AGGLOMERATION ECONOMIES AND FIRM'S EXPORT PERFORMANCE: EVIDENCE FROM PORTUGUESE MANUFACTURING SMES

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Abstract

Export performance is a very debated theme in literature, not existing a consensus in terms of its measures and determinants. Even though there is much discussion in terms of the specific determinants, most authors divide them into two groups: external and internal determinants. These determinants have been tested through empiric studies, existing a prevalence of papers that focus on the internal determinants over the external ones. In this work we will focus on the external determinants, namely on agglomeration economies, either being localization, urbanization economies or export spillovers, analyzing their impact on firm's export intensity. Based on a sample of 15458 Portuguese manufacturing SMEs over 8 years (2010 to 2017), the results of a fixed effects model indicate the existence of a positive relationship between agglomeration economies, particularly localization economies and export spillovers, and export performance, which means that firms located in regions where there is a higher concentration of other firms belonging to the same industry and other exporting firms tend to have a better export performance.

Resumo

O desempenho das exportações é um tema muito debatido na literatura, não existindo um consenso em termos das suas medidas e determinantes. Embora exista muita discussão em termos dos determinantes específicos, a maioria dos autores divide-os em dois grupos: determinantes externos e determinantes internos. Estes determinantes têm sido testados através de estudos empíricos, existindo uma prevalência de artigos que se centram nos determinantes internos sobre os determinantes externos. Neste trabalho vamos concentrar-nos nos determinantes externos, nomeadamente nas economias de aglomeração, quer sejam economias de localização, economias de urbanização ou spillovers de exploração, analisando o seu impacto na intensidade de exportação das empresas. Com base numa amostra de 15458 PMEs portuguesas pertencentes à indústria transformadora durante 8 anos (2010 a 2017), os resultados de um modelo de efeitos fixos indicam a existência de uma relação positiva entre economias de aglomeração, em especial economias de localização e de spillovers de exportação, e o desempenho das exportações. significando que que as empresas localizadas em regiões onde existe uma maior concentração de outras empresas pertencentes à mesma indústria e outras empresas exportadoras tendem a ter um melhor desempenho nas exportações.

Index

List of Tables

List of Figures

Acronyms

AML - Área Metropolitana de Lisboa

CAE - Classificação das Actividades Económicas Portuguesa por Ramos de Actividade

CLR - Conditional logit regression

GDP - Gross Domestic Product

GLM - Generalized linear model

GVA - Gross Value Added

MLE - Maximum likelihood estimation

NUTS - Nomenclature of Territorial Units for Statistics

OLS - Ordinary least squares

QFE - Quasi-fixed effects

R&D - Research and Development

SCIE - Sistema de Contas Integradas das Empresas

SMEs - Small and medium enterprises

1. Introduction

In an increasingly globalized world, where global supply chains are more common, firms and, in particular, manufacturing firms, cannot concentrate only on their domestic markets. Therefore, the internationalization process becomes inescapable for domestic firms that want to expand into new markets. This expansion can occur through different entry modes, but according to the Uppsala model (Johanson and Vahlne, 1977), one of the first and less committed steps in a firm's internationalization process are exports.

Once the exporting process has begun, the company needs to measure its success, which can be accomplished by determining the export performance. Even though this is a very important metric, there is not a consensus in its measurement, which is reflected in the several indicators and composite scales that are used to measure export performance (Carneiro at al., 2016), such as export value and export intensity. In this work, export performance will be measured through export intensity, one of the most commonly used indicators (Katsikeas et al, 2000).

The determinants of export performance are also a very debated topic with many studies dedicated to it. According to the literature, export performance can be influenced by multiple determinants which are divided by Sousa et al. (2008) and Chen et al. (2016) into internal and external determinants. As most studies have focused on internal determinants, such as managerial characteristics (e.g., Aaby and Slater, 1998 and Axin, 1988), marketing strategy (e.g., Leonidou et al., 2002) and innovative capability (e.g., Guan and Ma, 2003), this work will focus on the external ones.

Sousa et al. (2008) divide the external determinants into foreign and domestic market characteristics, while Chen et al. (2016) propose a slightly different division: industry-level and country-level characteristics, being the last one subsequently divided into domestic-market and foreign-market factors. In this work the focus will be on the domestic market characteristics/factors and industry level characteristics, such as agglomeration economies and local export spillovers, in order to determine to what extent they do indeed have an impact on a firm's export intensity.

Agglomeration economies are external economies of scale and can be of three types: localization economies – geographic concentration of companies from the same industry; urbanization

economies - the concentration of firms from various sectors geographically (Krugman, 1991) and export spillovers – concentration of exporting firms in the same geographic area. These agglomeration economies tend to happen due to knowledge spillovers, labor market pooling and lower shipping costs (Marshall, 1920 as cited in Ellison et al., 2010). Furthermore, the proximity to other exporting firms and its knowledge spillovers can help to mitigate some of the sunk costs firms face in the internationalization process and facilitate the beginning of the exporting process, especially for SMEs (Amato et al., 2021).

Several studies have already analyzed the effects of agglomeration economies and export spillovers on export performance for different countries. Amato et al. (2021) concluded that in Spain, export spillovers have a positive impact on the export propensity of small family-managed firms, especially in low-tech industries. For Portuguese firms, export spillovers tend to impact positively the export propensity of micro firms and firms from low-tech industries (Forte and Sá, 2021), and for French companies, this factor seems to influence the export propensity but not the export volume and it has a stronger influence when analyzing a specific a product or destination (Koenig et al., 2010).

In summary, the already existing studies center mainly on export propensity, neglecting other measures of export performance such as export intensity. The aforementioned studies have found a positive relationship between agglomeration and export propensity for small firms, specifically in low-tech industries, meaning that small firms in low-tech industries are more likely to export when agglomeration economies are present.

For Portugal, most of the studies that address export performance are focused on internal characteristics, such as financial structure (Pacheco, 2016) and R&D investment (Neves et al., 2016). Studies addressing external factors are not common, and the ones that exist address either industry characteristics (Reis and Forte, 2016) or the relation between agglomeration economies and export propensity (Forte and Sá, 2021), as previously stated.

Since the Portuguese market is mainly composed of SMEs, more exactly 99,9% of the market, according to Pordata's data from 2018, the main focus of this work will be on this type of

enterprises.[1] Therefore, in this work we will study if there is a relation between agglomeration economies, export spillovers and export intensity. For that purpose, this study will resort to panel data of Portuguese manufacturing SMEs, during a period of 8 years, from 2010 to 2017.

This work is divided into 5 chapters and respective sections: in the first chapter a brief introduction to the topic will be made. The second chapter will include a literature review. In the third chapter the methodology will be presented. The fourth chapter will present the estimation results and respective discussion. Finally, in the last chapter we will derive the main conclusions.

[1] SMEs are, according to Statistics Portugal, firms that employ less than 250 people and have an annual turnover of less than 50 million euros or annual balance sheet total does not exceed 43 millions.

2. Literature Review

In this chapter we will introduce the definition of export performance, debating how to measure it (section 2.1) and examining its determinants with particular emphasis on agglomeration economies (section 2.2). Finally, section 2.3 will analyze some empirical studies that relate agglomeration economies to export performance.

2.1. Concept and measures of export performance

The theme of export performance has been vastly discussed in literature. A proof of this is the existence of at least three literature reviews published in the last 20 years about export performance determinants: Katsikeas et al. (2000), Sousa et al. (2008) and Chen et al. (2016). These reviews contemplated respectively 93, 52 and 124 papers, which encompass publications since 1964 up to 2014. According to Sousa (2000), the increasing number of published works is an evidence of the significance of the topic but not of its comprehension. As Katsikeas et al. (2000) noted, this lack of comprehension derives from the difficulty to conceptualize, operationalize and measure the firm's export performance.

Diamantopoulos (1998) defines export performance as a reflection of the export behavior under specific firm and environmental circumstances, which will be explored further in the next section. For now, we will discuss also the difficult task to measure export performance.

Carneiro et al. (2016) synthetized the export performance measures identified in eight literature reviews: Madsen (1987), Aaby and Slater (1989), Cavusgil and Zou (1994), Al-Khalifa and Morgan (1995), Matthyssens and Pauwels (1996), Zou and Stan (1998), Katsikeas et al. (2000) and Leonidou et al. (2002), which can be seen in Table 1.

