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El proceso de internacionalización de las empresas manufactureras españolas

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EL PROCESO DE INTERNACIONALIZACIÓN DE LAS EMPRESAS MANUFACTURERAS ESPAÑOLAS

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A mis padres, Charo y Felipe

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Resumen

El objetivo de esta tesis doctoral es analizar el proceso de internacionalización de las empresas manufactureras españolas. Gracias a una muestra de más de 5.500 empresas entre los años 1990 y 2015, se pretenden presentar los principales determinantes de la exportación y de la inversión extranjera directa, desde la perspectiva de la heterogeneidad empresarial. Así, esta tesis doctoral está dividida en cinco capítulos netamente diferenciados, pero conectados entre sí. En primer lugar, el Capitulo 1 sirve de introducción al contenido de la tesis, en donde se presenta el marco teórico en el que se encuadra este trabajo, así como el interés que se desprende del estudio del comercio internacional de las empresas españolas. A continuación, los tres capítulos centrales de este manuscrito conforman las tres principales contribuciones de esta tesis a la literatura del comercio internacional. Así, el Capítulo 2 analiza el papel que la calidad de gestión empresarial juega en el proceso de internacionalización de las empresas, comparando su importancia con la de la productividad. El Capítulo 3 es un estudio acerca de los principales cambios que sufren las empresas a raíz de su entrada en los mercados internacionales, en otras palabras, un análisis sobre el impacto de la exportación en el desempeño empresarial. Por otro lado, el Capítulo 4 analiza un asunto de gran interés actual, esto es, el rol del proceso de transformación digital en los principales resultados empresariales, con especial atención al papel de la digitalización en la internacionalización. Finalmente, en el Capítulo 5 se presentan las principales conclusiones que se derivan de esta tesis así como sugerencias acerca de futuras líneas de investigación.

Summary

The aim of this Ph.D. thesis is to analyse the process of internationalization of Spanish manufacturing firms. Using a sample of more than 5.500 firms during the period 1990-2015, we try to depict the determinants of exporting and foreign direct investment, from the firm heterogeneity perspective. Hence, this thesis is divided into five chapters clearly differentiated, but interconnected. Firstly, the Chapter 1 serves as an introduction to the content of the thesis, presenting the theoretical framework and the empirical results of previous research, as well as the interest in the study of the international trade of Spanish firms. The next three chapters of this manuscript offer the main contributions of this work to the international trade literature. Therefore, Chapter 2 analyses the role that management practices have in the process of internationalization of firms, comparing its importance to the one of productivity. Chapter 3 is a study focusing on the main changes arising within the firm following its entry into export markets, in other words, a research regarding the impact of exporting on the firm performance. Furthermore, Chapter 4 is focused on an issue of a great recent interest, that is, the role that the digitization process has on the main indicators of the firm performance and competiveness, with a special consideration on the impact of the digital technologies on international trade. Finally, the main conclusions derived from this thesis are presented in Chapter 5, together with some suggestions and indications regarding future research lines.

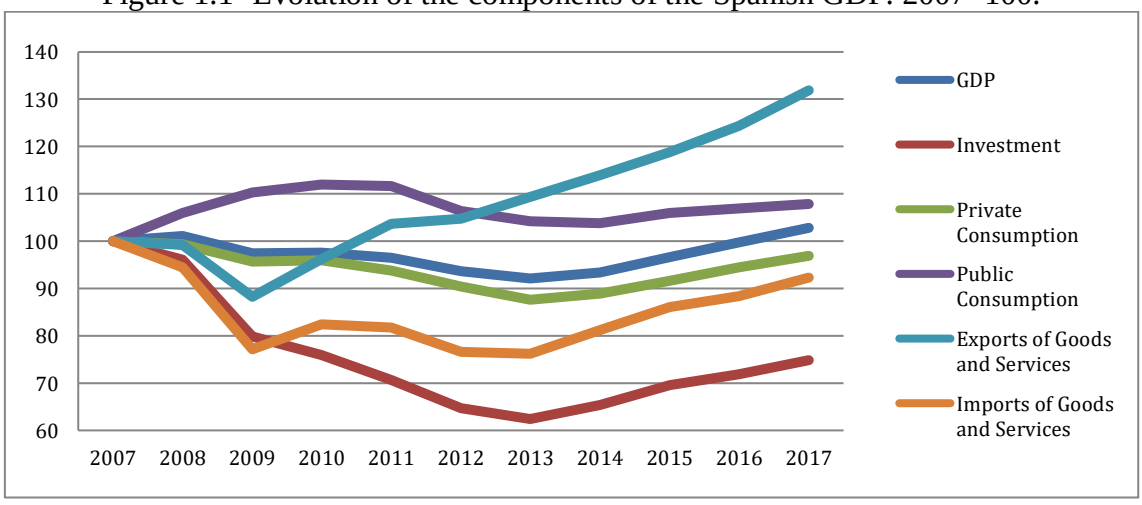
Chapter 1

Introduction

1.1. The Spanish export miracle

The purpose of this Ph.D. thesis is to analyse the process of internationalization of Spanish manufacturing firms. The study of the Spanish international trade in the last decade acquires a considerable relevance when we analyse the evolution of the main features of the Spanish economy since the beginning of the Great Recession in 2008. Figure 1.1 presents the evolution of the main components of the Spanish GDP since 2007. It can be noticed that, between 2008 and 2013, Spain lost 9% of its GDP, conforming the biggest economic crisis since the Great Depression in 1929. The main responsible of this negative trend was the investment collapse following the burst of the housing bubble, which fell a 38% between 2007 and 2013. The private consumption, which represents more than half of the Spanish GDP, fell as well a 12% between 2007 and 2013, mostly due to the increase in the unemployment (3.6 million of Spaniards lost their jobs between 2008 and 2013) and to the debt-relief process affecting the large majority of economic agents, who were trying to manage the debts contracted during the boom period (1997-2007).

Figure 1.1- Evolution of the components of the Spanish GDP. 2007=100.



Source: Eurostat

On the opposite trend we find the public consumption, that increased a 12% between 2007 and 2010, thanks to the automatic stabilizers of the public sector and to a discretional policy of the socialist government of Zapatero, called the Plan E. This plan, of Keynesian nature, consisted in the injection of 14.000 millions of euros in the economy, destined to public work projects and mostly managed at the local level. This

Plan E would be a good strategy if the Spanish economy would face a small cyclical recession, because it would accelerate the economic recovery. However, what Spain suffered in 2008 was not a cyclical recession, but a complete structural recession affecting its productive model (based on the growth of a low productive service sector and the housing sector), causing the lost of millions of jobs and the destruction of an important part of the productive tissue. Unfortunately, there is not any policy of public investment able to overcome such a structural recession.

