will be cheaper to export (de Matteis et al., 2019).

So, to decide export, a firm must have certain level of productivity (Altuzarra et al., 2016; Greenaway & Kneller, 2007). Otherwise, if the expected gross operating profits of exporting are lower than sunk entry costs, the firm loses money (Altuzarra et al., 2016).

Based on the above, we conjecture that:

H3: Geographical location and regions' characteristics impact on firms' export persistence.

H3a: Firms located in regions with high agglomerations tend to be more persistent in exports.

H3b: Firms which attribute high importance to cooperation with co-located organizations tend to be more persistent in exports.

H3c: Firms located in coastal regions tend to be more persistent in exports.

Figure 1 synthesizes the main theoretical approaches that explain firms' export persistence.

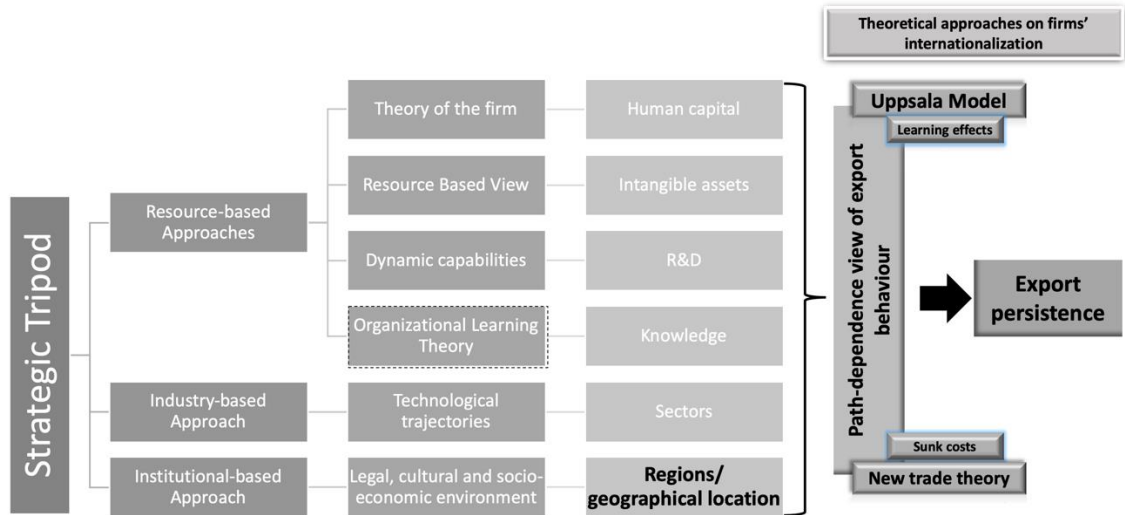


Figure 1: Theoretical framework

Source: Own elaboration

2.2. Extant empirical evidence of firms' export performance and persistence

Based on the above theoretical approaches it is possible to come up to 3 main categories of determinants that are likely to influence firms' export performance and behaviour: 1) Firm-level; 2) Industry/ External; and 3) geographical/ regional/ location.

Given that the focus of the present dissertation is on the influence that geographical location and regions' characteristics may have on firms' export persistence, we decided to analyse the empirical studies that addressed the relation between location and export performance (see Table A1, in Appendix. As referred earlier, most of these studies analysed the issue of export propensity and/ or intensity rather than export persistence. The few studies that focused on export persistence overlooked the location/ geographical factors.

2.2.1. Firm-level characteristics

Starting by the most studied determinant, firm-related characteristics can either be positively or negatively related with export propensity (Agnihotri & Bhattacharya, 2015; Altuzarra, Bustillo, & Rodríguez, 2016; Ayllón & Radicic, 2019; Cole et al., 2010; Farole & Winkler,

2014; Giovannetti et al., 2013; Serra, Pointon, & Abdou, 2012), export intensity (Brache & Felzensztein, 2019; de Matteis et al., 2019; Gao et al., 2009), and export persistence (Blum et al., 2013; Love & Máñez, 2019).

The empirical literature about firm-level determinants suggest that human capital (Agnihotri & Bhattacharya, 2015; Altuzarra et al., 2016; Blum et al., 2013; Cole et al., 2010; de Matteis et al., 2019; Serra et al., 2012), productivity (Altuzarra et al., 2016; Cole et al., 2010; de Matteis et al., 2019; Farole & Winkler, 2014; Love & Máñez, 2019), R&D and innovation (Altuzarra et al., 2016; Ayllón & Radicic, 2019; Brache & Felzensztein, 2019; Cole et al., 2010; Farole & Winkler, 2014; Gao et al., 2009; Giovannetti et al., 2013; Love & Máñez, 2019), firms structure (Altuzarra et al., 2016; Ayllón & Radicic, 2019; Blum et al., 2013; de Matteis et al., 2019; Farole & Winkler, 2014; Gao et al., 2009), firm size and age (Agnihotri & Bhattacharya, 2015; Altuzarra et al., 2016; Ayllón & Radicic, 2019; Brache & Felzensztein, 2019; Cole et al., 2010; de Matteis et al., 2019; Farole & Winkler, 2014; Gao et al., 2009; Giovannetti et al., 2013; Love & Máñez, 2019; Serra et al., 2012) and past experiences (Altuzarra et al., 2016; Cole et al., 2010) are the most significant determinants of export performance.

The approaches to human capital/ resources uncovered that usually it is significant and positively linked with export performance. Although some other studies suggest that this determinant has no impact. Agnihotri & Bhattacharya (2015) establish that education level (at less than 1%) and that tenure in the organization and age of management team (at less than 5%) is significant and positively related with export propensity. In contrast, Blum et al. (2013) found mixed results. When measuring human resources, employment and wages are positively and significantly linked to export persistence, but the share of white collars and the white-blue wage premium have no impact. In fact, several studies have stated that the percentage of white collars and skilled workers and no effect on firm export (Altuzarra et al., 2016; Cole et al., 2010; de Matteis et al., 2019).

Literature studying the impact of productivity on exports is quite consistent since all studies have demonstrated that productivity is significant and positively linked with export intensity (de Matteis et al., 2019), export propensity (Altuzarra et al., 2016; Cole et al., 2010; Farole & Winkler, 2014), and export persistence (Love & Máñez, 2019).

Most literature about R&D and innovation has established that undertaking R&D activities or being involved in innovation is positive and significant to export performance. Differentiation competencies, measured through innovation in products, is the most

consistent determinant, being positive related with export propensity, export intensity (Gao et al., 2009) and export persistent (Love & Máñez, 2019). Notwithstanding, some studies have shown that R&D might not impact on exports (Ayllón & Radicic, 2019; Giovannetti et al., 2013).

Concerning firm structure, being foreign owned is positive and significant for export propensity (Altuzarra et al., 2016; Cole et al., 2010; Farole & Winkler, 2014; Gao et al., 2009). However, being part of a group has been shown as not significant for export performance (Ayllón & Radicic, 2019).

With the exception of two studies (Agnihotri & Bhattacharya, 2015; Ayllón & Radicic, 2019), firm size and age is positively and significantly related to export propensity (Altuzarra et al., 2016; Cole et al., 2010; Farole & Winkler, 2014; Giovannetti et al., 2013; Serra et al., 2012), export intensity (Brache & Felzensztein, 2019; de Matteis et al., 2019; Gao et al., 2009) and export persistence (Love & Máñez, 2019).

Past experience's literature has also consistently demonstrated that having exporting in previous years has a positive and significant impact on subsequent export performance (Altuzarra et al., 2016; Cole et al., 2010).

2.2.2. External Forces (Industry-level characteristics)

Existing literature suggests that industry and external forces to firms' characteristics can affect export's propensity (Gao et al., 2009), intensity (Brache & Felzensztein, 2019; Gao et al., 2009) and export persistence (Blum et al., 2013; Love & Máñez, 2019). Literature referring this issue identifies economic sector (Brache & Felzensztein, 2019; Gao et al., 2009) and market demands (Blum et al., 2013; Love & Máñez, 2019) has the most significant determinants of export performance.