Table 1. Dimensions and indicators of export performance

Authors	Period	Dimensions and Indicators of the Export Performance Construct
Madsen (1987)	1967–1987	Sales, profits, and change in sales and profits
Aaby and Slater (1989)	1978–1988	(i) Behavioral/situational (propensity to export, export problems, exporters vs. nonexporters, and barriers to export); (ii) export sales performance (export sales, level of export, and export growth intensity); and (iii) overall (perceptions toward export)
Cavusgil and Zou (1994)	1979–1989	Unified scale of export (marketing) performance, composed of the sum of the values of four indicators: strategic goals achievement, perceived success, sales growth, and profitability
Al-Khalifa and Morgan (1995)	1964–1994	(i) Export effectiveness (attainment of export goals); (ii) export efficiency (the relationship between export performance outputs and the inputs required to achieve them); and (iii) export adaptiveness (the ability of the organization to adapt to changes in its export environment)
Matthyssens and Pauwels (1996)	1989–1994	(i) Level of analysis (strategic level or scope at which export performance is measured, e.g., corporate, SBU, product-market venture); (ii) frame of reference: norm against which success is judged, whether objective, subjective, goal-, domestic-, or industry-related; (iii) time frame: static or dynamic; (iv) data collection method: sources of data (primary vs. secondary) and the collection method itself; and (v) measures: criteria along which performance is judged, financial or non-financial
Zou and Stan (1998)	1987–1997	(i) Financial measures (sales, profit, growth); (ii) non-financial measures (perceived success, satisfaction, and goal achievement); and (iii) composite scales
Katsikeas et al. (2000)	1964–1998	(i) Viewpoints of performance (effectiveness, efficiency, adaptiveness); (ii) frames of reference (domestic market, temporal, industry, firm's own goals); (iii) stakeholder perspectives (internally oriented, competitor-centered, customer-focused); (iv) time horizon perspectives (historical, current, anticipated future); (v) unit of analysis (corporate, export venture, product/product line); and (vi) scope of analysis (all firm's export markets, geographic region, single country)
Leonidou et al. (2002)	1964–1998	(i) Six dimensions of export performance (export sales volume, export sales growth, export sales intensity, export profit level, export profit contribution, and export market share); (ii) an overall dimension; (iii) a composite measures dimension; and (iv) an "other" dimension; a distinction between subjective and objective measures

Source: Adapted from Carneiro et al. (2016).

According to Carneiro et al. (2016)' review, the dimensions of export performance have evolved through the years. The first indicators mentioned by the authors, based on the work of Madsen (1987), were merely financial ones – sales, profits and change in both measures. Then Aaby and Slater (1989) (cit in Carneiro et. al, 2016) add propensity to export as a dimension/indicator of

export performance, which translates into the decision to export or not. Furthermore, Cavusgil and Zou (1994) are the first authors mentioned in Carneiro et al. (2016) to include non-financial indicators. The authors included strategic goals achievement and perceived success in their scale of export performance, apart from the financial measures. According to Cavusgil and Zou (1994), strategic goals' achievement will be measured by the fact if the initial targets were attained, and the perceived success will depend on management's perception of the enterprise success.

Zou and Stan (1998) add satisfaction to the non-financial measures which, according to the authors, translates into the satisfaction that managers have with the company's export performance. Leomidou et al. (2002), the last authors mentioned by Carneiro et al. (2016) included three new financial measures: export sales intensity, export profit contribution and export market share. According to Estrin et al. (2008), export sales intensity is the proportion of sales that are exported. This can be calculated either for an economy or for a firm. In the case of a firm, it is represented by the proportion of sales directed to the external market in comparison to the total sales of the firm. The export profit contribution represents the part of a company's profit that derives from exports and the export market share is the market share in the international market (Vondra, 2017).

Apart from the dimensions, export performance can also be measured from different perspectives, particularly frame of reference, temporal orientation and unit of analysis (Carneiro et al., 2016). Regarding the frame of reference, export performance can be used as an absolute measure or in comparison to other aspects, such as other companies, other ventures or pre-established goals. The temporal orientation can also differ, with firms either using a static or a dynamic perspective when looking at export performance. The export performance can also be measured for the company as a whole, for only the exporting ventures, which is the most common measure, for single-product-country venture and for single-product-country-client venture (Carneiro et al. 2016).

Since export intensity is one of the most used measures to measure export performance (Carneiro et al, 2016) and the sales values of a company are easier to obtain than the market share or even profitability, this work will use this indicator to measure export performance.

2.2 Determinants of export performance

Taking into consideration the definition of export performance by Diamantopoulos (1998), some authors have developed theoretical frameworks to explain export performance, from which we will review the following: Katsikeas et al. (2000), Sousa et al. (2008) and Chen et al. (2016). These authors have compiled articles published between different periods and developed a theoretical framework based on them. Since, to the best of our knowledge, these three literature reviews are the last ones published, this section will be based on them, complemented with the studies on the topic published since 2014.

Katsikeas et al. (2000), taking into consideration 93 papers from 1964 to 1998, devised a model for export performance, based on the determinants present in the reviewed studies. In this model, the authors divided the determinants into two big groups: background variables (factors that indirectly impact a firm's export performance) and intervening variables, which have a direct impact on it. Background variables include environmental, organizational and managerial factors. Environmental factors are all the external factors that influence the domestic and international market and that the firm cannot control. According to the authors, studies regarding this topic are scarce, and the ones that do exist focus on barriers and/or incentives for exports. The organizational factors encompass the firm specific characteristics such as demography, resources, goals, objectives and operating elements (Leonidou (1998) as cited by Katsikeas et al. (2000)). According to the studies reviewed, Katsikeas et al. (2000) concluded that the firm's characteristics, such as size and resources available, have been found to have a positive impact on export performance. The managerial factors concern the export decision maker's profile, like previous experience or behavior. Some of these characteristics have been proven to have an impact, but empirical evidence on this topic is not as clear as for the previous factors (Katsikeas et al., 2000).

As for the variables that have a direct impact on a firm's export performance, Katsikeas et al. (2000) highlight two: targeting factors and marketing strategy factors. Targeting factors refer to the process of identifying, selecting and segmenting the international market. Few studies have been made regarding this topic, although the existing ones have shown significant relations between these factors and export performance. The last factor reported by the authors is the

marketing strategy for the foreign market, encompassing all its variables: product, pricing, distribution and promotion. A significant number of articles have studied the impact of the marketing strategy on export performance, and almost all obtained a positive relationship between the two variables (Katsikeas et al., 2000).

Sousa et al. (2008) propose a different framework based on studies published between 1998 and 2005. The factors that impact export performance are still divided into two categories, in this case the external and internal factors. The most common internal factors that the authors found in their research are: export marketing strategy, specifically the marketing mix variables, which are also mentioned by Katsikeas et al. (2000); firm characteristics, such as the size and the international experience, and management characteristics – education and commitment, per example. Regarding the external factors, Sousa et al. (2008) highlight the role of foreign market characteristics (socio-cultural and political) and domestic market characteristics, specifically export assistance, which has been found to have a positive impact on export performance, and environmental hostility, which has been found to negatively affect export performance. According to the authors, there are not still many studies that focus on this last factor: from 52 articles analyzed, only 6 mentioned the domestic market characteristics.

Finally, based on the review of studies published between 2006 to 2014, Chen et at. (2016) developed a model that, similar to Sousa et al. (2008), divide the determinants of export performance into internal and external. According to Chen et al. (2016)' review, the relevant internal variables are firm characteristics and capabilities, such as export market orientation and firm export experience and also management characteristics, specifically managers' international experience, even though some studies have concluded this factor to have a small impact on export performance. The external variables pointed by the authors are industry-level characteristics and country-level characteristics, being these last group divided into domestic market and foreign market factors. Regarding these last two factors, Chen et al. (2016) highlight domestic demand, export assistance, local market characteristics, infrastructure quality, legal quality and institutional environment as domestic market characteristics that may impact export performance, but it is not mentioned whether the impact is positive or negative. For the foreign market factors, the only two mentioned are competitive intensity and psychic distance. The

empiric studies about the first factor present mixed results and the ones about psychic distance have concluded that it does not have a significant impact on export performance.

In conclusion, the two most recent literature reviews (Sousa et al., 2008 and Chen et al., 2016) divide the determinants of export performance into internal and external factors, as can be seen on Table 2, being the characteristics of the domestic market one of the variables encompassed on the external factors. But as stated by Chen et al. (2016), there are still few studies that focus on the country level characteristics.

Table 2. Export performance determinants

	Variables	Author (year)
Internal Variables/Factors	Managerial factors	Katsikeas et al. (2000); Sousa et al. (2008); Chen et al. (2016)
	Firm characteristics	Katsikeas et al. (2000); Sousa et al. (2008); Chen et al. (2016)
	Targeting factors	Katsikeas et al. (2000)
	Marketing strategy factors	Katsikeas et al. (2000); Sousa et al. (2008)
External Variables/Factors	Environmental factors	Katsikeas et al. (2000)
	Foreign market characteristics	Sousa et al. (2008)
	Domestic market characteristics	Sousa et al. (2008)
	Industry-level characteristics	Chen et al. (2016)
	Country-level characteristics	Chen et al. (2016)

Note: The framework developed by Katsikeas et al. (2000) does not divide the factors into external and internal, but into background and intervening variables. In order to compare with the other works, in this table the variables were classified according to the division made in the other two studies.

After 2016, to the best of our knowledge, no literature review regarding this topic has been published but we will share some of the more recent frameworks presented by authors in more recent years.