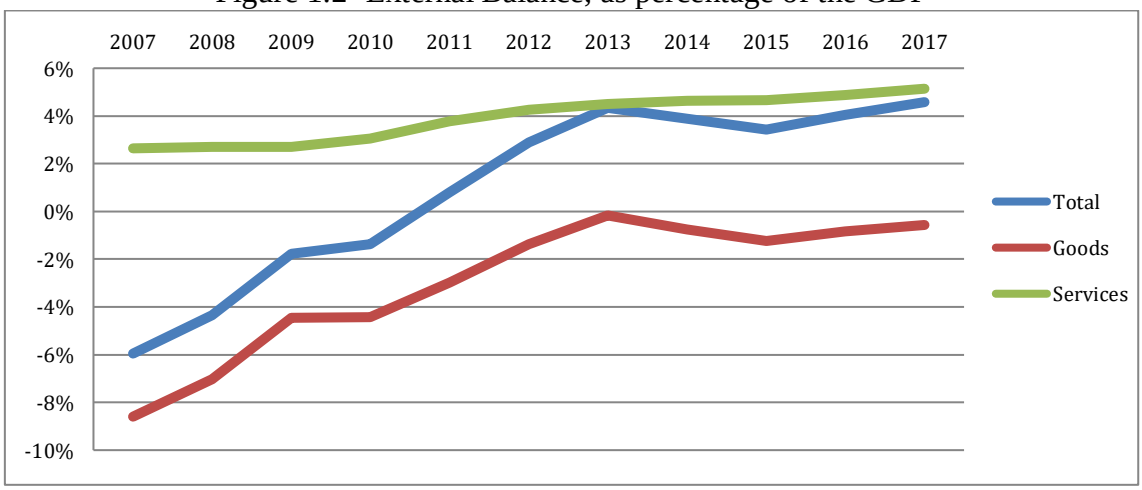
Therefore, the public sector faced a very difficult situation in terms of budget balance. On the one hand, the public revenues were falling: a fall in the income tax revenues due the to the increase of unemployment, a fall in the consumption tax revenues due to the fall of the private consumption and a fall in the profit tax revenues due to the collapse of the economic activity and the failure of millions of firms. On the other hand, the increase of the public expenditure through the Keynesian policies and the automatic stabilizers did not offer any relevant positive result. As a result of these two trends in the public revenue and the public expenditure, the public budget passed from a surplus of 1.9% of the GDP in 2007 to a deficit of 10.5% of the GDP in 2012. Indeed, with a public deficit of 10.5% there is no alternative other than a fiscal consolidation policy, moreover if Spain has signed the European Stability and Growth Pact. Nevertheless, even after adopting a fiscal consolidation policy since 2012, the public debt sharped from a 35% of the GDP in 2007 to a 100% of the GDP in 2014. Hence, taking into account all of this elements, we cannot talk about a success of the Spanish public policy during the recession.

Only a branch of the Spanish economy gave new life to this adverse situation: the export sector. The Spanish internal demand was depressed since the beginning of the recession in 2008, and therefore, Spanish firms must look beyond its borders in order to find more dynamic markets. So they did, and with remarkable success. Figure 1.1 shows that the Spanish economic recovery started in 2013 when the GDP, the investment, the private consumption and the imports started to increase again. However, the Spanish exports started to increase since 2009. The beginning of the recession in 2008 generated a collapse in the international trade, and the Spanish exports decreased a 12% between 2007 and 2009. However, since 2009, once this shock was overcome, the exports of goods and services have grown at an average annual rate of 5,5%, when the

GDP has only grown at an average annual rate of 0,7% during this same period. In volumes, Spanish exports have grown a 44% between 2009 and 2017. Hence, this substantial increase in the exports highlights the key role that exports had and still have in the recovery of the Spanish economy.

During the last decade, the growth spurt of the Spanish exports, together with the fall in the imports has lead into a positive external balance. Nevertheless, Figure 1.2 shows that the external balance of goods was still negative in 2017, but the effect of the positive sign in the services balance determined the final positive sign in the overall external balance. Hence, it is not all-good news regarding the Spanish international trade and there are still some improvements to do in the exports of goods, in order to obtain a positive balance in the trade of goods as well.

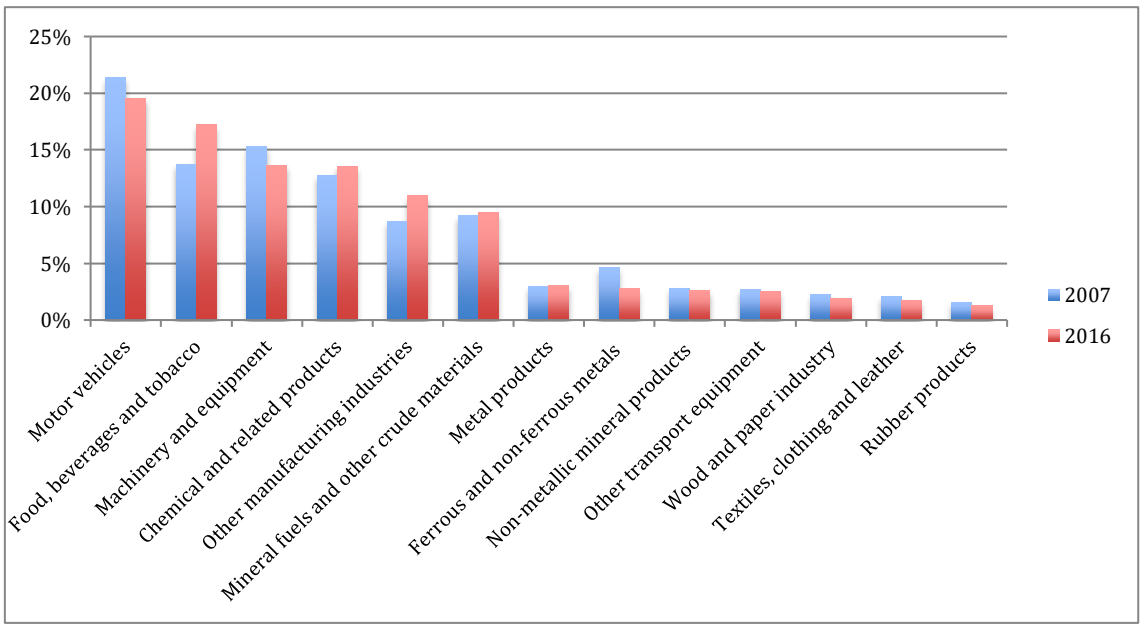
Figure 1.2- External Balance, as percentage of the GDP



Source: Eurostat

On the other hand, until now we have talked about the overall trade of goods and services. However, the exports of goods represent the 70% of the total Spanish exports. Figure 1.3 presents the main components of the Spanish exports of goods. As it can be noticed, the motor vehicles are the main exported product, accounting for the 20% of total exports. Food, beverages and tobacco (17%), machinery and equipment (14%) and chemical products (13%) are the following most exported products. From 2007 to 2016, the biggest increase in the share of exported goods corresponds to food, beverages and tobacco (from 14% to 17%), and the biggest decrease corresponds to motor vehicles (from 21.4% to 19.5%) and to ferrous and non-ferrous metals (from 4.6% to 2.7%).