The position of a company on specific sectors has been identified as significant and positively related with export intensity (Brache & Felzensztein, 2019). For instance, Brache & Felzensztein (2019) evidenced that companies in the consulting sector were likely to export more intensely.

Literature addressing domestic and foreign demands is also highly consistent indicating that changes in foreign market has no impact on exports (Blum et al., 2013; Love & Máñez, 2019).

Nonetheless, domestic sales (Blum et al., 2013) and domestic demand upturn (Love & Máñez, 2019) are positive and significantly related to export persistence.

2.2.3. Geographical location and regions' characteristics

Extant evidence suggests that location characteristics can affect export's propensity (Cole et al., 2010; Farole & Winkler, 2014; Giovannetti et al., 2013) and intensity (Brache & Felzensztein, 2019; de Matteis et al., 2019). Specifically, it shows that agglomeration (Brache & Felzensztein, 2019; Farole & Winkler, 2014), cooperation (Brache & Felzensztein, 2019) and location (Cole et al., 2010; de Matteis et al., 2019; Giovannetti et al., 2013) constitute the most significant determinants of exports propensity/ intensity.

The studies approaching the issue of agglomerations found that these are significant and therefore important in explaining export performance. Farole & Winkler (2014) established that despite agglomeration importance, not all types of agglomeration proxies have the same impact on export propensity. For instance, agglomeration measured through the percentage of exporters of total firms in a region is positively and significantly (at less than 1%) impacts on export propensity, whereas when measured through the sum of the squares of the output share, agglomerations have a negative and significant impact on export performance. Brache & Felzensztein (2019) found that agglomeration, measured through the quotient of the percentage employment of an industry in a region and the percentage employment in the same industry in the country, has a negative impact on export intensity. These negative results might come from congestion costs (Farole & Winkler, 2014). Another aspect that must have to be consider is the number of exporters in an industry, since this later determinant is positive and significant (at less than 1%) (Gao et al., 2009). Indeed, albeit the more the locals are agglomerated with exporting firms, the more non-exporting firms are likely to enjoy from spillovers, beyond a certain point, congestion costs might outweigh these spillovers. In other words, more firms will be competing for the same resources, such as human capital, bidding up the price of specialized inputs, which negatively affects its export decision of non-exporting plants (Kang, 2016).

For firms placed in core locations, all regional determinants of export participation emerged as statistically significant (Brache & Felzensztein, 2019; Cole et al., 2010; Giovannetti et al., 2013). de Matteis et al. (2019) found that distance to foreign markets is one of the most

significant determinants of export intensity. According to these findings the higher is the distance between markets, less is the export intensity.

For firms operating in Thailand, being located in the south is a significant determinant to become an exporter (Cole et al., 2010). Brache & Felzensztein (2019) underline that locations endowed with more natural resources foster export intensity. In a similar way, Giovannetti et al. (2013) found that being present on an industrial district or located close to an airport or seaport increases chances of export, highlighting the importance of facilities and institutions to firms' export performance. Regarding institutions, Gao et al. (2009) demonstrate that institutions, measured through two indices (free market mechanisms and intermediate institution development), enhance propensity and intensity. Additionally, de Matteis et al. (2019) evidenced that whereas education and bank sector are positive and significant related to export intensity, judicial efficiency is negatively related export intensity. Finally, trade facilitation (customs) and infrastructure (electricity), emerge, according to Farole & Winkler (2014), as critical determinants of export participation.

3. Methodological considerations

3.1. Main hypotheses to be tested

As previously referred, firm export behaviour has been understudied. In fact, to our best knowledge, no study has yet considered the effects of geographical related factors (e.g., agglomerations, cooperation or location) on export persistence. Thus, the present study aims at assessing the extent to which geographical factors impact on firms' export persistence.

Three main hypotheses are to be tested (cf. Section 2). The first relates the resources of firms with export persistence. According to the theoretical framework presented earlier firms with better resources, or in other words, firms that spend more money in R&D and training and that are able to learn from experience are more prone to export more continuously. The second hypothesis approach export persistence considering technological trajectories of firms. As science based, specialized suppliers and scale intensive firms are more committed to either recover sunk costs or learn from their routines, they will be more prone to be persistent in export.

To address the core of the study, the last hypothesis is divided in three parts that reflect the importance of location as determinants of export persistence. The first part of the hypothesis will test the presence of agglomeration. The extant literature suggests that spillovers resulting from these agglomerations can significantly and positively impact on firms export persistence. Another important hypothesis to be tested is the cooperation that firms may have engaged by being co-located with other organization, boosting this way a persistent pattern of exporting. The last, but not the least, it will be tested that firms located in coastal regions of Portugal are likely to be more persistent since, in these locations there are additional facilities to reach foreign markets.

To sum up, the three hypotheses to be tested in this study are as follows:

H1: Firms with higher competencies (education, training, R&D) tend to be more persistent in exports.

H2: Firms operating in science based, specialized suppliers or scale intensive sectors tend to be more persistent in exports.

H3: Geographical location and regions' characteristics impact on firms' export persistence.

H3a: Firms located in regions with high agglomerations tend to be more persistent in exports.

H3b: Firms which attribute high importance to cooperation with co-located organizations tend to be more persistent in exports.

H3c: Firms located in coastal regions tend to be more persistent in exports.

By testing these hypotheses together will help us having a better understanding of what are the determinants of export persistence, with a special focus on location factors, in the case of Portuguese firms.

3.2. Econometric specification

The aim of the present study is to determine the probability of being an exporter in period t subject to what has been done by the firm in the past. Therefore, the dependent variable is binary, taking the value of 1 if the firm i exports at time t and the value of 0 otherwise.

Given that the nature of the dependent variable dictates the choice of the econometric technique, in the case of binary dependent variables the most adequate techniques involve the use of probit (or logit) econometric specifications.

Regarding the estimation of a panel data, the options include fixed-effects or random-effects. However, as some of the explanatory variables of interest (e.g., technological trajectories or location) are time-invariant, fixed effects are unfeasible, forcing the choice to random-effects. Moreover, the use of the latter is only valid when the unobserved time invariant firm effects are uncorrelated to the explanatory variables. Given that the lagged value of the dependent variable is an explanatory variable, such validity assumption is not met. To overcome such a problem, we resort to Wooldridge's (2005) solution, which relaxes the "independence assumption" in the context of random effects dynamic probit models. Such solution consists in replacing the α_i in the equations below by a linear function of the firm's observable characteristic's (i.e. the average values of the time-variant exogenous characteristics) added to the value of the so-called "initial condition", i.e., the export or non-export state of the firm at the starting period in observation.

Thus, the estimations will involve the use of dynamic random effects probit models.

For the conventional hypothesis of export persistence, presented in model 1 entails a dynamic random effects probit specified as follows:

$$Exp_{it} = \beta_1 + \beta_2 Exp_{it-1} + \beta W_{it} + \delta V_i + \alpha_i + \varepsilon_{it} \quad (1)$$

Where firm i export status at time t by (Exp_{it}) depend on the export status at time $t-1$, a set of time-variant (W_{it}) and time-invariant (V_i) observable characteristics of the firm, and an unobservable firm-specific characteristic (α_i).

Time-variant (W_{it}) observable characteristics of the firm include human capital, R&D, Agglomeration, Cooperation, Size and Age. Time-invariant (V_i) observable characteristics of the firm include Location and Technological Trajectories.

This model only allows for the assessment of the traditional hypothesis of persistence, modelling the effect that past export status has on present export status without any discontinuity or variability added to a vector of explanatory variables. In the event $\hat{\beta}_2$ emerges as positive and statically significant, this would suggest that pure persistence hypothesis is valid.