Viet et al. (2017) developed a model to explain export performance and applied it to seafood firms in Vietnam. This model does not divide the determinants into external and internal as the previous theoretical frameworks. Even though this division is not made, all the factors used have already been evidenced by previous authors: characteristics and capabilities of the firm, domestic

and foreign market characteristics (Sousa et al., 2008 and Chen et al., 2016), management characteristics (all the authors previously reviewed), industry characteristics (Chen et al., 2016) and export marketing strategy (Katsikeas et a., 2000 and Sousa et al., 2008).

Haddoud et al. (2019)'s model was tested using Algerian exporters. The framework presented by the authors also encompasses the standard division between internal and external determinants. For internal determinants the authors suggest technological and managerial resources, innovative and marketing capabilities. Looking into the previous models, the marketing capabilities and managerial resources are already present as a category of factors, and we could also include the innovative capabilities and technological resources as firm's characteristics. The external determinants enumerated are local and foreign relational resources, similar to the categorization used by Sousa et al. (2008) and Viet et al. (2017).

Safari and Saleh (2020) also separated the determinants analyzed between external and internal, which were then tested using the example of the Vietnamese economy. The internal factors used were managerial and organizational determinants, which are common to other authors previously analyzed, and the external factors were left as a broader category of external determinants, as presented also by Katsikeas et al. (2000). This study focused not only on understanding the effect of these determinants on export performance but mostly the relationship that could exist between export performance and three potential mediators: innovation, export marketing and business strategy. According to their results, the final model only has one mediator, business strategy, since innovation and export marketing strategy had no significant effects on export performance.

In conclusion, these last three studies do not exactly introduce new determinants but test different aspects of the determinants mentioned by the three literature reviews in specific situations. From all the determinants presented in Table 2, most of the empiric studies have focused on the internal factors, so in this work we will focus on the external factors, namely agglomeration economies, which can be integrated either in the domestic market characteristics or country-level characteristics, depending on the framework we are talking about. In the next section this subject will be further developed.

2.3. The role of Agglomeration economies on export performance

Agglomeration economies or external economies of scale exist when the concentration of companies, either from the same or from different industries, in a geographical space leads to the reduction of the average cost of production (Krugman, 1991). This proximity of firms leads to knowledge spillovers that can reduce the uncertainty about the external markets (Andersson & Weiss, 2012). These externalities can be divided into three types: localization, urbanization economies (Moomaw, 1988) and export spillovers (Aitken et al.,1997). Localization economies have to do with the scale of the firm's industry, they represent agglomerations of firms belonging to the same industry or of related industries, and urbanization economies are related to the agglomeration of firms from different industries, particularly in cities (Moomaw, 1988). Export spillovers have been proposed by Aitken et al. (1997), who tested the hypothesis that the costs of entering a foreign market are reduced when a firm is located near an exporting firm due to informational spillovers. Although these authors have concluded that these costs are indeed reduced but only with informational spillovers from multinational firms, Andersson and Weiss (2012) concluded that nearness of exporters reduces the costs of entry in a foreign market, thus increasing the probability of a firm becoming an exporter and increasing its export performance.

As previously stated, local market characteristics are determinants of export performance, meaning that they can impact a firm's export performance (Sousa et al., 2008). An example of such characteristics are agglomeration economies. In this section we will look at empirical studies that analyze the relationship between agglomeration economies and export performance.

While conducting a search through Web of Science with the terms "Export Performance" and "Agglomeration" we found 75 articles, of which only 11 are studies about the influence of agglomeration economies on export performance. In addition to these 11 studies, it was also included the work of Amato et al. (2021) which was the only relevant article that was not repeated from the search of "Export Performance" and "Export Spillovers". In Table 3 we can see a summary of these articles, which are organized chronologically.

Table 3. Summary of empirical studies on agglomeration economies and export performance

Author (year)	Country	Sample (Period)	Methodology	Measure of export performance	Type of agglomeration economy	Measure of agglomeration economy	Results
Becchetti and Rossi (2000)	Italy	3852 firms (1989 to 1991)	MLE	Export intensity	Localization economies	Geographical Agglomeration = (Em,ls/Et,ls)/Em,i/Et,i)	Positive impact, especially in small companies
Malmberg et al. (2000)	Sweden	10 000 exporting manufacturing firms (1994)	OLS	Export value	Localization economies & urbanization economies	Localization – (firms from same region in industry/total firms in industry)/ (total local firms /total firms from all industries) Urbanization - Number of exporting firms in the region	Urbanization economies are more important; localization economies are quite irrelevant
Ito et al. (2015)	China	Chinese firms (2000 to 2007)	Probit model	Export propensity	Local export spillovers	Number of incumbent exporters in the region belonging to the same industry	Positive, stronger for larger, more productive, and more skill-intensive indigenous firms with previous exporting experience
Hu and Tan (2016)	China	Chinese exports by product and destination country (2000 to 2006)	OLS	Export propensity	Local export spillovers	Number of exporting firms in the same region	Positive impact, stronger on small-scale firms, multi-product, exporting complex goods and firms exporting to easy-entry destinations
Kang (2016)	Chile	4846 Chilean plants (1999 to 2003)	Dynamic panel probit	Export propensity	Local export spillovers	Characteristics of plants in the same province and SIC 3 industry	Inverted U-shaped relationship; causes agglomeration costs

Table 3. Continuation

Author (year)	Country	Sample (Period)	Methodology	Measure of export performance	Type of agglomeration economy	Measure of agglomeration economy	Results
Brache and Felzensztein (2017)	Chile	51378 firms (2013 and 2015)	GLM with a logit transformation	Export intensity	Localization economies	Regional location quotient as described by the Cluster Mapping Project	Negative impact
Zhao et al. (2017)	China	207,738 firms (2007)	Two-step estimation method proposed by Heckman (1979)	Export propensity and intensity	Local export spillovers	Number of exporting firms in the region	Positive impact; same industry are stronger and from local exporters, in opposition to MNEs
Hong and Wu (2018)	China	88,457 exporting firms (2000 to 2006)	CLR	Export propensity	Local export spillovers	Number of establishments the year before the venture began exporting	Positive impact, stronger for intra-industry
Brunow et al. (2019)	Germany	29,220 firms (1995 to 2010)	QFE models	Export intensity	Localization & urbanization economies	Urbanization and location measures as suggested by Combes	Positive impact, especially for small firms and manufacturing firms
Amato et al. (2021)	Spain	20,255 firm-year observations (2003 to 2015)	Linear probability model	Export propensity	Local export spillovers	Share of exporting firms belonging to the same sector s (at the two-digit level) and operating in the same region r of the focal firm	Positive impact

Table 3. Continuation

Author (year)	Country	Sample (Period)	Methodology	Measure of export performance	Type of agglomeration economy	Measure of agglomeration economy	Results
Forte and Sá (2021)	Portugal	20,234 Portuguese manufacturing SME's (2013)	Probit model	Export propensity	Localization economies & urbanization economies & Local export spillovers	Urbanization - Region number of firms per km2 Localization - Share of employment accounted by industry j in region k relative to industry j share in national employment Export spillovers - Region export intensity	Localization and export spillovers have a positive impact; urbanization economies have a negative impact
Gaasland et al. (2020)	Norway	230 salmon exporters (2004 to 2014)	OLS	Export value	Localization economies	The number of production licenses in a region divided by the size of the region's coastline	Positive impact

Legend: MLE - Maximum likelihood estimation; Em_{ls} - number of employees in manufacturing firms with less than 250 employees in a town council; Et_{ls} - number of workers in the manufacturing sector in a town council; Em_I - total number of workers in manufacturing firms with less than 250 employees in Italy; Et_i - is the total number of employees in the manufacturing sector in Italy; OLS - Ordinary least squares; GLM - Generalized linear model; CLR - Conditional Logit Regression; QFE - quasi-fixed effects.

In these studies, twelve different samples from eight different countries were tested, from 1994 to 2015. Only two countries appear repeated in them: China, in four studies, and Chile in two. The measures of export performance used in the studies are export intensity, export value and export propensity, which is the most common measure, used in seven of the twelve studies. Regarding the types of agglomeration economies analyzed, most of the studies focus either on local export spillovers or localization economies and only three take into consideration urbanization economies.

Most of the studies summarized on table 3 concluded that agglomeration economies have a positive impact on export performance. There are however two studies (Brache and Felzensztein (2017) and Kang (2016), for Chile) that have a different conclusion. Brache and Felzensztein (2017) concluded that localization economies have a negative impact on a firm's export performance while Kang (2016) concluded that the relationship between export spillovers and export performance, measured in this case by export propensity, has an inverted U shape, meaning that after a degree of local export spillovers the effect on export performance tends to be negative. It is important to note that the studies use different measures of export performance: Kang (2016) analyzes the probability of a firm to export while Brache and Felzensztein (2017) measure the impact of localization economies on a firm's export intensity; that is, one focuses on the decision to export and the other on what happens after the exporting venture has begun.

Regarding the effects of urbanization economies, there are also mixed results. While Malmberg et al. (2000) state that this type of agglomeration economies is the one that has a bigger impact on a firm's export performance, Brunow et al. (2019) do not make this distinction, stating that both localization and urbanization economies have a positive impact on export performance. Forte and Sá (2021) concluded the opposite: urbanization economies have a negative impact on export performance. It is important to highlight that all these studies used different measures of export performance: Malmberg et al. (2000) used the export value, Brunow et al. (2019) resorted to export intensity and Forte and Sá (2021) focused on export propensity.