Figure 1.3- Main components of the Spanish exports of goods, percentage of total



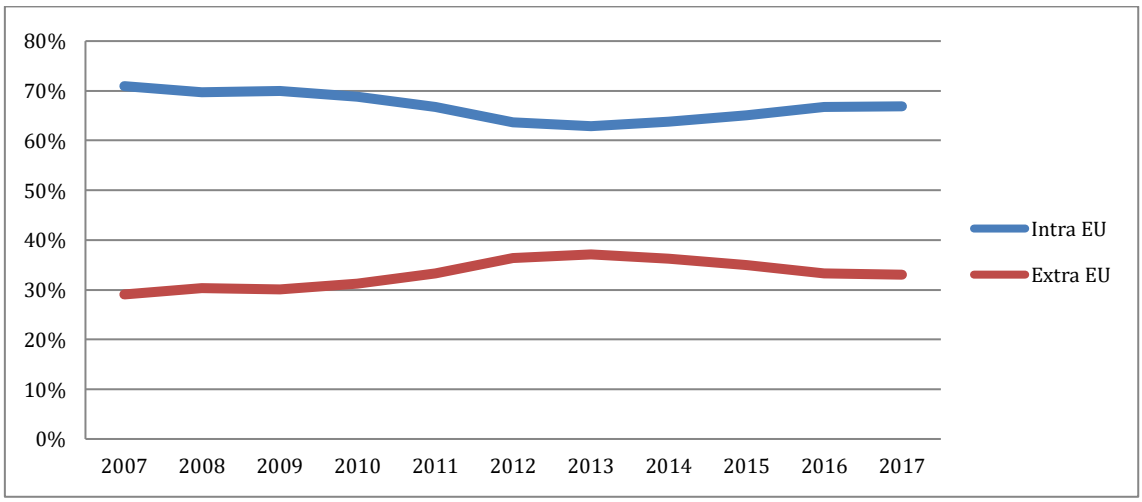
Source: UNCTAD

Figure 1.4 shows that the main export destination of Spanish goods is the European Union, accounting for two thirds of total exports in 2017. Interestingly, during the recession years, there was a considerable reallocation of the Spanish exports towards the rest of world, detriment to the European Union. From 2007 to 2013, the share of exported products to the European Union fall 8 percentage points (from 71% to 63%), corresponding to the worst years of the recession in the European countries. In other words, during the first years of recession, Spanish firms looked for more distant, but more dynamic, markets in order to increase their exported sales (Myro, 2013). This substitution of exports toward extra-EU countries starts to decrease after 2013, along with the economic recovery of European countries and the weight of intra-EU exports started to increase again (67% in 2017).

Therefore, until now we have shown that Spanish exports have lived a veritable growth spurt, or an "export miracle" (Eppinger et al. 2017) since the beginning of the recession in 2008, highlighting the key role that exports had in the recovery of the Spanish economy. Nevertheless, the reader may ask if this export success is only a Spanish phenomenon, or, on the contrary, other countries in similar circumstances have reacted in a similar way. A comparative analysis with other countries is always a very enriching activity when we are studying a country case. Figure 1.5 shows the evolution of the exports of good and services from 2007 to 2017 in the bigger EU countries:

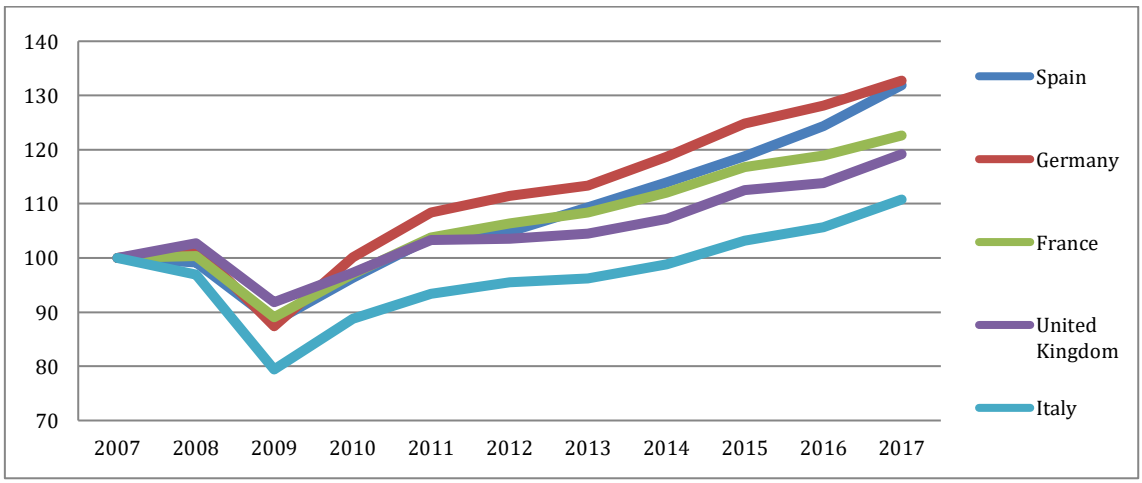
Germany, France, United Kingdom and Italy. Results show that all these countries have increased their exports in the last decade; however, only Germany (33%) has increased their exports more than Spain (32%). France (23%), United Kingdom (19%) and Italy (11%) appear far away Germany and Spain in terms of exports growth between 2007 and 2017.

Figure 1.4- Destination of Spanish exports of goods, percentage of total



Source: Eurostat

Figure 1.5- Evolution of Exports of goods and services, 2007=100

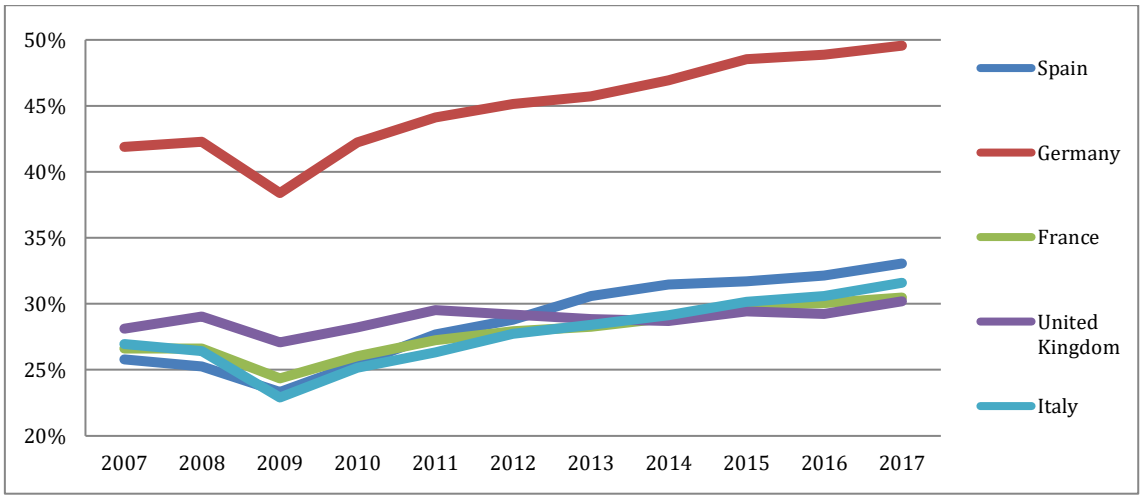


Source: Eurostat

The fact that Spain is only behind Germany (and only 1% behind), the paradigm of the exporter country, emphasizes the magnitude of the export growth spurt in Spain in the last decade. Figure 1.6 shows the share of exports on the GDP in the same five European countries. As it can be appreciated, Germany is a total exporter country, with exports accounting for the 50% of the German GDP in 2017. In a second position we

find Spain, with exports representing 33% of the Spanish GDP in 2017. Interestingly, in 2007 Spain was the last country of this group in terms of share of exports in the GDP, with only 26%. Italy (32%), France (30%) and United Kingdom (30%) are behind Spain in terms of the share of exports in the GDP in 2017.