The analysis of persistence/ intermittence in export behaviour requires the consideration of subgroups according to firms' past export behaviour, most notably:

- Persistent exporters – firms that continuously exported over the period in analysis;
- Intermittent exporters – firms that exported in some years but failed to do so in other years;
- Non exporters – firms that never exported over the period in analysis;

In this context, the specification of the second model comes as follows:

$$Exp_{it} = \beta_1 + \beta_2 Persistent_Exp_{it-1} + \beta_3 Intermittent_Exp_{it-1} + \beta W_{it} + \delta V_i + \alpha_i + \varepsilon_{it} \quad (2)$$

This second model allows for unconventional hypothesis of persistence, enabling the modelling of export persistence/ intermittence. Evidence in favour of export persistence would require a positive and statistically significant $\hat{\beta}_2$ coefficient, as well as a negative and statistically significant $\hat{\beta}_3$ coefficient or a non-significant $\hat{\beta}_3$.

3.3. Data source and description of the relevant variables

The data used in this research is Bank of Portugal's Central Balance Sheet Harmonized Panel Data.¹ This database encompasses 177865 companies operating in Portugal in the period 2006-2017. Additionally, in order to compute agglomeration, cooperation and location variables, we used other databases namely those from Agência Portuguesa do Ambiente (APA), Eurostat and INE.

Given the research question, and in line with extant empirical research (Table A1, in Appendix), we resort to quantitative, econometric models, most notably, dynamic random effects panel data probit models, where the dependent variable, export behaviour, assumes 2 possible values: 0 – does not export; 1: exports.

- 1) “exporter”: dummy variable that takes value of 1 if a company exports (“exporta” take values of 1, 2 or 3) in time t and 0 if a company does not export (“exporta” equals 0). “exporta” is an original variable from BPLIM, which takes values of 0 (does not export), 1 (export to community market), 2 (export to extra-community market) and 3 (export to community and extra-community markets);
- 2) “P_exporter”: dummy variable which takes value 1 if a company has exported persistently in time t and $t-1$ and 0 otherwise;
- 3) “I_exporter”: dummy variable which takes value 1 if a company has exported intermittently in the current year and the previous year. In other words, a company has export in one year but does not export in the other;
- 4) “HR”: Average wages paid per remunerated employee at a firm's service. Based on the literature, higher average wages reflect higher levels of human capital (Borjas, 2013);
- 5) “RD”: Research and Development - dummy variable which takes value 1 if a company has, at least, one employee allocated to R&D activities and 0 otherwise;
- 6) “tech_traj”: technological trajectories - variable which takes values “Information Networks”, “Knowledge Intensive Business Services”, “Non Market Services”, “Physical Networks”, “Scale Intensive”, “Science-based”, “Specialized suppliers”, “Supplier Dominated” and “Supplier Dominated Services” according to their correspondence to ISIC used by Castaldi (2009) and which was converted to CAE based

¹ This research benefited from a protocol established between the author of this dissertation, his supervisor and Bank of Portugal (reference: p059_TeixeiraSilva, from 21st January 2020).

on Eurostat. Based on that, we transform these possible values in dummy variables to use in the models above mentioned;²

- 7) “Agglomeration”: calculated according a regional co-location quotient of industry establishments defined in the Cluster Mapping Methodology³ by Harvard Business School and U.S. Economic Development Administration (Brache & Felzensztein, 2019). The formula used is $agglomeration = \frac{E}{E_i} \times \frac{e_i}{e}$, where

E= Total of establishments in the country

E_i= Total of establishments of industry *i* in the country

e= Total of establishments in the region

e_i= Total of establishments of industry *i* in the region

This formula allows a better understanding of agglomerations dynamics. Once it uses industries, regional and national values, it allows to understand the behaviour of agglomerations of companies of a certain industry in a given location compared to the national level;

- 8) “coop_market”: obtained from Community Innovation Survey (CIS), being an average of the percentage of companies by industry that attributes “high” importance to cooperation for product and/or process innovation with external entities related to market organizations and/or sources (e.g. competitors, suppliers, costumers). For each company, it is considered the industry average where the firm operates.
- 9) “coop_institution”: obtained from Community Innovation Survey (CIS), being an average of the percentage of companies by industry that attributes “high” importance to cooperation for product and/or process innovation with external entities related to institutional organizations and/or sources (e.g. universities, research institutes). For each company, it is considered the industry average where the firm operates.
- 10) “coop_institution”: obtained from Community Innovation Survey (CIS), being an average of the percentage of companies by industry that attributes “high” importance to cooperation for product and/or process innovation with external entities related to

² Table A2 in Appendix details the conversion of sector taxonomy to CAE.

³ www.clustermapping.us/content/cluster-mapping-methodology, last accessed on June 2020.

‘Other’ organizations and/or sources (e.g., sectors’ associations, conferences). For each company, it is considered the industry average where the firm operates.

- 11) “location”: dummy variable which takes value 1 if a company is located in a coastline county, 0 otherwise;
- 12) “E001”: size of a company measured by the number of employees;
- 13) “firm_age”: firm’s age since its foundation.

4. Results

4.1. Description of Portuguese companies' market and database

Based on the initial evaluation of basic statistics of our variables (see Table 1), it is possible to provide a brief description of the companies in the database.

Regarding export behaviour and strategies, doubtless the non-export strategy stands out since 88% companies does not export, and the set of exporting companies is only 12%. It is worth noting that around 8% of the companies demonstrate a pattern of persistent exports, while only 9% exhibit an intermittent pattern of exporting.

Other aspect worth referring is the average wage paid per employee, once it is very close to the minimum wage in Portugal, reflecting the relatively low qualified labour. Regarding R&D, more than 62% of the companies allocated, at the least, one employee to R&D activities. Yet, on average, less than 0.3% of firm's employees are allocated to these activities. Larger firms have, on average, more human resources allocated to R&D (around 0.05%) while smaller firms have only less than 0.03% of their resources allocated to these activities.

In what concerns technological trajectories, it is observed that the percentage of exporters is greater in specialized suppliers (40%) followed by supplier dominated (30%). On other side, information networks and non-market services are the technological trajectories with lower percentage of exporters, with only 2% of the companies being involved in export.

Companies located in the coastline are mainly operating in physical networks sectors (31%), followed by supplier dominated services (14%) and knowledge information business services (KIBS) (14%). Nevertheless, the structure is similar for those firms located far from coastline, since physical networks are the technological trajectory type most common (32%), followed by knowledge information business services (13%) and supplier dominated services (13%).

Another aspect worth referring is that companies located in regions with an agglomeration index above the national average tend to export more, since 13% of the firms located in more agglomerated regions export against only 10% of the companies located in less agglomerated regions.

Additionally, only, on average, 7% of the industries in Portugal attribute high importance to external market related organizations as sources of information for innovation. The

corresponding percentage is even lower (4%) regarding cooperation with institutional organizations (e.g., Universities). About 7% of the firms highly praise other organizations (e.g., associations) as sources of innovation.

At national level, the companies in analysis are relatively small (around 7 employees) and experienced in business, since the average age of the companies is higher than 12 years old. Additionally, 66% of the total are located outside the coastline.

4.2. Empirical results from the estimation of the econometric specifications

Diagnosis tests (see Table 2) evidence that there are problems related to heteroskedasticity (the null hypothesis of homoskedasticity is rejected, based on the Cook-Weisberg test for heteroskedasticity) but not multicollinearity issues as the mean Variance Inflation Factor is around 1.5 (and the maximum VIF is lower than 5). In order to work around this problem, we resorted to robust standard errors in the two estimations of pure (Model A) and conditional (Model B) export persistence.

The two estimated models are globally significant as reflected by the p-value 0 obtained from the Wald-test.

Estimations results evidence that firms in analysis exhibit both pure (Model A) and conditional (Model B) export persistence as the estimated coefficients associated with the past export variables are positive and significant.

The literature predicted that past experience in exporting would increase the likelihood to export in the present and in the future (Chen et al., 2016; Lages, Jap, & Griffith, 2008). This implies that being persistent or intermittent is better for future exporting activity comparatively to non-exporter. The conditional persistence model (Model B) indicates that, both strategies, are significant and positive correlated. Nevertheless, the persistence coefficient is higher than the intermittent coefficient indicating that a continuous learning curve is better for export persistence. It also indicates that there are losses on the learning curve when interrupting exports for a period of time (Love & Máñez, 2019).