Comparing the studies that analyze Chinese companies, these encompass samples from the same period and analyze the same agglomeration economy – local export spillovers. The measure of export performance is also the same – export propensity – with the exception of Zhao et al. (2017) that also uses export intensity. The conclusions, even though similar regarding the impact as a whole, are different in regard to firm's specific characteristics. While Ito et al. (2015) concluded that the impact of local export spillovers is stronger for larger firms, for firm with previous experience and for more productive firms, Hu and Tan (2016) had a different result – the impact was stronger for smaller firms. In the last two publications (Zhao et al., 2017 and Hong and Wu, 2018) it was concluded that the impact of local export spillovers is stronger for firms belonging to the same industry. Studies for other countries, like Becchetti and Rossi (2017) and Brunow et al. (2019), have also achieved the conclusion that agglomeration economies have a stronger positive impact on smaller firms, corroborating Hu and Tan (2016)'s conclusion.

To sum up, most of the studies have found a positive relation between agglomeration economies and export performance. For the Portuguese case, in specific, the conclusion was also that there is a positive impact for export spillovers and localization economies but a negative impact in the case of urbanization economies. It is, although, important to note that Forte and Sá (2021) analyzed data from only one year and used export propensity, the probability of a firm to export, as a proxy for export performance. This leaves a gap in empiric studies regarding Portugal. There is the need to test the hypothesis of a relation between the different types of agglomeration economies and export performance for Portuguese companies with a large sample and using a different measure, such as export intensity.

3. Methodology

In this chapter, we start by introducing the model that will be used to test whether a relationship between agglomeration economies and export intensity exists (section 3.1). Then, in section 3.2. we proceed by examining the data and characterizing the sample. Finally, section 3.3. presents an analysis of the descriptive statistics and evolution of the main variables of the model.

3.1. Model's specification

This work focuses on the study of the impact of agglomeration economies on export performance. This is accomplished through a quantitative study based on an econometric model in which the firm's export intensity (Exp_Int) is the dependent variable, that will serve as a proxy for export performance. The independent variables related to agglomeration economies are: urbanization economies (UrbEcn), localization economies (LocEcn), and export spillovers (ExpSpl). Finally, we also introduce some control variables based on firm's characteristics, such as innovation (Innov), size (Size) and productivity (Prod). The econometric model is given by the following equation:

$$Exp\_Int_{it} = \alpha_{it} + \beta 1 \times UrbEcn_{kt} + \beta 2 \times LocEcn_{jkt} + \beta 3 \times ExpSpl_{kt} + \beta 4 \times Innov_{it-1} + \beta 5 \times Size_{it-1} + \beta 6 \times Prod_{it-1} + \varepsilon_{it}$$

Where the indices i, j, k and t refer to firm, industry, region and year, respectively.

The necessary information related to the dependent and control variables (firm level data) was extracted from the Statistics Portugal's database SCIE[2] while the information related to agglomeration economies was collected from annual reports from Statistics Portugal (*Anuário Estatístico de Portugal*). Indeed, our database encompasses panel data from Portuguese manufacturing SMEs for a period of 8 years: from 2010 to 2017.

[2] Sistema de Contas Integradas das Empresas

According to the determinants presented in Table 2, we propose that the firm's export performance, measured by export intensity (the percentage of export sales in total sales), is influenced by both national market attributes and firm's own characteristics. In this work, agglomeration economies, namely, urbanization economies, localization economies and export spillovers are the attributes of the domestic market that are considered. For the firm's own characteristics, the focus is on innovation, size and productivity. The specifications of these variables are outlined in Table 4.

Table 4. Summary of independent variables, their measures and expected impact on export performance

Variable	**Meaning**	**Measure**	**Expected impact on export performance**
UrbEcn	Urbanization Economies	Number of firms per km2 per NUTS II region	+/-
LocEcn	Localization Economies	Percentage of employment by industry j in region k relative to the employment of same industry j in Portugal	+/-
ExpSpl	Export Spillovers	Export intensity of region j calculated as the ratio between the region's international sales and its GDP	+
Innov	Innovation	Share of firm's R&D expenses per employee	+
Size	Size	Number of employees	+/-
Prod	Productivity	Gross value added (GVA) per employee	+

Similar to Forte and Sá (2021), the urbanization economies are measured by the number of firms per km2 per region, based on the regions from the NUTSII 2013 classification. According to the literature (e.g., Malmberg et al., 2000, Forte and Sá, 2021), urbanization economies can have either a positive or negative impact on export performance. In these cases, the positive impact can be due to an increase to the scale of the region's production or due to a more competitive environment, with more resilient firms that are more capable to face new obstacles (Malmber et al. 2000). The negative impact of this type of agglomeration economies can be due to high costs to stay in the region, diminishing the opportunity of the firms to export (Forte and Sá, 2021).

Following also Forte and Sá (2021), the localization economies are measured by the percentage of employees from industry j, based on the CAE REV.3 industry two-digit codes, in a region k in comparison to the whole country. This variable is expected to have either a positive impact on the firm's export performance, especially for small firms (Becchetti and Rossi, 2000) due to complementarity between firms belonging to the same industry or a negative impact (Brache and Felzensztein, 2017) due to the increase of competition. Finally, similar to Forte and Sá (2021), export spillovers' measure is each region's export intensity. According to the majority of the studies synthetized in Table 3, it is anticipated to have a positive impact on export performance.

Regarding the firm's characteristics, R&D is used as a proxy for innovation, which is measured, in accordance with Becchetti and Rossi (2000), by the share of firm's R&D per employee. The size of the firm is measured by the number of employees and the productivity by the Gross Value Added (GVA) per employee, similar to Amato et al. (2021). This last variable will be logarithmized, as well as innovation. Furthermore, all the control variables will be lagged by a year in order to avoid endogeneity problems, similar to Ito et al. (2015). In terms of innovation, the studies that included this control variable (e.g., Amato et al., 2021, Brache and Felzensztein, 2017, Becchetti and Rossi, 2000) all obtained a positive relation between innovation and export performance, since the ability to innovate improves the changes of success when competing outside of the home country. Finally, regarding the impact of firm's size and productivity on export performance, the first can be either positive or negative and the second is expected to be positive. On the one hand, larger firms have more resources, so they are more capable of enduring the endeavors of exporting (Sousa et. Al, 2008) and, on the other hand, given their size they may have less incentives to export if they already supply a large domestic market (Zhao et al., 2017). Also, more productive firms have more capability to support the costs of the internationalization process (Forte and Sá, 2021), so they are more likely to succeed in exporting.

3.2. Data and characterization of the sample

For this work a total of 349043 firm/year observations were considered, based on Statistics Portugal's SCIE database, that was accessed in February 2021. These observations cover a period

of 9 years (from 2010 to 2018) and include firms from the 7 Portuguese NUTSII regions – Norte, Centro, Área Metropolitana de Lisboa (AML), Alentejo, Algarve, Região Autónoma dos Açores and Região Autónoma da Madeira. The firms from the initial data set belong to 24 divisions of CAE Rev. 3's category C (from Division 10 to 33), and were exclusively corporations, either privately or publicly traded (unipersonal firms were excluded).

Since we wanted to have a stable number of firms for the period under analyses, all the firms that were born or died from 2010 to 2018 were removed from the sample, leaving a total of 211039 firm/year observations. Then we removed all the firms that belonged to Região Autónoma dos Açores and Região Autónoma da Madeira because these regions are archipelagos that have specific characteristics for agglomeration economies such as the firms' insularity. After that, in order to focus on SMES, large firms (i.e. firms with 250 or more employees) were also removed from the sample. Furthermore, all the firms with a negative or null GVA were removed, since it is not economically rational. For the same reason, we also removed all firms that had a negative value for Research and Development (R&D). We then removed all the firms from CAE 19, since most of the information regarding the variable localization economies was not available. After noticing that some companies present missing values for some years, we decided to remove them so that all the firms in the final sample have observations from 2010 through 2018, in order to have a balanced panel data. Finally, since the observations for 2018 presented highly discrepant values from the other years and due to the provisional values for the localization economies variable, we decided to only use the information from 2010 to 2017.

At the end, the elimination process left us with 15458 firms representing a total of 123664 firm/year observations, distributed by 5 regions as evidenced on table A1 (in Appendix). As we can see from this table, the Norte region is the most represented in the sample (with more than half of the firms), followed by the Centro region (with about a quarter). The region with less representation is the Algarve region. Regarding the two-digit sector, in the end we have only firms from 22 divisions, since firms from sectors 12 and 19 were removed in the cleansing process. The sector with more firms is sector 25 - Manufacture of metal products, except machinery and equipment (with around a fifth) and the less represented in this sample is sector 21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations as we can

see from table A2 (in Appendix). Finally, regarding the size and exporting profile of the firms in the sample, Table 5 characterizes the sample concerning these two dimensions.