Figure 1.6- Share of exports of goods and services in the GDP



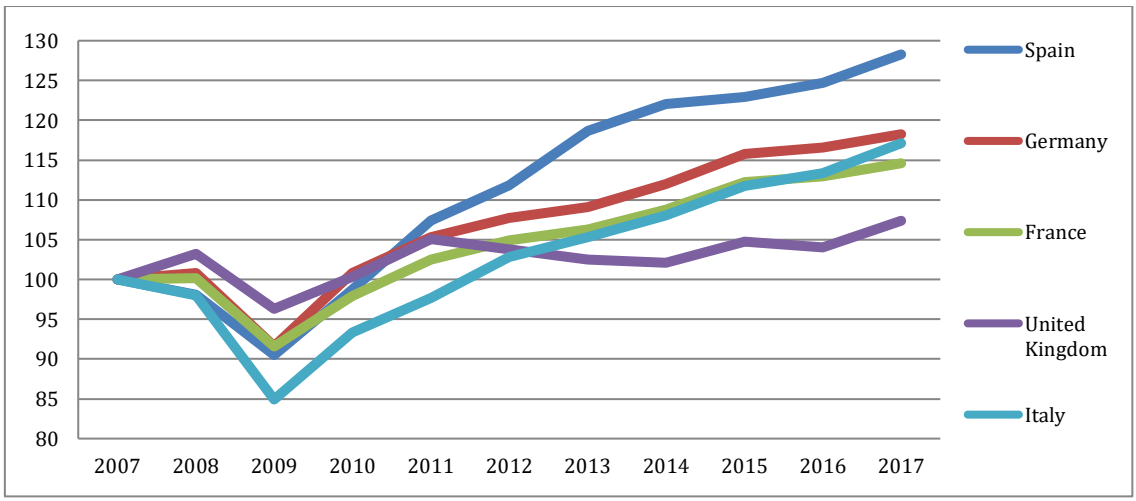
Source: Eurostat

Finally, Figure 1.7 shows the evolution of the share of exports in the GDP between 2007 and 2017. Now we can confirm what we suspected: Spain is the country where exports have the most increased their weight on the GDP, an increase of 28% since 2007. This phenomenon is explained, on the one hand, by the increase of the volume of total exports, and on the other hand, by the decrease in the internal demand (private consumption and investment). The rest of the countries analysed have as well increased the share of their exports on the GDP, but in a lower proportion: Germany (18%), Italy (17%), France (15%) and United Kingdom (7%). Therefore, we have shown that other European countries have as well lived an export growth spurt, but lower compared to the Spanish case.

This considerable increase in the Spanish exports was possible thanks to a general competitiveness improvement of the Spanish economy (Myro, 2015). To be competitive in costs is one of the main important objectives in a firm, and the labour costs represent the larger cost category within firms. Figure 1.8 shows the evolution of the unit labour costs, a common measure of firm competitiveness, between 2007 and 2017. As it can be noticed, Spain is the only country, together with United Kingdom,

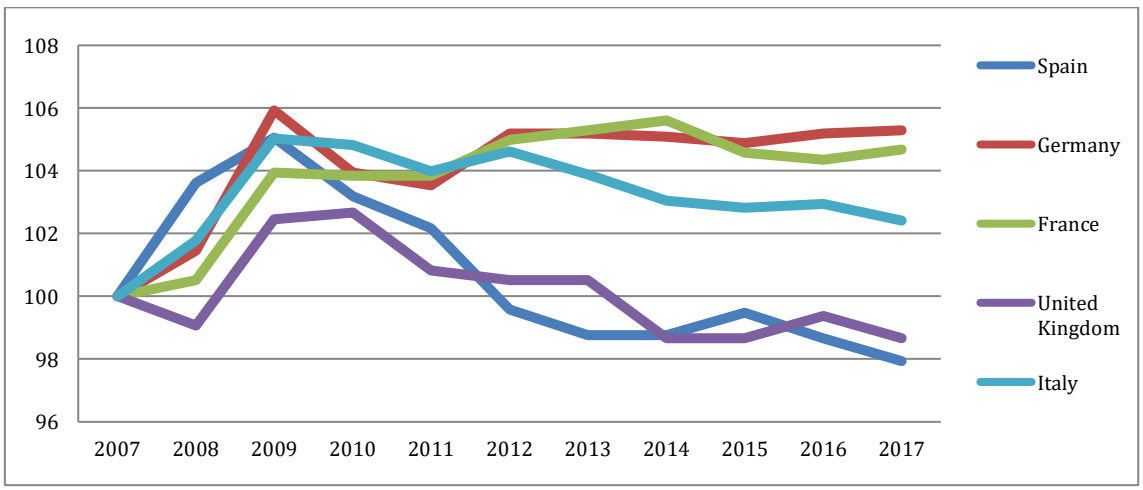
that has reduced its unit labour costs, and consequently, improved its competitiveness. Spanish firms has reduced their unit labour cost a 2,1% since 2007 and 7,1% since 2009. In this sense, such a reduction in the larger cost aspect in the firm has allowed Spanish firms to gain competitiveness and be able to export with success in the last years. Surprisingly, Germany is the country where the unit labour costs has increased the most since 2007, a 5,3%.

Figure 1.7- Evolution of the share of exports of goods and services in the GDP, 2007=100



Source: Eurostat

Figure 1.8- Evolution of the unit labour costs. 2007=100

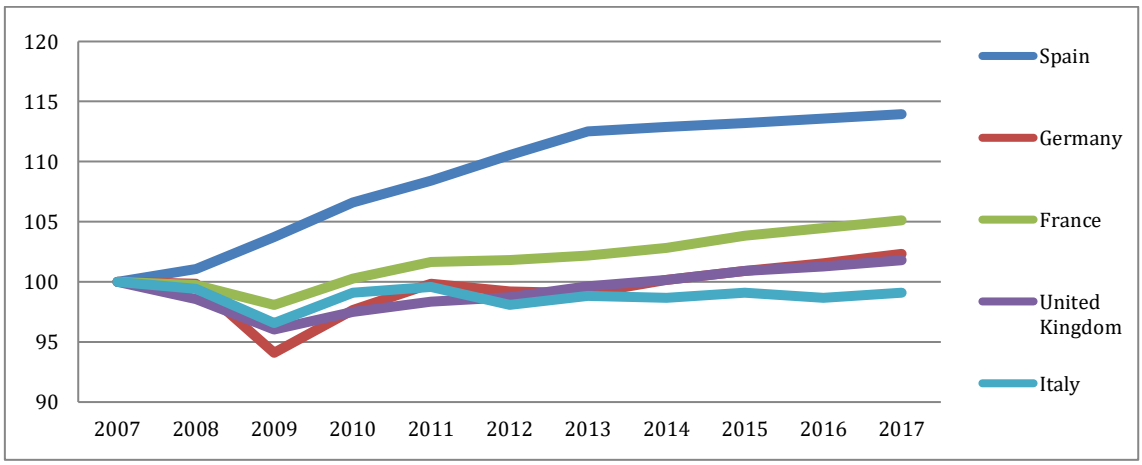


Source: Eurostat

The unit labour costs are calculated trough the wages/productivity ratio, and, hence, Figures 1.9 and 1.10 present the evolution of productivity and wages, respectively, between 2007 and 2017. Figure 9 shows that the labour productivity has