Table 1: Descriptive statistics of the relevant variables

		Variable	Description	No. observations	Mean	Min	Max	St deviation		
Dependent variable		Exporter (t)	Dummy variable assuming value 1 if the firm exports in time t and 0 otherwise	4 574 014	0.120	0	1	0.3254391		
Independent core variables		Exporter (t-1)	Dummy variable assuming value 1 if the firm exports in time t-1 and 0 otherwise	4 574 013	0.120	0	1	0.3254392		
	Export behaviour / strategy	Intermittent exporter (t-1)	Dummy variable assuming value 1 if the firm export in time t-1 or t-2 and 0 otherwise	4 574 014	0.092	0	1	0.288739		
		Persistent exporter (t-1)	Dummy variable assuming value 1 if the firm export in time t-1 and t-2 and 0 otherwise	4 574 014	0.075	0	1	0.2625999		
	Firms' related variables	Human capital		Average remuneration per remunerated employee	3 322 332	6 115.001	0	2 280 594	7 552.943	
		R&D		Dummy variable assuming value 1 if a firm has at least 1 employee allocated to R&D activities and 0 otherwise	4 574 014	0.622	0	1	0.4849754	
		Technological trajectories	Science based		Dummy variable assuming value 1 when the industry CAE is equal to ... (see Table A2 in Appendix) and 0 otherwise	4 574 014	0.006	0	1	0.0761067
			Specialized Suppliers			4 574 014	0.005	0	1	0.0694059
			Scale Intensive			4 574 014	0.049	0	1	0.2157782
			Supplier dominated			4 574 014	0.051	0	1	0.2193121
			Information Networks			4 574 014	0.088	0	1	0.2832176
			Physical Networks			4 574 014	0.319	0	1	0.4662469
			Knowledge Intensive Business Services			4 574 014	0.132	0	1	0.3381664
	Non-Market Services		4 574 014	0.065	0	1	0.2458078			
	Regional/ location related variables	Agglomeration		Agglomeration of companies of a certain industry in a given location compared to the national level	3 129 615	1.111	0.206	5.859	0.4267754	
		Cooperation	Market cooperation		Average of companies in a given industry that consider market sources the “high degree of importance” as sources of information for the implementation and realization of Innovation projects classified by companies with innovation activities	4 574 014	0.065	0	0.53	0.0741318
			Institutional cooperation		Average of companies in a given industry that consider institutional sources the “high degree of importance” as sources of information for the implementation and realization of Innovation projects classified by companies with innovation activities	4 574 014	0.040	0	0.41	0.0646165
Other cooperation's			Average of companies in a given industry that consider other type of sources the “high degree of importance” as sources of information for the implementation and realization of Innovation projects classified by companies with innovation activities	4 574 014	0.072	0	0.57	0.0963204		
Location		Dummy variable which assumes the value 1 when the firm is located in coastline and 0 otherwise.	4 574 014	0.343	0	1	0.4747435			
Control variables	Size		Number of employees	4 513 171	7.007	0	25 209	80.49797		
	Age		Number of years in business	4 572 145	12.250	-3*	818	12.80627		

*A small number of companies has information shared with Banco de Portugal before their foundation.

Regarding the hypothesis put forwarded and starting with H1 - “Firms with higher competencies (education, training, R&D) tend to be more persistent in exports” – results evidence that this hypothesis is clearly validated in both pure and conditional export persistence. In concrete, average wages and R&D emerge as positive and significant (p -value <0.01), indicating that higher human capital and having employees allocated to R&D activities boost export persistence. Literature has suggested that firms’ competencies would impact on exports because it would make companies more receptive to new knowledge (Savino et al., 2017), more capable of innovating and thus more competitive (Love & Roper, 2015). Importantly, such resources determine both firm’s competitive advantage and export performance (Chen, Sousa, & He, 2016).

Addressing the H2 hypothesis, which theorized that firms operating in science based, specialized suppliers or scale intensive sectors tend to be more persistent in exports, results partially validate this hypothesis. Indeed, although the estimates of the coefficients associated with those 3 technological trajectories are positive and highly significant, manufacturing supplier dominated, physical networks and knowledge intensive business services (KIBS) technological trajectories are also associated to higher (pure and conditional) export persistence. In contrast, firms operating in information networks and non-market services are less likely to be persistent in export as compared to services supplier dominated sectors. The literature, as we underlined in Section 2, although refers the importance of industry for export propensity (Gao et al., 2009) and persistence (Blum et al., 2013; Love & Máñez, 2019) has not yet addressed the contribution of technological trajectories for export persistence. In Table A4 (in Appendix) we present pure and conditional export persistent models (Models A and B, respectively) by technological trajectory. Interestingly, we find that pure persistence is not validated in the case of the firms operating in specialized suppliers.

Although conditional export persistence is verified, we found that intermittence in firms operating in science based, specialized suppliers, scale intensive and manufacturing supplier dominated sectors past intermittence in exports is more likely to explain future exports than past persistence.

Love & Máñez (2019) identified two motives why export persistence should be more likely to explain future exports than intermittence. The first reason is because firms with continuous behaviour in exporting may have developed a deeper routine base by having done the same tasks more times than those who export more intermittently. The second reason is

the atrophy of knowledge resulting from interrupting many times firms exporting spell. Given this scenario, a firm who keeps stopping and re-entering the export activity, will have to re-learn what has forgotten from previous exporting spell. Firms operating in science-based sectors, alongside with specialized suppliers are known for having high levels of investment in R&D and innovation (Pavitt, 1984). In other words, this means that these two sectors are not related with routine tasks, and so, helps understand why intermittence in exports is more likely to explain future exports than past persistence. In what concerns scale intensive firms, despite being associated with immensely routine tasks, they innovate through process innovation (Pavitt, 1984). So, they learn by internal learning of production, where export activity plays a minor role. Finally, the supplier dominated firms, which are usually small and have weak capabilities of absorbing new knowledge (Pavitt, 1984). So, the impact on their learning curve is lower.

Regarding the importance of geographical related factors, we have conjectured that firms located in regions with high agglomerations (H3a), that attributed high importance to external co-located organizations (H3b) or are located in coastal regions (H3c) tend to be more persistent in exports.

Results evidence that agglomerations are positive and significantly related to export persistence (thus, H3a is verified). This supports the literature suggesting that agglomerations could have a positive effect as it is likely to permit a reduction of costs because of the proximity with stakeholder as well as with labour force ('labour market pooling'), promotes knowledge sharing through knowledge spillovers (Brache & Felzensztein, 2019), which might outpace the potential negative externalities in high agglomeration settings derived from rises in the price of resources (Kang, 2016). Although some argue that export performance and persistence are contingent to the net effect emerging from these two forces (see Brache & Felzensztein, 2019), in the Portuguese case positive spillover effects seems to be enough for the time span analysed (2006-2017) to counterbalance the potential downside from (excessive) agglomerations.

Regarding H3b hypothesis, which stated that firms which attribute high importance to cooperation with co-located organizations tend to be more persistent in exports. Both models demonstrate that cooperation is significant at 1%, 5% and 10%. As predicted, cooperation with co-located external organizations such as universities, R&D organizations, sector Associations or other specialized external sources of innovation explain export

persistence. However, in industries where firms attribute high importance to co-located external market related sources of information for innovation (e.g., clients, suppliers, other firms), the propensity for export persistence is lower. Thus, H3b is partially validated. The literature has suggested that the impact of cooperation in export will depend on the cost-benefit ratio of cooperation. So, if spillovers exceed cooperation costs, then companies will benefit from cooperation (Nowak, 2012). In this particular case, the benefits that firms which attribute high importance to co-located external market related sources of information for innovation are inferior to the costs.