Table 5. Characterization of firms in terms of size and exporting profile

Firms' characteristics		Number of observations	Percentage
Exporting activity	Yes	48977	40%
	No	74687	60%
Size	Micro	69549	56%
	Small	44266	36%
	Medium	9849	8%

As we can see, more than half of the firms from the sample are micro firms, meaning that they have less than 10 employees, small firms represent about a third of the sample and only 8% of the firms are medium sized (have less than 250 employees but more than 49). However, this is in line with the characteristics of Portuguese's business community. Indeed, according to Pordata's 2019 data, 99,9% of Portuguese firms are SME's, of which a total of 96% represents micro companies, 3,3% small firms and 0,5% medium firms. As to the exporting profile, we have more firms that do not export than the ones that do export, just as the exporting profile of the Portuguese firms, which in 2018, according to Statistics Portugal, only around 6,3% of non-financial firms were exporters and, specifically only 16,3% of manufacturing firms had exporting activity.

3.3. Descriptive Statistics

In order to better understand the variables of the model, it is important to analyze the descriptive statistics. Table 6 summarizes the main descriptive statistics for the variables used in this study.

Table 6. Descriptive statistics of the model's variables

Variable (unit)	Mean	Minimum	Maximum	Standard Deviation
Exp_Int (%)	13,209	0,000	100,000	27,233
UrbEcn (Firms per km2)	26,506	2,100	113,100	32,294
LocEcn (%)	43,040	0,079	92,172	25,298
ExpSpl (%)	30,408	1,780	38,420	6,521
Innov (Euros)	88,704	0,000	114050,000	1372,972
Size (Employees)	17,435	1,000	249,000	27,262
Prod (Euros)	22305,687	2,000	36569614,000	231549,566

Source: Own elaboration

In terms of our dependent variable, we can conclude that most of the companies present in the sample do not export or have a low export intensity, since the average percentage of exports over total sales is only 13,209%, even though there are also companies that channel their entire production for the international markets as evidenced by the maximum value of this variable.

In regard to the independent variables related to agglomeration economies, urbanization economies is the variable with the highest dispersion of data, as evidenced by the standard deviation. On average, each region has about 27 firms per km2 although Alentejo only has 2,1 firms per km2 (the minimum value present in 2010) and, the maximum, 113,1 firms per km2, is registered by Área Metropolina de Lisboa (AML) in 2011. On average, the share of employment accounted for by two-digit industry per region relative to the same industry's share in national employment is 43,1%, meaning that 43,1% of the employees of a two-digit sector are more likely to be in the same region, leaving the rest of the regions with the remaining 56,9%. On one hand we have some regions that have almost no employment in certain two-digit sector (0,079% value

for this variable in those cases) and the maximum of concentration that we have in the sample is 92,172% (sector 15 - Leather and related products in the Norte region in 2017). In terms of export spillovers, all regions export but only, on average, 30,605% of their production. The lowest value is of 1,78% (Algarve region in 2010) and the highest value is close to the average, 38,42% (Norte in 2017).

When looking at the firm specific variables we can see that the sample is highly heterogenous by the standard deviation values. In terms of innovation, a firm invests, on average 88,704 Euros per employee in R&D but there are some firms from the sample that have null values of investment and others that invest around 114 thousand Euros per employee. In regard to size, this ranges from 1 to 249 people per firm and the average number of employees per firm is 17, although most of the firms in this sample are micro firms (see Table 5). The productivity of the firms in this sample is the variable with the highest variation, being that the firm with the maximum value has a GVA per employee of around 36 million Euros and the minimum value is only 2 Euros per employee. On average, for the firms in this sample, each employee adds around 22305,687 Euros in gross value.

When taking a closer look at the average values per sector for the main independent variables (the agglomeration economies variables) and the dependent variable, which can be seen in Table 7, we can conclude that, in terms of export intensity, the sector in which firms have, on average, a better export performance is sector 30 - Other transport equipment, which means that the firms belonging to this sector tend to export a higher percentage of their production when in comparison to the other sectors. Regarding urbanization economies, sector - Pharmaceutical products and basic pharmaceutical preparations has the higher average, meaning that the firms that belong to this sector are, on average, located in regions with a higher percentage of firms per km2.

Concerning the localization economies and export spillovers, the sector with the maximum value for both these variables is sector 15 - Leather and related products, which means that this sector is highly concentrated in one region and the regions in which its firms are located have the highest export intensity from all the regions studied.

It is worth mentioningthat sector 21, in spite of having the highest average value in most of the variables (dependent and independent), has the lowest value in export spillovers, meaning that its firms are located, on average, in regions with the lowest export intensity from the sample in study. Sector 15 also has the lowest value for Urbanization Economies, meaning that firms from this sector are located in regions with lower concentration of firms.

Table 7. Average value of selected variables per two-digit sector

Two-digit sector	Exp_Int	UrbEcn	LocEcn	ExpSpl
10	3,224	23,558	25,053	28,543
11	16,190	18,886	26,581	29,340
13	14,399	19,749	72,127	33,480
14	20,965	19,504	78,852	34,077
15	26,149	17,668	82,992	34,105
16	12,609	19,934	40,703	31,119
17	7,423	24,461	37,594	31,900
18	3,192	44,410	30,961	27,990
20	14,525	34,916	28,313	29,146
21	11,601	97,882	58,643	22,947
22	16,825	25,335	38,370	30,637
23	18,755	27,075	32,692	28,648
24	17,526	26,866	38,802	30,913
25	11,725	26,766	34,194	29,662
26	22,539	36,044	38,997	29,975
27	17,233	32,805	28,998	29,719
28	19,996	31,277	37,195	30,068
29	22,919	25,627	32,905	30,073
30	29,859	27,918	31,072	27,176
31	16,651	22,286	48,087	31,835
32	9,026	37,614	35,360	29,856
33	4,740	46,859	28,974	26,826

Finally, when looking at the average values of the control variables per sector, as per Table A3 (in Appendix), we can conclude that firms belonging to sector 21 have the highest expense in R&D per employee and are the largest firms in terms of size while firms from sector 20 – chemical products, have the highest productivity per employee, on average. On the opposite side we have sector 16 - Wood and products of wood and cork, except furniture, articles of straw and plaiting materials which presents the firms with the lowest value invested in R&D per employee; sector 33 - Repair, maintenance and installation of machinery and equipment which has the smallest firms, with an average of 8 employees per firm; and finally, sector 14 – Clothing with the lowest value of productivity per employee.

When we look into the averages per regions (see Table 8), there are 3 regions that stand out: Norte, Algarve and AML. The Norte region has the highest value for export intensity, localization economies and export spillovers, therefore, on average, the firms located in this region have a higher export performance, the industries located in this region tend to absorb most of the employment of the industry, and the region is the top performer in export intensity. Algarve is quite different from Norte, since it has the lowest values for three of the variables: export intensity, localization economies and export spillovers. The other region that also stands out is AML which has a higher concentration of firms per km2.

Table 8. Average value of selected variables per region

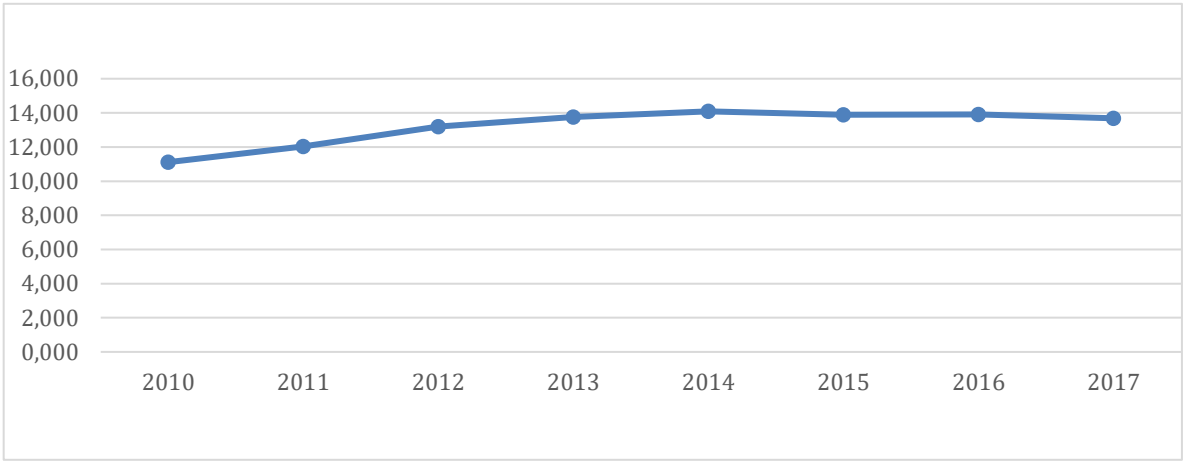
Regions	Average of Exp_Int	Average of UrbEcn	Average of LocEcn	Average of ExpSpl
11 - Norte	15,626	17,500	58,607	34,835
15 - Algarve	3,549	11,850	1,724	1,878
16 - Centro	12,683	8,588	31,674	28,631
17 - AML	7,485	106,817	21,642	22,021
18 - Alentejo	8,778	2,450	7,604	24,454

Legend: AML – Área Metropolitana de Lisboa

Regarding the values of the control variables per region, as can be seen in Table A4 (in appendix), the Norte region has the largest firms, on average. In spite of this, the region has the firms with the lowest productivity values. Algarve is quite different from the Norte region, since it has the lowest values for two of the variables: innovation and size. The other region that also stands out, AML, has the highest productivity and the firms located there invest more in R&D per employee compared to the other regions.