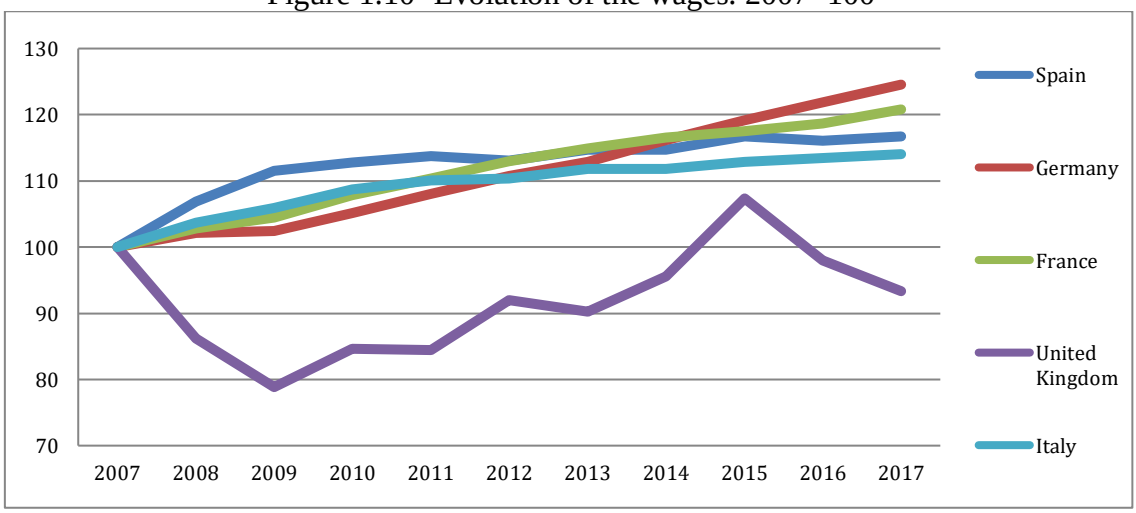
grown in Spain 14% between 2007 and 2017, much more than France (5%), Germany (2%), United Kingdom (2%) and Italy (-1%). On the other hand, Figure 10 shows that wages in Spain have experienced a moderated increase between 2007 and 2017, in line with what has happened in the others four countries belonging to the monetary union. Wages have increased a 17% in Spain, 14% in Italy, 21% in France and 25% in Germany. On the contrary, wages in United Kingdom has surprisingly fall a 7% since 2007, partly due to the devaluation of the sterling pound during the recession years.

Figure 1.9- Evolution of the labour productivity. 2007=100



Source: Eurostat

Figure 1.10- Evolution of the wages. 2007=100



Source: Eurostat

Hence, as we have seen, the improvement of the unit labour costs in the United Kingdom is the result of a decrease in wages rather than an increase in the productivity. On the other hand, in the Spanish case, the improvement in the unit labour costs is the

result of a big increase in the productivity together with a moderate increase in the wages. As striking fact, in 2016 Spain regained the pre-crisis production level in constant terms (around 1.100 milliard €), but employing 2.4 less million workers. This is the reason of the huge productivity increase that is behind the competitiveness improvement, and, as we will see later, productivity is probably the most important element for firms in their internationalization process.

1.2. The study of international trade

At the end of the XVIII century, Adam Smith, in *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776) anticipated that international trade was beneficial for those involve in it. He noted, "if a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it of them with some part of the produce of our own industry, employed in a way in which we have some advantage". In fact, Adam Smith realized that international trade allowed agents to take advantage from the differences in the production costs between countries.

Nevertheless, it was not until the beginning of the XIX century when David Ricardo developed the first theory about the international trade: the theory of comparative advantage (Ricardo, 1817). From Ricardo's view, each country has incentives to specialize in those industries in which is more productive, has lower production costs, among all the industries in the country. In this sense, every country has a comparative advantage in one industry. The core of Ricardo's argument is that relative productivities are a major source of comparative advantage and that patterns of specialization depend on the comparative advantages, not absolute advantages. Hence, each country will export the good in which is more productive and will import the rest of goods, implying that the technological characteristics of countries are important determinants of international trade flows. Ricardo designed a theoretical model composed of two countries, two industries and one production factor (labour).

In the 1930's, two Swedish economists, Eli Heckscher and Bertil Ohlin, suggested a new theory to explain the international trade flows. According to the model of Heckscher-Ohlin (Heckscher, 1919; Ohlin, 1933), trade exchanges were not the

result of differences in the labour productivity between countries, as Ricardo affirmed, but there were the result of differences in the endowment of production factors between countries. This model suggested that the technological possibilities are the same in all countries and that specialization depends on the relative price of production factors. In each country, the relatively cheap factor is the abundant factor and the relatively expensive factor is the scarce factor. Hence, every country will specialize in "the abundant cheap factor". In other words, every country will export those products whose production use intensively the abundant factor in the country, and will import the rest of goods. This model was composed of two countries, two industries and two production factors (labour and capital).

The classical theory of international trade (Ricardo, Heckscher-Ohlin) was only able to explain trade between countries specialized in different goods or between countries with a different factor endowment, in other words, the inter-industry trade. However, these theories could not give a response to an increasingly relevant stylised fact: an important share of the international trade occurs between countries with similar factor endowments, exchanging similar goods, that is, the intra-industry trade. In 1953, the economist Wassily Leontief highlighted the limitations of these models: during the post Second World War period, the United States was, by far, the country in the world with the highest capital/labour ratio. According to the model of Heckscher-Ohlin, United States should export goods intensive in capital (abundant factor) and import goods intensive in labour (scarce factor). However, the data showed that the imports' capital intensity was larger than the exports' capital intensity. How this contradiction was possible? This fact will be later known as the Leontief paradox.