Location in coastal areas / regions does not emerge as statistically significant for explaining export persistence. Thus, H3c is not corroborated by our data. The literature suggested that firm's location was important since it would indicate a greater or lesser proximity with international markets (de Matteis et al., 2019). In Portugal, the main gateways for these markets are located in the coastline (seaports and main airports) but also the land border with Spain. This might explain the non-significant coefficient.

Table 2: Determinants of pure and conditional export persistence: dynamic random effects probit models

	Variables	Model A	Model B	
	Exporter (t-1)	0.544*** (0.006)	-	
Export behaviour/ strategy	Persistent exporter (t-1)	-	1.153*** (0.008)	
	Intermittent exporter (t-1)	-	1.055*** (0.006)	
Firms' related variables	Human capital (ln)	0.022*** (0.001)	0.019*** (0.001)	
	R&D (dummy)	0.026*** (0.005)	0.026*** (0.004)	
	Technological trajectories (dummies: default category: Supplier dominated services)	Science based	1.465*** (0.034)	1.153*** (0.026)
		Specialized Suppliers	1.793*** (0.033)	1.387*** (0.026)
		Scale Intensive	1.332*** (0.015)	1.024*** (0.012)
		Supplier dominated (industry)	1.364*** (0.015)	1.043*** (0.012)
		Information Networks	-0.113*** (0.021)	-0.070*** (0.016)
		Physical Networks	1.191*** (0.010)	0.938*** (0.008)
		Knowledge Intensive Business Services	1.064*** (0.012)	0.825*** (0.009)
		Non-Market Services	-1.005*** (0.023)	-0.789*** (0.017)
Regional/ location related variables	Agglomeration (ln)	0.410*** (0.010)	0.328*** (0.008)	
	Cooperation	Market cooperation (ln)	-5.131*** (0.055)	-5.300*** (0.049)
		Institutional cooperation (ln)	4.174*** (0.089)	3.928*** (0.078)
		Other cooperation's (ln)	1.354*** (0.051)	1.511*** (0.046)
	Location (dummy: coastal)	-0.004 (0.007)	-0.001 (0.005)	
Control variables	Size (ln)	0.345*** (0.007)	0.304*** (0.006)	
	Age (ln)	0.965*** (0.012)	0.536*** (0.011)	
Wooldridge correction	Initial exports	0.060*** (0.006)	0.068*** (0.005)	
	Human Capital (mean)	0.013*** (0.002)	0.008*** (0.001)	
	Size (mean)	0.252*** (0.008)	0.129*** (0.007)	
	Age (mean)	-1.255*** (0.014)	-0.778*** (0.012)	
	Number of observations	2 249 452	2 249 452	
	Number of groups	462 622	462 622	
Diagnosis tests	Breusch-Pagan / Cook-Weisberg test for heteroskedasticity (p-value)	615 077.97 (0.000)	810 349.04 (0.000)	
	Variance Inflation Factor (VIF) mean [max]	1.55 (4.55)	1.53 (4.54)	
Goodness of fit	Wald-test (p-value)	134 230.63 (0.000)	176 097.01 (0.000)	

Notes: *** (**) [*] statistically significant at 1% (5%) [10%]. Robust errors in brackets.

5. Conclusion

The main aim of the current study was to assess the determinants of export persistence, in particular the role of geographical related factors – agglomerations, co-located cooperation and location – in explaining pure and conditional export persistence.

To undertake such endeavour, we resort to Bank of Portugal's Central Balance Sheet Harmonized Panel Data, which includes 177865 companies over a 12-year period, 2006-2017. In order to account for the endogeneity and omission variables issues we estimated the relevant econometric specification using dynamic random effects probit models.

The results showed that human capital, R&D, technological trajectories, agglomeration, as well as, co-located institutional cooperation are significant determinants for export persistence (pure or conditional) of Portuguese companies.

The study contributes to the literature in two main ways. First, at the theoretical level. It proposes a novel framework that integrates the literature on persistence with trade and location related literature. Although there is some literature about persistence (Blum et al., 2013), which integrate innovation (Love & Máñez, 2019), and some literature about export intensity/propensity, which integrate trade and location (Cole et al., 2010; Giovannetti et al., 2013; Farole et al., 2014; Brache & Felzensztein, 2019; de Matteis et al., 2019), it did not exist yet an integrated framework to test the role of innovation, trade and location on export persistence. Second, at the empirical level. The study, in contrast with the few studies that analysed export persistence (Blum et al., 2013; Love & Máñez, 2019), resorts to a dynamic panel data methodology and a large set of companies. Blum et al. (2013), an investigation with 4938 observations, studied export persistence using linear probability models and Love & Máñez (2019), a study with 23053 observations, resorted to multivariate analysis, namely survival models, to assess about export persistence.

Our results provide interesting policy implications on supporting exporters and export strategies. Based on the results, we recommend policymakers to be incentivise cooperation with co-located partners, in order to reduce the costs of cooperation and be easier to companies profit from that. It also desirable to incentivise firms do attract higher human resources and to invest in R&D activities, allowing firms to export more continuously. Relocation measures should be considered carefully because to main reasons: firstly, our

results showed that location in coastal areas has not impact on export persistence; secondly, companies' relocation may affect agglomeration and result in an undesired outcome.

In spite the contributions, some limitations are worth to highlight. First, although the number of observations area large and involving a relatively long-time span, we only analyse firms located in one given country, Portugal. Further research should analyse other settings characterized by lower and higher innovative capabilities. Second, the time span covered include the world financial crises which obviously affected companies' capabilities and propensity to export. To estimate the relevant models separating the time interval into three main phases – before the world financial crisis, 2006-2010; the external adjustment program, 2011-2014; and the post-Troika, 2015-2017 – would be an interesting avenue for further research.

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Table A 1: Synthesis of the empirical evidence on the determinants of export propensity/ intensity and persistence

Study	Country	Period	N° Observations	Methodology	Proxy for export persistence	Determinants of export (persistence)			Results
						Variable	Variable	Proxy	
Love & Máñez (2019)	Spain	1992-2013	23 053	Multivariate Analysis: Survival model	Export Persistence: Spell duration	Firms' resources/ characteristics	Export Intensity	Export over sales	+++
							Patents	Dummy=1 if firm reports to have registered a new patent	0
							Product innovations	Dummy=1 if firm reports to have introduced at least a new product	+
							Processes innovations	Dummy=1 if firm reports to have introduced at least a new process innovation	0
							Size	N° employees	+++
							Total Factor Productivity	Calculated following Wooldridge (2009)	++
						Age	Firm's age	+++	
						Demand	Domestic demand upturn	Dummy=1 for upturn periods, 0 for downturns	++
							Foreign demand upturn	Dummy=1 for upturn periods, 0 for downturns	0
Changes in demands	Dummy=1 if face na expansive/recessive demand in domestic/foreign market	0							
Blum et al. (2013)	Chile	1991-2008	4 938	Linear probability model.	Export Persistence: Spell duration	Firms' resources/ characteristics	Capital	Capital Stock	+++
							Human Resources	Employment	+++
								Average Wages	+++
								Share White colars	0
						Demand	White-blue wage premium	0	
							Domestic Market	Domestic Sales	+++
							Foreign Market	Change in foreign demand	0
Serra et al. (2012)	UK and Portugal	2003	332	ANOVA, multiple regression analysis and principal component analysis	Export Propensity	Firms' resources/ characteristics	Firm size	Number of full-time employees	++
							Competitive advantage	Scale 1-4 (questionnaires)	++
							Technology orientation	Nature of production methods used	++
						Decision Maker's characteristics	Competencies	Age	0
								Education	0
								Number of languages spoken	++
							Traits	Propensity to take risks: 3 levels	0
								Perception of costs	0
Benefits from exporting	0								

(...)