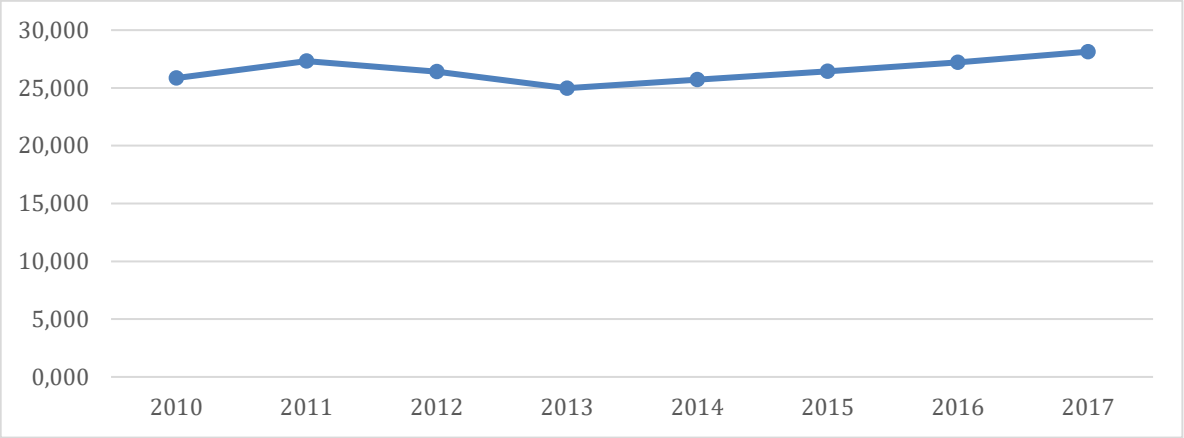
In terms of annual evolution of the variables, the information can be seen in Graph 1, 2, 3 and 4 for the dependent variable and the main explanatory variables.

Graph 1. Evolution of annual average of Export Intensity (%)



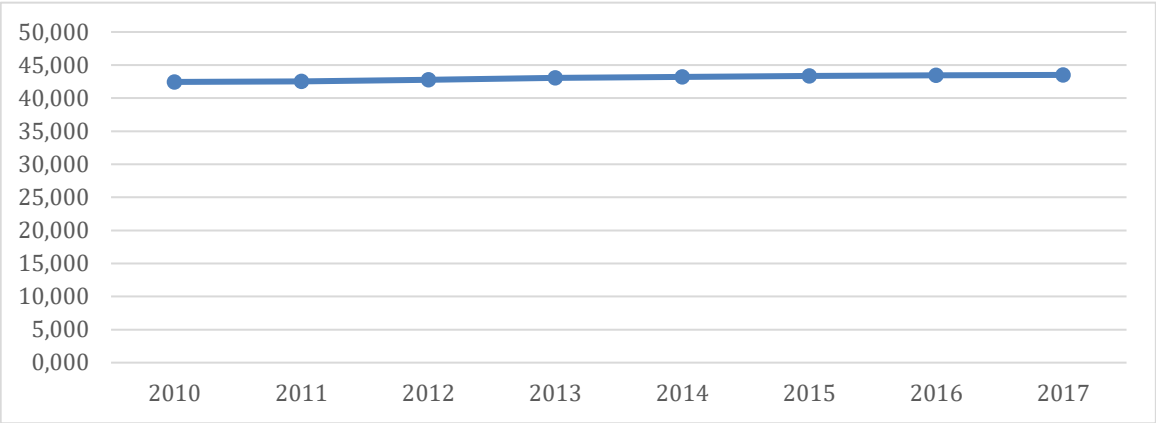
When we look at each of the variables and their annual evolution, we instantly notice that they all have a growth tendency. Export intensity, as seen in Graph 1, has a steady increase across the years with a slight decrease in the last 3 years, presenting in 2017 a figure that is around 2 percentage points higher than its value in 2010. Despite this increase, the maximum value is reached in 2014, of around 14% and then the variable faces a slim decrease until 2017.

Graph 2. Evolution of annual average of Urbanization Economies – firms per km^2

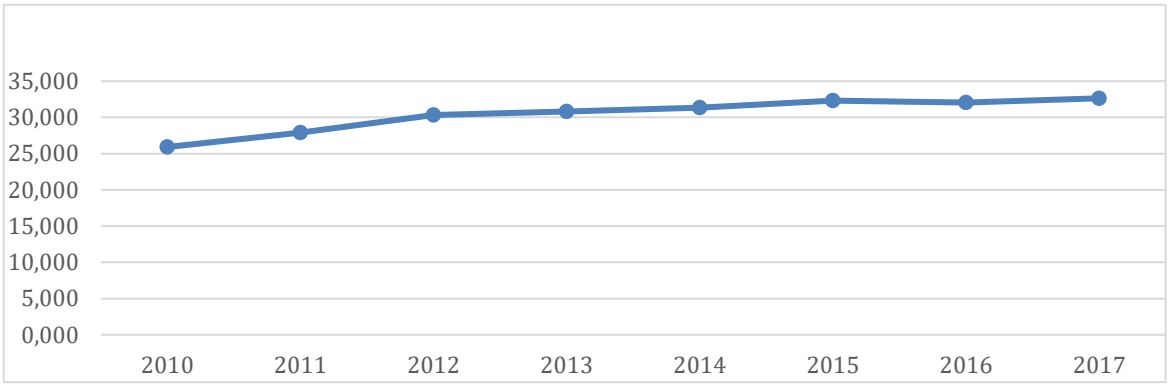


Urbanization economies do not have a linear growth throughout the years, but its tendency is to increase. From 2010 to 2011 there is an increase of two firms per km2 but in the two following years this increase is erased, and the variable faces its lowest figure (24,978 in 2013). This evolution pattern may be explained by an increase in insolvencies. In fact, according to an annual report published by Statistics Portugal – *Empresas em Portugal* -there were more deaths than births of firms in 2012 (Statistics Portugal, 2014). In 2013 the variable reaches its lowest value with around 25 firms per km^2 and then it starts to grow and reaches its maximum in 2017 with around 28 firms per km^2.

Graph 3. Annual evolution of Average value of Location Economies (%)



Graph 4. Annual evolution of Average value of Export Spillovers (%)



Localization economies, on the other hand have a linear growth reaching its peak in 2017 with around 44%, meaning that the there is a tendency for industry concentration. Export spillovers also follow this tendency, only with a small decrease from 2015 to 2016. From 2010 to 2017 we have an increase of around 6 percentage points, reaching its peak with 32,633%, meaning that the regions are, on average, exporting more percentage of their production.

Finally, in terms of evolution of the control variables, the information can be seen in Graphic A1, A2 and A3 (in Appendix). All the variables have a general increasing tendency, apart from innovation. Also, they all present a small decrease around the years 2011 and 2012 that can be explained by the economic crisis that Portugal was facing at the time. Productivity and size have since then continuously increased while innovation faced yet another decrease between the years 2012 and 2013 and 2016 and 2017. From all of the control variables, innovation seems to be most volatile variable.

4. Empirical Results

In this chapter we will check our model for correlation between variables (section 4.1), then we will present the estimation results (section 4.2) and finally we will compare the results with the current literature (section 4.3).

4.1 Correlation matrix

Before estimating the model, we tested the variables for correlation. The results can be seen below in Table 9.

Table 9. Correlation coefficients and respective p-values

	Exp_Int	UrbEcn	LocEcn	ExpSpl	Innov	Size	Prod
Exp_Int	1,000						
UrbEcn	-0,073 (0,000)	1,000					
LocEcn	0,169 (0,000)	-0,250 (0,000)	1,000				
ExpSpl	0,116 (0,000)	-0,429 (0,000)	0,587 (0,000)	1,000			
Innov	0,188 (0,000)	-0,469 (0,000)	-0,007 (0,021)	-0,021 (0,000)	1,000		
Size	0,410 (0,000)	-0,044 (0,000)	0,129 (0,000)	0,076 (0,000)	0,262 (0,000)	1,000	
Prod	0,192 (0,000)	0,065 (0,000)	-0,103 (0,000)	-0,050 (0,000)	0,197 (0,000)	0,197 (0,000)	1,000

Since almost all of the correlation coefficients between the independent variables are below 0,5, we can conclude that there is a low probability of these variables being correlated. The only value above 0,5 concerns the relation between export spillovers and localization economies but since it is below 0,7 it only represents a moderate probability of correlation (Mukaka, 2012). Therefore, we can conclude that our variables are not highly correlated between them.