During the mid 1970's, some Swedish economists focused their research in the process of internationalisation of firms, in other words, the decided to analyse the behaviour of individual firms in international markets. This study of international trade at a microeconomic level was a very different exercise from what it had been done in the field, focused until that moment in the trade between countries at a macroeconomic level. Johanson and Wiedersheim-Paul (1975) and Johanson and Vahlne (1977) proposed a model that described the behaviour of multinational and exporting firms, later called the Uppsala Model. Through the study of the cases of four Swedish multinational firms, they concluded that firms experienced a process of gradual

internationalization in their conquest of international markets, a process they called "The Establishment Chain". Firstly, due to the lack of knowledge about foreign countries and the propensity to avoid uncertainty, firms develop in the domestic market, selling only in the home country. Secondly, firms start to export to neighbouring countries, which are comparatively well known and they share similar business practices. And finally, they start producing or manufacturing abroad, getting involved in foreign direct investment activities. Hence, the Uppsala model suggests that the process of internationalization of firms depends on a gradual acquisition, integration and use of knowledge about foreign markets and operations.

At the beginning of the 1980's, the economists Paul Krugman and Elhanan Helpman (Krugman, 1980; Helpman, 1984; Krugman and Helpman, 1985) suggested that the limitations of the Classical Theory of international trade lied in the trade model's assumptions. In fact, classical models incorporated three key assumptions: the existence of a representative firm in every industry, a perfect competition situation in markets, and constant returns of scale in every firm. Therefore, Krugman and Helpman decided to break with these assumptions, incorporating in the trade models the concepts of economies of scale in firms and monopolistic competition in markets. This new form of approaching the international exchanges between countries, later known as "The New Trade Theory", was able to explain the intra-industry trade between countries.

On the one hand, according to these authors, economies of scale can be an independent source of specialization, other than labour productivity (Ricardo's model) or factor endowment (Heckscher-Ohlin's model), and therefore can impact foreign trade. A firm or a sector obtains technology driven economies of scale when a proportional expansion of all inputs raises output more than proportionately. In the presence of important fixed costs, the economies of scale lead as well to declining average costs. Therefore, a country that manages to attain large-scale production in an industry with economies of scale, manufactures its product with low unit cost, and therefore exports this product. As a result, scale of production may be as well a source of comparative advantage.

On the other hand, the concept monopolistic competition refers as well to another kind of specialization, this time at the firm level. Each firm will specialize on a

specific variety of a product, to the extent that this variety is an imperfect substitute for other varieties of this same product produced by other firms. The market power of each firm that characterizes the monopolistic competition comes from the fact that each firm may fix the price to the specific variety produced. Nevertheless, there exist a limited number of varieties for each product and the presence of competitors in each variety exercises a competitive pressure and guarantee that, in equilibrium, profits are zero.

Suppose a market with monopolistic competition. One firm produces one variety of a product, sets its price and obtains positive profits. The existence of positive profits in this market will lead to new firms enter the market and to produce this same variety. This generates an increase in the supply of this variety, and assuming a constant demand, the price of this variety will decrease, and the profits of each firm will decrease as well. This will cause the exit of firms from the market until the equilibrium point, characterized by a fixed number of producers for each variety and zero profits in each firm. Extrapolating this situation to the international trade, we find that firms start exporting their variety to a foreign country up to the point at which the profits of incumbents are close to zero and no incentives exists for additional firms to enter. These are the features of monopolist competition in international markets, where trade leads to competitive product differentiation and international exchange of differentiated products. Moreover, this product differentiation within industries explains the intra-industry trade: Helpman and Krugman (1985) pointed out that if all sectors manufacture homogenous products then the share of intra-industry trade is zero, and if some sectors manufacture differentiated products then the share of intra-industry is positive.

Furthermore, “The New Trade Theory” included as well two other explanations for the bilateral trade flows between countries: the gravity model and the home market effect. The gravity model predicts that the trade volume between a pair of countries is proportional to the product of their market size, measured by the GDP of each country. Moreover, others variables such as the distance between countries, the tariffs, or a common language are as well significant elements that determine the amount of trade between two countries. In addition, countries that became more similar in size over time (measured as the GDP) will trade more between them over time. Furthermore, if goods are produced with capital and labour, the share of intra-industry trade should be larger the more similar are the capital-labour ratios of the two countries. The home-market

effect (Krugman 1980) establishes that under the presence of trade costs, firms will tend to install their production in the larger country. In the absence of trade costs, firms can choose to install their production in any specific country because the cost of providing their product is the same whenever is the country of origin or destination. However, in the presence of trade costs, a firm will tend to install their production in the larger market in order to be able to sell to this market without trading costs, ultimately increasing their profits.

In the mid 1990s, the increasing availability of data at the firm level showed that the Classical Models of international trade as well as the New Trade Theory had serious limitations in explaining the behaviour of individual firms in international markets. Even though these trade models incorporated appropriate elements to describe some stylized facts of international trade (comparative advantages, specialization, imperfect competition and economies of scale), "they proved inadequate to explain a range of empirical findings that emerged in the 1990s from new firm level datasets" (Helpman, 2011). Since that moment, the international trade literature has been focused in analysing the role of firm heterogeneity in international markets. More precisely, it has tried to explain a stylised fact that all the previous models have failed to explain: why some firms export while others do not. Not even the Uppsala Model would able to explain this issue. This model accounted for a gradual process of internationalization of firms, but did not explain why firms export regularly, others export occasionally and others do not export.

The first people to undertake an empirical study about exporting across firms and between industries were Bernard and Jensen (1995). Thanks to panel data of US manufacturing firms between 1976 and 1987, they found remarkable differences between exporter and domestic firms. Specifically, they discovered that exporters were larger, were more capital intensive, paid higher wages, received higher benefits, invested more per employee and showed higher labour productivity than non-exporter firms. However, the theoretical model that recognized differences between individual producers within an industry did not arrive until Bernard et al. (2003) and Melitz (2003) broke with the classical assumption of a representative firm to incorporate firm heterogeneity in markets. In his model, Melitz (2003) made an extension of the Krugman (1980) model with monopolistic competition and increasing returns to scale

but incorporating firm level productivity differences. In the Melitz model, the key element used to explain why some firms export while others do not is productivity. According to him, there are some sunk costs associated with the entry into export markets and only the most productive firms are able to overcome these costs and obtain positive profits. In this sense, the least productive firms serve only the domestic market while the most productive firms can export to international markets.

Helpman et al. (2004) extended the Melitz's (2003) model to include firms that invest abroad. Their results showed that multinational firms, those firms who own foreign subsidiaries or license foreign firms to produce their products, are more productive than others (exporters and domestic firms). In other words, only the most productive firms are able to become involved in foreign direct investment. The hierarchy of firms in terms of productivity presented by Melitz (2003) is extended in the Helpman et al. model: the least productive firms serve only the domestic market, firms with an intermediate productivity export, and only the most productive firms are able to become involved in FDI activities. Moreover, the activity of multinational firms has been linked to the geographic distance (Yeaple, 2009) or to the contract enforcement (Antràs, 2014) between the parent firm and the subsidiary.

Therefore, this Ph.D. thesis is framed within the literature focused in analysing the role of firm heterogeneity in international trade, and the determinants of exporting.