Study	Country	Period	N° Observations	Methodology	Proxy for export persistence	Determinants of export (persistence)			Results
						Variable	Variable	Proxy	
Agnihotri & Bhattacharya (2015)	India	2002-2012	45 500	Tobit model was used for statistical analysis with a lower limit specified as zero	Export Intensity: total exports divided by total sales	Firms' resources/ characteristics	Educational level	Total length of formal education	+++
							Tenure in an organization	Average number of years that executives have spent in the organization	++
							International exposure	Total number of years spent abroad	+++
							Age of a top management	Average age of the top management team	++
							Firm's age	Year of incorporation of the firm	0
							Firm's size	Total assets of the firm	+
Ayllón & Radicic (2019)	Spain	2001-2014	20 118	Estimation of a joint dynamic probit model	Export Propensity	Firms' resources/ characteristics	R&D	Expenditure in R&D	0
							Firm size	Number of employees	+++
							Market share	Firm's market share in the markets in which it sells its products	0
							Firm age	Age	0
							Firm structure	Dummy=1 if belongs to a group	0
Gao et al. (2009)	China	2001-2005	74 576	Logistic and tobit models for the estimation of export propensity and export intensity, respectively	Export propensity and export intensity – to measure export behaviors	Firms' resources/ characteristics	Cost leadership competencies	Production cost to total sales ratio	0
								Selling and administrative cost to total sales ratio	---
							Differentiation competencies	R&D expenses divided by total sales	+++
								New product outputs to total outputs ratio	+++
							Firm size	Number of employees	+++
						Foreign ownership	Dummy=1 if foreign owned	+++	
						Institutional characteristics	Institutional Environment	Free market mechanism development	+++
								Intermediate institutions development	+++
						Industry-level characteristics	Industry Factors	% of exporters in a specific industry	+++
		Industry instability, cf. Sakakibara and Porter (2001)	0						
Altuzarra et al. (2016)	Spain	1990-2012	6 235	Dynamic random effects probit models	Export Propensity	Firms' resources/ characteristics	Export share	Percentage of exports over total sales	+++
							Labour productivity	Output per employee	++
							Skilled workers	% of skilled workers over total workforce	0
							Firm size	Firm size (log);	++
							Foreign ownership	% of foreign capital	++
							Innovation Product	Dummy= 1if the firm has innovated in a product	0
							R&D	Dummy=1 if the firm performs R&D	0
							Past exporting experience	Dummy=1if the firm export in prior year	+++

(...)

Study	Country	Period	N° Observations	Methodology	Proxy for export persistence	Determinants of export (persistence)			Results
						Variable	Variable	Proxy	
Cole et al. (2010)	Thailand	2001-2004	9 049	Pooled Probit Model for a Firm's Decision to Export	Export Propensity	Firms' resources/ characteristics	Past exporting experience	Dummy=1if the firm export in prior year	+++
							Foreign ownership	Dummy=1 if foreign owned	+++
							Total Factor Productivity	Intermediate inputs + endogenous R&D + value added over total labour	+++
							Firm size	Dummy according the size	+++
							Human resources	Skilled labour to total labour	0
								Dummy=1 if the workforce within a firm receives formal training	0
						Innovation	Dummy= 1if the firm has innovated in a product	0	
Dummy= 1if the firm has innovated in a process	0								
Localization characteristics	Region	Vector of five regional dummies	+++						
Giovannetti et al. (2013)	Italy	2001-2003	4 305	Multilevel approach	Export Propensity: % production exported	Firms' resources/ characteristics	Firm's size	Number of sales classes	+++
							Investment	technological level	0
								R&D expenditures	+++
						International exposure	Number of markets	+++	
						Localization characteristics	Province	Propensity to export by prov.	+++
								Industrial District	+++
								Seaport	+++
Airport	0								
de Matteis et al. (2019)	Italy	2000-2013	20 815	Binomial model, OLS, Tobit model and GLS	Export Intensity: % exports over total sales	Firms' resources/ characteristics	Employees	Avg. n° of employees in the current/previous/following year	+++
							Age	Firm's age	+++
							Productivity	Total sales over year-end employees	+++
							Capital intensity	Investment in assets over year-end employees	+++
							Share of white collars	Share of white collars over blue collars	0
						Institutional characteristics	Education efficiency	Public sector spending in education	+++
							Judicial efficiency	n° of days needed to complete a first-degree trial court	-
							child and health care efficiency	Public sector spending in child and health care	0
						Bank sector efficiency	Deposits/GDP	+++	
						Localization characteristics	Distance	geographical distance from foreign destination markets	---
Population age	Avg. Age of population	--							

(...)

Study	Country	Period	N° Observations	Methodology	Proxy for export persistence	Determinants of export (persistence)			Results
						Variable	Variable	Proxy	
Brache & Felzensztein (2019)	Chile	2011-2014	269 786	Estimation of a General Linear Model with a logit transformation	Export Intensity: % exports over total sales	Localization characteristics	Co-location	Following the Cluster Mapping Project from the U.S. Department of Commerce	---
							Cooperation	Institutional cooperation measured through a survey	---
								Inter-firm cooperation measured through a survey	---
						Location	Dummy=1 if the firm is located in areas with mining and fishing natural resources	+++	
						Firms' resources/ characteristics	R&D	Dummy=1 if firm conducted R&D	+++
							Age	Firm's age	+++
							Firm size	Number of workers	+++
Industry-level characteristics	Economic Sector	Dummy=1 if the firm is in the consulting sector	+++						
Farole et al. (2014)	76 countries	2006-2010	35 000	Regression Analysis	Export Propensity	Firms' resources/ characteristics	Firm age	Years of operation	0
							Firm size	Number of permanent and temporary employees	+++
							FDI	Dummy=1 if foreign owned	+++
							Compensation	Avg. Real compensation per worker (including wages, salaries and bonus)	++
							Productivity	TFP	+
							Technology	Set of dummy's for certifications, technology licensed, own website and email	+++
						Institutional characteristics	Customs	Avg. N° of days to clear imports from customs	-
							Electricity	hours of power outages per month	---
							License	Avg. Days to obtain licences	0
							Credit	% firms with credit lines	0
						Corruption	% firms expected to pay informal payment to public officials	0	
						Localization characteristics	Agglomeration Size	N° of firms as a % of a country total number of firms	0
							HHI	Sum of squares of industry's output share	--
							Agglomeration industry	region's number of firms within the same industry as % of country's total number of firms in the same industry	0
Agglomeration exporters	N° of exporters as % of a region's total number of firms	+++							

Legend: 0: not significant; +++ (++) [+]/--- (-) [-]/ positive/negative significant at 1%(5%)[10%].