4.2. Estimation results

The sample used for the estimation is composed by panel data from 15458 firms over 8 years (2010 through 2017). Since some of our variables' unit is euros per employee, following standard practices we logarithmized them – this was the case for innovation and productivity. According also to the empirical studies revised before, all the control variables (innovation, size and productivity) are lagged by a year since the company characteristics will not have an immediate impact in the firm's export performance and to avoid endogeneity problems.

For the estimation of panel data there are two possibilities: to use either a panel data estimation with fixed effects or random effects, where in the fixed effects model the effects are common for all observations and in the random effects model they vary between observations (Gelman, 2004). Before testing for random or fixed effects with a Hausman test, we need to verify if heteroskedasticity is present in the model and correct it, in the case it exists (Adkins et al., 2012). In order to choose the model that would fit best our sample we first tested for both cross section and period heteroskedasticity using the Likelihood Ration test[3] and concluded that there is cross-section heteroskedastic, according to Table 10 below.

Table 10. Heteroskedastic Test

	Cross-section			Period		
Test Summary	Value	d.f.	Prob.	Value	d.f.	Prob.
Likelihood ration	4423297,000	15458	0,000	49,329	15458	1,000

Source: Own elaboration based on Eviews estimation

[3] This test examines the hypothesis of the residuals of the estimation are homoskedatic (null hypothesis)

We then performed the Hausman test to determine if the best option would be a fixed effect or random effect model, as can be seen in Table 11 below.

Table 11. Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1458,328	6	0,000
Period random	0,000	6	1,000
Cross-section and period random	1512,434	6	0,000

Source: Own elaboration based on Eviews estimation

Since the probability value is less than 0,05, we choose the cross-section and period fixed effects model (Hausman, 1978).

We then proceeded to estimate the model cross section and period fixed effects. The results of the estimation can be seen below in Table 12.

As we can see from Table 12, all the variables are statistically significant, with the exception of Urbanization economies and Innovation since the p-value for these variables is higher than 10%. All the other variables - localization economies, export spillovers, size and productivity are statistically significant at a p-value of 1%.

Table 12. Results of the fixed effects estimation

Variable	Full sample	Portuguese firms	Micro firms	Small and medium firms
C	-0,868 (1,841)	-0,977 (1,928)	-5,059 (0,164)	2,850 (5,200)
URBECN	0,008 (0,014)	-0,005 (0,015)	0,024 (0,022)	-0,007 (0,021)
LOCECN	0,085*** (0,021)	0,083*** (1,019)	0,077*** (0,030)	0,101*** (0,032)
EXPSPL	0,117*** (0,020)	0,113*** (0,020)	0,106*** (0,021)	0,093** (0,047)
LAG_LINNOV	0,041 (0,032)	0,041 (0,032)	-0,018 (0,026)	0,052 (0,038)
LAG_SIZE	0,087*** (0,008)	0,087*** (0,009)	0,115** (0,056)	0,079*** (0,009)
LAG_LPROD	0,552*** (0,160)	0,568*** (0,167)	0,382*** (0,109)	1,006** (0,490)
Number of observations	108206	106139	60813	47393
R-squared	0,861	0,856	0,76	0,889

Source: Own elaboration based on Eviews estimation, White cross section to correct for Heteroscedasticity,

Note: standard error between parenthesis, **p < 5%, ***p < 1%

According to the expectations from the literature, the only variables that were expected to have a negative impact on export performance, but could also have a positive one, were urbanization economies, localization economies and the firm's size, with the results of this model concluding for instead a positive impact in terms of localization economies and size. Regarding urbanization economies, since the result was not significant, we will not make any conclusions based on the value obtained for its coefficient. The variables that seem to have the biggest impact on export performance are productivity and export spillovers, both with a positive effect. All the other variables have coefficients lower than 0,1, meaning that their impact is relatively small.

It is also important to note that, according to the estimation, the model can explain 86% of the variations of the dependent variable, meaning that most of the variations of export intensity are explained by the variables used in the model.

In order to test the robustness of the results, three more estimations were performed: one for only Portuguese firms[4], another for micro firms and finally one with small and medium firms. The results can be seen in Table 12. It is however important to notice that these estimations have an unbalanced set of observations.

As can be seen from the table, the same variables are statistically significant with urbanization economies and innovation still remaining not statistically significant. For the Portuguese firms, all the significant variables are statistically significant at a p-value of 1%. For the micro firms, size is only significant at a p-value of 5% and for the small and medium firms, with the exception of size, all the other statistically significant variables are so at a p-value of 5%. In terms of type of impact, it is always a positive impact, while the only thing that changes is the magnitude of the impact which will be discussed in the next section.

4.3. Discussion

As previously mentioned, the existing literature that focuses on export performance is not coherent across its results and conclusions, particularly in terms of the relation between export performance and agglomeration economies, in particular urbanization and localization economies and export spillovers. Some theoretical arguments and empirical studies differ in relation to some of the variables, namely localization economies and size, that could have either a positive or negative impact on export performance.

First, we will compare our results regarding the main independent variables related with agglomeration economies. Localization economies, according to our estimations, have a positive impact on export performance, meaning that a firm located near other firms of the same industry will have a better export performance. The studies reviewed had mixed results in terms of this

[4] The sample included some multinational firms that are traditionally exporters and might influence the analysis in terms of the export performance.

variable. While Bechetti and Rossi (2000) and Brunow at al. (2019) concluded that localization economies had a positive impact on export performance, especially for small firms, Malmberg et al. (2000) found the relationship to be quite irrelevant and Brache and Felzensztein (2017) found a negative relationship between the two variables. Our results, that there is a positive relation between the variables, are aligned with the ones presented by Bechetti and Rossi (2000) and Brunow at al. (2019) for colocar país. For just Portuguese firms and micro firms the relation seems to be a bit less significant but when looking at the results of small and medium firms, localization economies are the second variable with the highest impact on export intensity.

In terms of export spillovers, we also found a positive relation between the variable and export intensity, which means that the proximity to other exporting firms increases the possibility of having better export performance. This is in line with the expected impact we had pointed before. All the authors reviewed that tested this relation found similar results, with the exception of Kang (2016) who concluded that the relation was an inverted U shaped instead of linear. In terms of the specifics of the impact on different types of firms, Hu and Tan (2016) concluded that the impact was stronger on small firms while Ito et al. (2015) found that this was the case for larger firms. Our results showed for Portugal the opposite, when analyzing SMEs – as the size of the firm grows, the impact seems to diminish. While for micro firms the impact of localization economies is smaller than of export spillovers, the opposite happens for small and medium firms. For Portuguese firms the impact seems to be also smaller than the one of the whole sample but still higher than the one of the estimations with micro and small and medium firms.

Regarding the control variables, in specific size, the expected result was either a positive or a negative relation. In our model we found that size impacts positively the export performance of a firm, meaning that the bigger the firm, the better the export performance will be. Zhao et al. (2017) concluded that the relationship between size and export performance was an inverted U shaped so, until a certain size the firms would have an improvement in export performance, but this would cease and then the effect would be the opposite. According to the authors this would happen when a large firm has no motivation to export or to increase their exportations due to the significant size of the domestic marked that they already serve. All the other authors analyzed

(e.g., Amato et al., 2021 and Brache and Felzensztein, 2017) concluded that there was a positive relation between the variables. Our results support also this conclusion, size has a positive impact on export performance. This seems to be specifically relevant for micro firms but when we see the results for small and medium firms, they are lower, indicating that, perhaps with the increase of size of a firm, this variable tends to have a lesser impact on export performance.

The results for productivity also are in line with the results presented in the studies reviewed previously. Firms that are more productive tend to have a better export performance. This seems to be quite relevant for small and medium firms, where the value was twice higher than the coefficient for the whole sample. For micro firms the value was lower than for the whole sample. This could mean that with the increase in size, productivity tends to be one of the main internal variables that impacts a firms' export performance. For the Portuguese firms, the value was similar to the one of the whole sample.

If we compare our results with the other study applied to Portugal, Forte and Sá (2021), which focused on localization and urbanization economies and export spillovers there is a clear similarity in the results - both localization economies and export spillovers had a positive impact. In this case, the impact of the localization economies is also higher for small and medium firms than for micro firms. In terms of export spillovers, our results presented always a positive impact, even though it was more relevant for micro firms than for small and medium firms, while Forte and Sá (2021) had a negative result for small and medium firms. When looking at the control variables, size is the variable, out of all the independent variables that has the bigger impact in Forte and Sá (2021) study and it is higher for small and medium firms than for micro firms. Our results show the opposite, there is a higher impact for micro firms and size is not the variable that impacts more on export performance. The results in terms of productivity also are in accordance with their study. It is important to note that this study was only conducted with observations from one year, 2013 and that the dependent variable used was export propensity while the one used in the present work is export intensity.

5. Conclusion

In this work we proposed to discuss the impact of agglomeration economies on export performance. Given the gap in the literature, this topic was applied to the Portuguese economy, focusing on SME's. In order to do so a sample of SME's was extracted from Statistics Portugal's SCIE database from the years of 2010 to 2018. Our purpose was to confirm if there exists a relation between agglomeration economies and export performance. For this we estimated a Fixed effects model using export intensity as our dependent variable, urbanization and localization economies and export spillovers as our independent variables and the size, productivity and innovation of the firm as control variables.