1.3. The focus on manufacturing firms

This Ph.D. thesis will be focused in the study of the internationalization process of Spanish manufacturing firms. In 2017, the export of goods represented the 70% of total exports in Spain, and the export of services represented the other 30%. Therefore, if the goal of this work is to analyse the behaviour of Spanish firms in international markets, we should focus on manufacturing firms, which are the main actors of the Spanish exports. Fortunately, since the 1990's there have emerged a considerable number of datasets at the firm level in many advanced and developing countries, allowing the study of the behaviour of individual manufacturing firms. Hence, the reason to focus this Ph.D. on manufacturing firms is twofold. Firstly, manufacturing firms are the main actors in international markets, and secondly, we dispose of good

information and data availability regarding the characteristics of these manufacturing firms.

The data source used in this Ph.D. thesis is the Survey of Firms' Business Strategies (ESEE) drawn up by the Spanish Ministry of Industry and the SEPI Foundation. This data set is an annual survey, which refers to a representative sample of Spanish manufacturing firms, according to industry and size. The survey applies random sampling for firms with 10 to 200 workers and exhaustive sampling for firms with 200 or more workers. The survey started in 1990 and since this year, 5.566 firms have participated in the survey. Some firms answer every year while others do not, which makes the dataset an unbalanced panel. From 1990 to 2015, on average 1.820 Spanish manufacturing firms have participated in the survey every year.

Table 1.1- Sample description of the ESEE and representativeness

Sample of the ESEE (1990-2015)		Firms	Percentage
Manufacturing firms with more than 10 employees	Between 10 and 50 employees	2.809	50%
	Between 50 and 200 employees	1.199	22%
	More than 200 employees	1.558	28%
	Total	5.566	100%
Spanish Economy in 2015		**Firms**	**Percentage**
Manufacturing firms	Without employees	58.407	36%
	Between 1 and 10 employees	79.208	48%
	More than 10 employees	25.837	16%
	Total	163.452	100%
Manufacturing firms with more than 10 employees	Between 10 and 50 employees	21.236	82%
	Between 50 and 200 employees	3.627	14%
	More than 200 employees	974	4%
	Total	25.837	100%

Source: DIRCE

Table 1.1 presents a summary of the sample of the ESEE and its representativeness. As it can be noted, the Spanish manufacturing industry is primarily composed by micro and small firms. Among the 163.452 manufacturing firms registered in 2015 in Spain (last year available in the ESEE), 58.407 firms had not employees and 79.208 firms had between 1 and 10 employees, accounting for the 36% and 48% of the total manufacturing firms, respectively. Therefore, only 16% of Spanish manufacturing firms (25.837 firms) affirmed to have more than 10 employees in 2015.

Among these firms, it predominated those with between 10 and 50 employees (82%), and firms with more than 50 employees only represented the 18% of the total.

On the other hand, the sample of the ESEE is composed by 5.566 manufacturing firms with more than 10 employees, representing the 21% of the universe of Spanish manufacturing firms with more than 10 employees. Regarding the distribution of firms according to the number of employees, our sample is slightly biased towards large firms, precisely due to this exhaustive sampling for large firms performed by the ESEE. Nevertheless, the sample of the ESEE is a rich dataset composed by more than 5.500 firms answering during 26 years and we dispose of more than 140.000 observations with a panel data structure.

Regarding the information presented in the ESEE, the survey is oriented to capture the information related to the business strategies of the firms. The survey is composed by 746 variables (questions) in total. Some questions remain in the survey since 1990, others were drop from the survey and others were added in the 26 years of duration of the survey. In general, the questions of the ESEE may be divided into the following 8 categories:

1- *Activity, products and production processes*: it includes some characteristics of the company and its operations, such as its establishments, its legal form and some significant holdings in its social capital, activity and characteristics of the manufactured products and technology used.

2- *Customers and suppliers*: it collects information related to the type of customers of the company, the final destination of the manufactured products, distribution channels used, commercial promotion activities, characteristics of suppliers and contracting services.

3- *Costs and prices*: it provides information about the prices paid by the company and the sales price policy.

4- *Markers served*: it collects information related to the markets served by the company, and are identified by product lines, type of customers, geographic

scope or other characteristics. The information refers to the market share of the company, the number of competitors and the share of the principals, the variation experienced by prices during the year and the reasons for that change.

5- *Technological activities*: it includes questions related to R & D activities, patent registration, product and process innovations and payments and revenues from licenses and technical assistance.

6- *Foreign trade*: it includes exports and imports, and its distribution by geographical areas

7- *Employment*: it collects the personnel employed in the company, its composition according to contract types, categories and degree and other data aimed at determining the effective workday during the year.

8- *Accounting data*: this last part incorporates three blocks of information. The first is a summary of items in the profit and loss account. The second includes the value of the investments in tangible fixed assets. The third is a summary of the most important items in the company's balance sheet.

This Ph.D. thesis is empirical in nature, and we will employ the ESEE as the main source of information in all this work.

1.4. The empirical analysis of the internationalization process of Spanish manufacturing firms.

The literature dedicated to the analysis of the internationalization process of Spanish manufacturing firms in the last two decades has been primarily focused on depicting the determinants of exporting. Both from a theoretical and an empirical approach, the main goal of these analyses has been to determine why some firms export while others do not. Nevertheless, the study of the Spanish case cannot be isolated from the study of other countries cases, and therefore, the international literature has

influenced in a considerable degree the topics analysed, the economic approach, and the econometric tools employed in the field.

There are mainly two analyses that have been employed in order to determine why some manufacturing firms export while others do not. On the one hand, a branch of the literature has been focused on depicting the variables that significantly affect the export decision, in other words, which are the determinants of the export probability. On the other hand, another branch of study has been concentrated in analysing the differences between exporting and domestic firms, in order to detect some common characteristics present on exporter firms that would be different from other common characteristics present on domestic firms.

Regarding the study of the exporting decision or the export probability, the existent literature in Spain has showed that productivity is one of the most relevant variables in order to determine the decision of exporting. Therefore, more productive firms are more likely to enter the export markets (Máñez-Castillejo et al. 2004, Altuzarra et al. 2016). Moreover, the firm size, both measured as the number of employees or the amount of sales, is a relevant variable in order to define the export probability. Larger firms are more likely to engage in export activities (Máñez-Castillejo et al. 2004, Martín et al. 2013, Altuzarra et al. 2016). Nevertheless, according to Esteve et al. (2011) "the introduction of the euro has remarkably weakened the role of firm size in the decision to export to the Eurozone".

Furthermore, the R&D activities in the firm have as well a direct impact on the firm export decision. Product innovations, patents and processes innovations positively affect the export probability (López et al. 2005). In this line, Caldera (2010) specified that, in particular, product upgrading had larger effect on the firm export participation than the introduction of cost saving innovations. Besides, the nature of the firm ownership has been proved to be a relevant element in determining the firm export decision. Foreign-owned firms are more likely to enter the export market than the rest of firms (Máñez-Castillejo et al. 2004, Altuzarra et al. 2016). Moreover, Fernández et al. (2006) showed that internationalisation is negatively related to family ownership and positively related to corporate ownership, and the presence of a corporate block holder in family encourages internationalisation.