Table A 2: Conversion of sectorial taxonomy to CAE

Sector Code	Industries	ISIC rev. 3	CAE rev. 3
Scale Intensive	Food, drink & tobacco	15-16	1011 - 1200
Supplier Dominated	Textiles & clothing	17-18	1310 - 1439
Supplier Dominated	Leather and footwear	19	1511 - 1520
Supplier Dominated	Wood & products of wood and cork	20	1610 - 1629
Supplier Dominated	Pulp, paper & paper products	21	1711 - 1729
Supplier Dominated	Printing & publishing	22	1811 - 1820
Supplier Dominated	Printing & publishing	22	5811 - 5819
Scale Intensive	Mineral oil refining, coke & nuclear fuel	23	1910 - 1920
Science-Based	Pharmaceuticals	244	2110 - 2120
Scale Intensive	Chemicals excl. Pharmaceuticals	24x	2011 - 2030
Scale Intensive	Chemicals excl. Pharmaceuticals	24x	2041 - 2120
Scale Intensive	Rubber & plastics	25	2211 - 2229
Scale Intensive	Non-metallic mineral products	26	2311 - 2399
Scale Intensive	Basic metals	27	2410 - 2454
Scale Intensive	Fabricated metal products	28	2511 - 2530
Scale Intensive	Fabricated metal products	28	255 - 2599
Specialized Suppliers	Mechanical engineering	29	2751 - 2790; 2811 - 2822; 2824 - 2899; 3030 - 3040
Science-Based	Office machinery	30	3320; 2823; 2620; 6209
Supplier Dominated	Insulated wire	313	2731 - 2732
Specialized Suppliers	Other electrical machinery and apparatus	31x	2711 - 2712
Specialized Suppliers	Other electrical machinery and apparatus	31x	2720; 2740; 2931
Science-Based	Radio, TV & comm. equipment	32	2611 - 2640
Science-Based	Scientific instruments	331t4	2660; 325
Scale Intensive	Other instruments	334t5	2651 - 2652; 2670; 3320
Scale Intensive	Motor vehicles	34	2910 - 2920; 2932
Scale Intensive	Other transport equipment	35	3011 - 3030; 3091 - 3099
Supplier Dominated	Furniture, miscellaneous manufacturing; recycling	36-37	3101 - 324; 3291 - 3299; 3831 - 3832
Physical Networks	Sale, maintenance & repair of motor vehicles; retail sale of automotive fuel	50	4511 - 4540; 4730
Physical Networks	Wholesale trade and commission trade, exc. motor vehicles	51	4611 - 4690
Physical Networks	Retail trade, exc. motor vehicles; repair of personal & household goods	52	4711 - 4799; 9512 - 9523; 9525 - 9529
Supplier Dominated Services	Hotels & restaurants	55	5510 - 5630
Physical Networks	Inland transport	60	4910 - 4950
Physical Networks	Water transport	61	5010 - 5040
Physical Networks	Air transport	62	5110 - 5122
Physical Networks	Supporting & aux. transport activities; activities of travel agencies	63	5210 - 5229; 7911 - 7990
Information Networks	Communications	64	5310 - 5320; 6010 - 6190
Information Networks	Financial intermediation	65-67	6411 - 6630
Information Networks	Real estate activities	70	6810 - 6832; 4110; 8110
Supplier Dominated Services	Renting of machinery and equipment	71	7711 - 7739
Knowledge Intensive Business Services	Computer and related activities	72	6201 - 6312; 5821 - 5829; 3312; 9511
Knowledge Intensive Business Services	Research and development	73	7211 - 7220
Knowledge Intensive Business Services	Other business activities	74	6910 - 7120; 7311 - 7490; 7740 - 7830; 8010 - 8030; 8121 - 8129; 8211 - 8299; 8560
Non-market services	Public admin. and defence; compulsory social security	75	8411 - 8430; 8110
Non-market services	Education	80	8510 - 8559
Non-market services	Health and social work	85	8610 - 8899; 7500
Supplier Dominated Services	Other community, social and personal services	90-93	3700 - 3822; 3900; 5911 - 5920; 9001 - 9499; 9601 - 9609

Table A 3: Correlation matrix

		Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
Dependent variable		1. Exporter (t)	1.000																								
Independent core variables		2. Exporter (t-1)	0.598	1.000																							
	Export behaviour/ strategy	3. Intermittent exporter (t-1)	0.304	0.349	1.000																						
		4. Persistent exporter (t-1)	0.508	0.778	-0.115	1.000																					
	Firms' related variables	5. Human capital		0.209	0.198	0.084	0.187	1.000																			
		6. R&D		0.027	0.026	0.009	0.026	0.030	1.000																		
		Technological trajectories	7. Science based		0.032	0.029	0.016	0.025	0.036	0.006	1.000																
			8. Specialized Suppliers		0.063	0.062	0.031	0.058	0.033	0.004	-0.006	1.000															
			9. Scale Intensive		0.115	0.112	0.051	0.105	0.049	0.004	-0.020	-0.017	1.000														
			10. Supplier dominated		0.128	0.126	0.069	0.115	0.016	0.004	-0.020	-0.017	-0.058	1.000													
			11. Information Networks		-0.068	-0.065	-0.043	-0.054	-0.015	0.004	-0.017	-0.015	-0.051	-0.051	1.000												
			12. Physical Networks		0.069	0.067	0.047	0.054	0.004	-0.000	0.058	-0.052	-0.173	-0.173	-0.152	1.000											
			13. Knowledge Intensive Business Services		0.031	0.023	0.026	0.010	0.043	0.009	-0.032	-0.029	-0.095	-0.095	-0.084	-0.284	1.000										
	14. Non-Market Services		-0.103	-0.097	-0.067	0.079	-0.014	0.004	-0.022	-0.020	-0.066	-0.066	-0.058	-0.197	-0.109	1.000											
	Regional/ location related variables	15. Agglomeration		0.085	0.081	0.043	0.073	0.023	0.011	-0.001	0.017	0.030	0.217	0.013	-0.151	-0.001	-0.037	1.000									
		Cooperation	16. Market cooperation		0.022	-0.015	0.055	0.028	0.057	0.004	0.057	0.066	0.082	0.025	-0.161	0.023	0.177	0.223	-0.027	1.000							
			17. Institutional cooperation		0.029	0.024	0.019	0.012	0.036	0.008	0.051	0.044	0.054	-0.039	-0.119	-0.216	0.151	0.420	-0.011	0.723	1.000						
18. Other cooperation's			0.070	0.064	0.050	0.029	0.045	0.009	0.024	0.066	0.078	0.007	-0.151	-0.051	0.173	0.309	-0.024	0.661	0.802	1.000							
19. Location		-0.021	-0.020	-0.010	-0.018	-0.020	0.005	0.006	0.001	-0.010	-0.073	0.027	-0.008	0.015	0.020	-0.059	-0.005	0.007	-0.002	1.000							
Control variables	20. Size		0.063	0.062	0.019	0.064	0.070	0.016	0.006	0.013	0.024	0.020	-0.008	-0.013	0.008	-0.007	0.013	0.003	0.001	0.001	-0.009	1.000					
	21. Age		0.054	0.061	-0.015	0.083	0.148	0.008	-0.012	0.029	0.082	0.034	-0.011	0.086	-0.112	-0.040	-0.032	-0.027	-0.055	-0.029	-0.022	0.056	1.000				

Table A 4: Determinants of pure and conditional export persistence by Technological Trajectory: dynamic random effects probit models