In this work we concluded that localization economies and export spillovers have a positive impact on export performance. For urbanization economies, our result was statistically non-significant, so no conclusion is possible. Regarding the control variables, both size and productivity showed a positive impact on export performance and innovation was also statistically non-significant. The results regarding localization economies and export spillovers indicate that Portuguese manufacturing SMEs located in regions with a higher percentages of industry concentration and with more exporters will tend to have a better export performance. In term of firms' characteristics, bigger and more productive firms will have better export performance. This would mean that, if a firm wants to export and to be successful in doing so, it should locate itself in exporting regions where there are more exporting firms, and more firms from its own industry, following the conclusions of Brunow et al. (2019) that the concentration of firms from the same industry leads to gains for manufacturing firms. This would translate into a higher concentration of firms in regions with an already high concentration, which could possibly mean that regions with less firms would tend to stay with lower concentration rates, and therefore its firms with a lower probability of a good export performance.

It is important to note that this work presents several limitations. Not all Portuguese manufacturing SMEs were included in our sample. Since we intended to have a balanced panel data for the Fixed effects estimation, only firms that were born before 2010 and were dissolved after 2017 were included in our sample, so all firms with less than 8 observations were not included. Firms that also closed during the period under analysis or that, for example, grew in

size from SMEs to firms with more than 250 employees were removed from our sample as well. This left our sample with only mature firms that stayed always below the threshold of 250 employees. This limitation also applies to the robustness check.

Another limitation was the information used for localization economies. Some of the two-digit sectors for manufacturing firms had confidential information in terms of employment per region which forced us to remove them from our study. For some other sectors there was also some information missing which was completed by the estimation of a few intermediate values. Finally, as pointed before, our estimation method only gives a value for the relation between two variables so we are unable to identify if there might exist some relations that are U shaped or the opposite. Future works should test for a non-linear relation between agglomeration economies and export performance.

Further work is still needed in terms of the impact of agglomeration economies and export performance. There are some gaps in the literature in terms of, for example, the types of impacts when looking at developed countries and countries in development as well as in emerging economies. Most of the studies focus only in one economy and in one year. In order to have a more robust result, new studies should use panel data for several years and more than one country, to test the relation in general for a sample of heterogenous countries and then separating in terms of type of country by development or by exposure to the international markets.

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Appendix

Table A1. Distribution of firms per region

	Number	Percentage
Norte	65993	53%
Algarve	1993	2%
Centro	32867	27%
AML	16875	14%
Alentejo	5936	5%

Source: Own elaboration

Table A2. Distribution of firms per two-digits sector

Two-digit sector	Number	Percentage
10	16741	13,54%
11	1960	1,58%
13	6637	5,37%
14	13200	10,67%
15	6385	5,16%
16	7893	6,38%
17	1376	1,11%
18	6487	5,25%
20	1398	1,13%
21	168	0,14%
22	3620	2,93%
23	7842	6,34%
24	799	0,65%
25	24526	19,83%
26	509	0,41%
27	1654	1,34%
28	4396	3,55%
29	1451	1,17%
30	418	0,34%
31	6532	5,28%
32	4218	3,41%
33	5454	4,41%

Source: Own elaboration

Table A3. Average value of control variables per two-digit sector

Two-digit sector	Average of Innov	Average of Size	Average of Prod
10	66,103	16,429	16536,063
11	408,623	18,948	61206,146
13	61,329	21,572	18586,614
14	23,071	25,044	13226,901
15	62,392	30,115	16661,868
16	25,979	11,348	18578,887
17	74,228	22,076	23063,625
18	77,620	9,772	20689,914
20	233,930	23,697	197704,845
21	335,744	45,851	49162,638
22	149,616	25,668	27226,833
23	105,634	15,920	19072,753
24	92,170	28,548	30370,942
25	73,370	13,504	21336,297
26	860,166	28,031	30497,965
27	107,783	22,416	23853,897
28	229,370	20,146	30532,170
29	104,086	27,409	23175,145
30	359,451	31,211	23371,472
31	47,635	14,791	14616,438
32	97,445	10,830	20989,296
33	158,950	8,598	27088,314

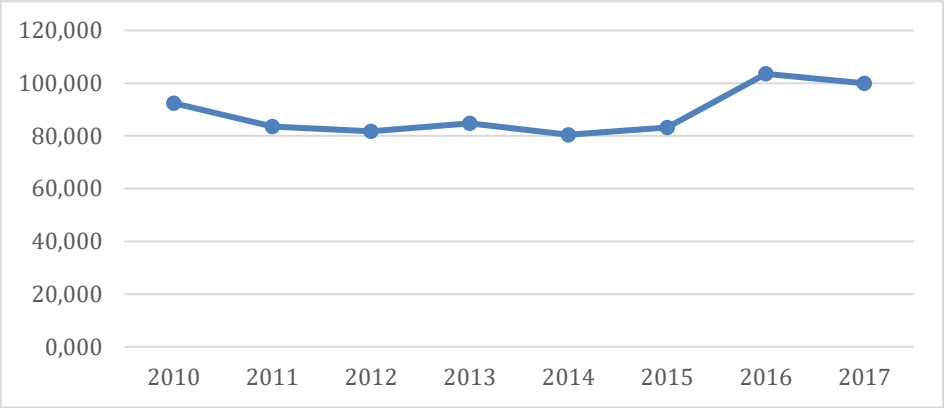
Source: Own elaboration

Table A4. Average value of control variables per region

Region	Average of Innov	Average of Size	Average of Prod
Norte	73,096	18,844	19219,234
Algarve	28,739	9,426	16378,466
Centro	129,421	17,357	28179,342
AML	67,656	13,931	23834,202
Alentejo	116,758	14,848	21742,027

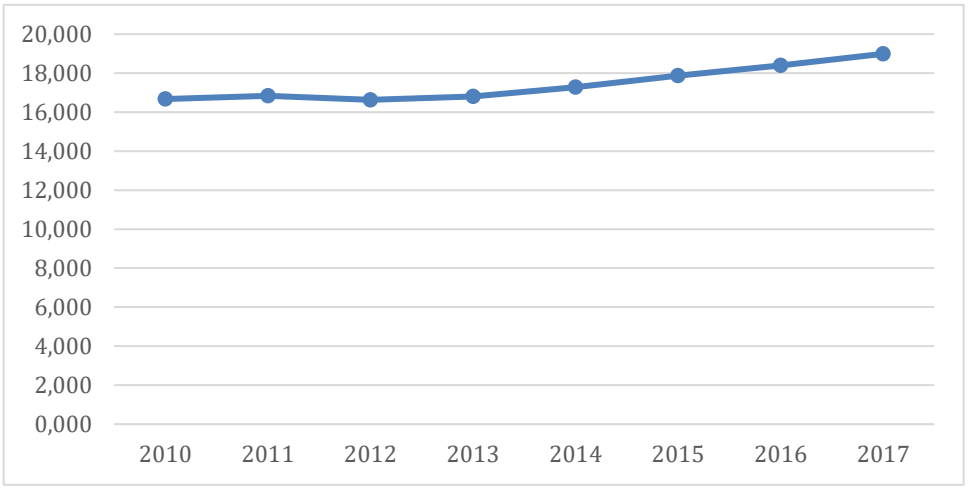
Source: Own elaboration

Graph A1. Evolution of annual average of Innovation (Euros per employee)



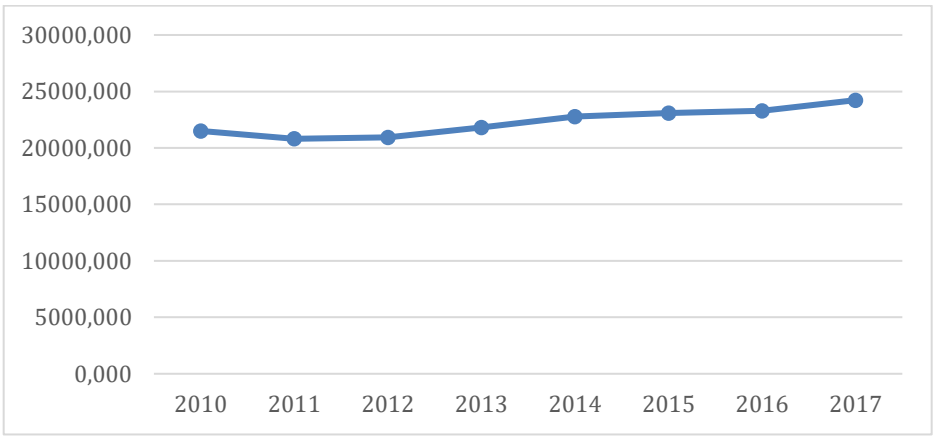
Source: Own elaboration

Graph A2. Evolution of annual average of Size (Number of employees)



Source: Own elaboration

Graph A3. Evolution of annual average of Productivity (Euros per employee)



Source: Own elaboration