	Variables	Information Networks		KIBS		Non-market Services		Physical networks		Scale Intensive		Science Based		Specialized Suppliers		Supplier Dominated		Supplier Dominated Services		
		Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	
	Exporter (t-1)	1.008*** (0.046)	-	0.657*** (0.014)	-	1.028*** (0.041)	-	0.481*** (0.009)	-	0.197*** (0.022)	-	0.349*** (0.058)	-	-0.205*** (0.063)	-	0.172*** (0.019)	-	0.878*** (0.024)	-	
Export behaviour/ strategy	Persistent exporter (t-1)	-	1.415*** (0.052)	-	1.103*** (0.018)	-	1.323*** (0.052)	-	1.226*** (0.014)	-	1.223*** (0.035)	-	0.889*** (0.081)	-	0.514*** (0.089)	-	0.951*** (0.027)	-	1.196*** (0.030)	
	Intermittent exporter (t-1)	-	1.064*** (0.040)	-	0.927*** (0.014)	-	1.016*** (0.041)	-	1.113*** (0.011)	-	1.254*** (0.026)	-	0.933*** (0.065)	-	0.913*** (0.070)	-	1.077*** (0.022)	-	0.850*** (0.023)	
Firms' related variables	Human capital (ln)	-0.004 (0.007)	-0.006 (0.007)	0.015*** (0.002)	0.015*** (0.002)	0.015* (0.008)	0.014* (0.007)	0.019*** (0.002)	0.016*** (0.002)	0.040*** (0.006)	0.032*** (0.005)	0.027** (0.011)	0.025** (0.011)	0.008 (0.015)	0.012 (0.014)	0.049*** (0.005)	0.041*** (0.005)	0.019*** (0.004)	0.018*** (0.004)	
	R&D	-0.005 (0.030)	0.002 (0.027)	0.044*** (0.011)	0.044*** (0.010)	-0.006 (0.030)	-0.001 (0.028)	0.015* (0.008)	0.016** (0.007)	0.054*** (0.018)	0.050*** (0.014)	0.065 (0.049)	0.054 (0.043)	0.019 (0.049)	0.021 (0.041)	0.031* (0.016)	0.027* (0.014)	0.017 (0.018)	0.017 (0.017)	
Regional/ location related variables	Agglomeration (ln)	0.092** (0.046)	0.073* (0.041)	0.573*** (0.025)	0.468*** (0.021)	0.232*** (0.080)	0.208*** (0.073)	0.512*** (0.033)	0.401*** (0.025)	0.558*** (0.030)	0.339*** (0.020)	0.200*** (0.069)	0.163*** (0.055)	0.500*** (0.080)	0.347*** (0.063)	0.104*** (0.028)	0.062** (0.021)	0.220*** (0.040)	0.188*** (0.037)	
	Cooperation	Market cooperation (ln)	-1.510*** (0.468)	-2.443*** (0.470)	-2.962*** (0.146)	-3.711*** (0.138)	-1.974*** (0.520)	-1.720*** (0.507)	-7.728*** (0.199)	-7.520*** (0.181)	-5.504*** (0.208)	-5.141*** (0.160)	-5.337*** (0.478)	-5.854*** (0.439)	-7.519*** (0.961)	-5.354*** (0.869)	-9.345*** (0.193)	-8.662*** (0.162)	8.158*** (0.859)	6.681*** (0.823)
		Institutional cooperation (ln)	5.369*** (0.868)	5.394*** (0.789)	8.131*** (0.202)	7.644*** (0.181)	-0.169 (0.314)	-0.294 (0.306)	10.300*** (0.810)	9.876*** (0.739)	5.595*** (0.502)	4.778*** (0.417)	9.930*** (0.779)	8.896*** (0.651)	14.90*** (2.716)	17.81*** (2.468)	6.371*** (0.640)	5.069*** (0.503)	-4.310** (1.696)	-4.657*** (1.575)
		Other cooperation's (ln)	1.600*** (0.377)	1.678*** (0.347)	-1.594*** (0.128)	-1.160*** (0.117)	-0.026 (0.125)	0.076 (0.123)	1.095*** (0.138)	1.461*** (0.126)	4.319*** (0.190)	4.027*** (0.169)	0.317 (0.590)	0.504 (0.534)	-	-	1.012*** (0.201)	1.075*** (0.182)	8.373*** (0.451)	8.114*** (0.420)
	Location (dummy: coastal)	-0.081** (0.035)	-0.069** (0.031)	0.014 (0.015)	0.011 (0.013)	0.035 (0.035)	0.030 (0.032)	0.043*** (0.011)	0.031*** (0.008)	-0.065** (0.026)	-0.039** (0.017)	0.055 (0.065)	0.051 (0.052)	0.037 (0.068)	0.033 (0.053)	0.058** (0.028)	0.042** (0.021)	-0.030 (0.022)	-0.025 (0.020)	
Control variables	Size (ln)	0.325*** (0.040)	0.310*** (0.037)	0.329*** (0.015)	0.291*** (0.014)	0.169*** (0.050)	0.163*** (0.048)	0.366*** (0.012)	0.305*** (0.010)	0.444*** (0.024)	0.358*** (0.020)	0.387*** (0.068)	0.327*** (0.062)	0.522*** (0.074)	0.435*** (0.063)	0.412*** (0.023)	0.335*** (0.020)	0.280*** (0.025)	0.274*** (0.024)	
	Age (ln)	0.564*** (0.067)	0.432*** (0.060)	0.545*** (0.026)	0.259*** (0.024)	0.631*** (0.072)	0.564*** (0.068)	1.031*** (0.021)	0.521*** (0.018)	1.590*** (0.060)	0.676*** (0.050)	1.288*** (0.136)	0.737*** (0.125)	0.848*** (0.187)	0.249 (0.161)	0.642*** (0.047)	0.186*** (0.041)	0.728*** (0.040)	0.625*** (0.037)	
Wooldridge correction	Initial exports	0.004 (0.043)	-0.008 (0.040)	0.041*** (0.015)	0.039*** (0.014)	-0.005 (0.042)	-0.015 (0.040)	0.070*** (0.009)	0.084*** (0.008)	0.086*** (0.020)	0.122*** (0.016)	-0.019 (0.063)	0.003 (0.056)	0.020 (0.055)	0.048 (0.049)	0.050*** (0.018)	0.084*** (0.016)	0.015 (0.024)	0.006 (0.023)	
	Human Capital (mean)	0.048*** (0.009)	0.045*** (0.008)	0.018*** (0.003)	0.014*** (0.003)	-0.023** (0.010)	-0.021** (0.009)	0.034*** (0.003)	0.021*** (0.022)	0.042*** (0.010)	0.020*** (0.007)	0.021 (0.016)	0.013 (0.014)	0.080*** (0.024)	0.051** (0.020)	-0.008 (0.008)	-0.012* (0.006)	-0.030*** (0.006)	-0.028** (0.006)	
	Size (mean)	0.149*** (0.046)	0.066 (0.042)	0.150*** (0.017)	0.088*** (0.016)	0.103* (0.056)	0.079 (0.054)	0.300*** (0.014)	0.139*** (0.012)	0.319*** (0.027)	0.099*** (0.022)	0.367*** (0.074)	0.253*** (0.066)	0.280*** (0.080)	0.171** (0.067)	0.239*** (0.026)	0.113*** (0.021)	-0.018 (0.029)	-0.039 (0.027)	
	Age (mean)	-0.906*** (0.076)	-0.717*** (0.067)	-0.957*** (0.032)	-0.620*** (0.029)	-1.024*** (0.085)	-0.900*** (0.079)	-1.283*** (0.023)	-0.724*** (0.020)	-1.754*** (0.064)	-0.833*** (0.052)	-1.625*** (0.156)	-1.042*** (0.141)	-0.945*** (0.201)	-0.351** (0.171)	-0.526*** (0.051)	-0.145*** (0.043)	-0.935*** (0.043)	-0.804*** (0.040)	
	Number of observations	96 274	96 274	304 797	304 797	157 914	157 914	763 768	763 768	123 192	123 192	14 617	14 617	11 649	11 649	123 032	123 032	322 165	322 165	
	Number of groups	24 290	24 290	67 474	67 474	30 745	30 745	153 235	153 235	22 773	22 773	3 093	3 093	2 223	2 223	24 312	24 312	73 996	73 996	
Diagnosis tests	Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	111874.2 (0.000)	116376.9 (0.000)	44 235.08 (0.000)	61 567.61 (0.000)	326 508.00 (0.000)	327 779.47 (0.000)	102 204.86 (0.000)	167 441.40 (0.000)	2 141.06 (0.000)	6 335.60 (0.000)	424.91 (0.000)	772.08 (0.000)	114.41 (0.000)	6.24 (0.013)	749.78 (0.000)	3 518.32 (0.000)	448 584.84 (0.000)	450 958.41 (0.000)	
	Variance Inflation Factor (VIF) mean [max]	1.88 [4.60]	1.80 [4.60]	1.96 [4.62]	1.88 [4.65]	1.95 [5.36]	1.87 [5.36]	3.14 [12.58]	2.96 [12.64]	1.36 [2.04]	1.36 [2.07]	1.33 [1.81]	1.32 [1.82]	2.70 [7.93]	2.71 [8.42]	1.34 [1.85]	1.33 [1.85]	3.77 [16.54]	3.52 [16.55]	
Goodness of fit	Wald-test (p-value)	2 389.5 (0.000)	2 849.5 (0.000)	17 378.08 (0.000)	20 527.81 (0.000)	1 610.87 (0.000)	1 796.47 (0.000)	39 233.70 (0.000)	50 321.48 (0.000)	12 338.94 (0.000)	18 575.89 (0.000)	1 518.31 (0.000)	1 862.60 (0.000)	1 451.23 (0.000)	1 802.08 (0.000)	11 517.07 (0.000)	14 673.71 (0.000)	6 788.03 (0.000)	7 535.43 (0.000)	

Notes: *** (**) [*] statistically significant at 1% (5%) [10%]. Robust errors in brackets.