In his seminal paper, Melitz (2003) argued that the presence of sunk costs at the entry into export markets prevented low productive firms to engage in export activities, because only the most productive firms were able to overcome these costs and obtain positive profits. Following the success of his model, many scholars started to investigate the role of sunk costs in the export decision. Blanes et al (2008) established that sunk exporting costs were relevant for Spanish firms, and differed depending on the destination market. Furthermore, Máñez-Castillejo et al. (2008) showed evidence supporting the sunk costs theory of exports, specifying that large firms face smaller sunk costs than small firms at the entry of export markets.

Some studies have approached the influence of others additional variables on the export probability. Altuzarra et al. (2016) argued that having exported before is significantly correlated with the future export decision. Máñez-Castillejo et al. (2004) found that while regional and local spillovers and the advertising intensity have a positive impact, the public sector oriented sales have a negative impact on the firm export probability. Finally, Martín et al. (2013) established that the human capital, in particular the international experience of managers, and the internationalization trough other channels (the participation in global values chains or the performance of foreign direct investment) have a significant influence in the firm export decision.

Until now, we have seen that the literature focused on depicting the determinants of the export decision has proved that there exist many relevant variables that affect the internationalization process. However, we know that some firms decide to internationalize while others do not. Therefore, these two kinds of firms, exporters and domestics, must differ in those aspects that are relevant in the firm export's decision. This is precisely the goal of the branch of the literature that analyses the differences between exporting and domestic firms, in order to detect some characteristics that would foster the export participation in some firms and prevent it in other firms.

Following the results of Melitz (2003), a relevant body of the empirical literature for Spanish firms has focused on analysing the differences in terms of productivity between exporters and domestic firms. The main findings highlight that exporters firms are more productive than domestic firms (Delgado et al. 2002, Merino 2004). Mainer

(2014) accounted for this productivity *premia* on Spanish exporters firms. She found that the TFP is a 23% larger, and the labour productivity a 39% larger in exporter firms compared to domestic firms. Furthermore, the ISGEP (2008) established that the productivity *premia* on exporters tend to increase with the share of exports on total sales. In addition to the productivity *premia* on exporters, results also show the existence of a productivity *premia* on firms that source abroad (perform FDI) compared to firms that do not source abroad (Fariñas et al. 2010).

Eppinger et al. (2017) analysed the behaviour of Spanish manufacturing firms during the last decade, and how they reacted to the Great Recession. They found that the overall TFP level for Spanish manufacturing firms deteriorated by around 15% from 2007 to 2009. Nevertheless, while the TFP of domestic firms continue do decrease another 15% until 2011, exporters firms reached to maintain their TFP levels between 2009 and 2011. Hence, their results proved not only that exporters firms are more productive than domestic firms, but also showed that Spanish exporters firms are more resilient to economic shocks than domestic firms.

Finally, some studies have analysed how exporters and domestic firms differentiate in terms of others firm characteristics. Fariñas et al (2007) found that Spanish exporters are bigger in terms of employees, pay higher wages and are more innovative compared to Spanish non-exporters. Moreover, Muñoz (2014) suggested that Spanish exporters have larger domestic sales, both in volumes and in growth rates, compared to Spanish non-exporters. Finally, Moreno et al. (2010) highlighted that persistent exporters have larger margins compared to domestic firms. However, their results put forward that larger export ratios are negatively associated with margins for persistent exporters, suggesting that efficiency advantages for exporters are partially compensated by higher competitive pressure in international markets.

Among all these differences between exporter and domestic firms, productivity has been placed at the core of the firm's internationalization process. Despite there exists a widespread consensus about the superior productivity of exporter firms, the source of this superiority is still debated. On the one hand, some researchers affirm that exporter firms were more productive than domestic firms even before their entry into export markets. This idea is translated into the self-selection hypothesis of better firms

entering export markets. On the other hand, some economists establish that firms improve their productivity levels after start to export, suggesting that firms take advantage from a higher competition level in international markets. This concept has been called the learning-by-exporting hypothesis.

The hypothesis of self-selection of more productive firms entering export markets has received remarkable support in the Spanish empirical studies (Delgado et al. 2002, Fariñas et al. 2007, IGSP 2008). Máñez-Castillejo et al. (2010) limited this self-selection process of more productive firms entering export markets to small firms, and they did not find a self-selection mechanism on large firms. The hypothesis of learning-by-exporting has not received, however, comparable support in the empirical literature for Spanish firms. On the one hand, some studies have found significant productivity improvements in firms after their entry into export markets (Merino 2012). Manjón et al. (2013) accounted for this learning-by-exporting mechanism, suggesting that yearly average gains in productivity for exporters are around 3% for at least 4 years.

Other studies have found significant improvements in productivity following the entry in export markets but conditioned to some elements. Segarra-Blasco et al. (2006) argued that the productivity improvements depend on the level of market competition: when the level of competition in the export market rises compared to the domestic market, new exporters moderate their productivity growth. Máñez-Castillejo et al. (2010) suggested that while the extra productivity growth takes longer to start for large than for small firms, it is more intense and progressive for large firms. Salomon et al. (2008) affirmed that the benefits of exporting depend on the technological level of the industry: firms in technologically lagging industries learn more from exporting than those firms in technologically leading industries.

On the contrary, a considerable body of research has found no evidence of productivity improvements in Spanish firms following their entry into export markets (Delgado et al. 2002, Fariñas et al. 2007, ISGEP 2008). Nevertheless, the learning-by-exporting hypothesis should not be restricted only to the impact of exporting on productivity, but may be expanded to other firm characteristics. The entry into export markets may bring to the firm others positive spillovers beyond a productivity

improvement. Hence, some studies have analysed the impact of exporting in other variables than productivity. Esteve et al. (2008) highlighted a "surviving-by-exporting" effect, suggesting that Spanish exporter firms face a significantly lower probability of failure than non-exporters. Finally, Salomon et al. (2010) affirmed that exporting is associated to an increase in the innovation intensity for both technologically leading and lagging firms.

Nevertheless, productivity, innovation, size and internationalization are interconnected and it is difficult to establish causes and consequences. Many studies have tried to disentangle the mechanisms throughout which this variables act on the internationalization process of firms. The link between innovation, productivity and exports has received a considerable attention of the literature (Máñez-Castillejo et al. 2009, Cassiman et al. 2010, Cassiman et al. 2011, Esteve et al. 2013, Máñez-Castillejo et al. 2015). Golovko et al. (2011) showed a positive connection between innovation, exports and the firm's growth rate. Huerta et al. (2014) studied the link between productivity and firm size and Guillamón et al. (2017) analysed the dynamic linkages between productivity growth and firm growth. Finally, Guadalupe et al. (2012) linked the innovation level and the exporting activities with the ownership of firms.

1.5. The contribution to the literature of this Ph.D. thesis

In the framework that we have previously presented, this Ph.D. thesis will make three substantial contributions to the literature focused on analysing the internationalization process of Spanish manufacturing firms. More precisely, the aim of this thesis is to explore the influence of some variables, other than productivity, in the debate about the determinants of exporting. Overall, we study the influence of the business management practices (Chapter 2) and the process of digital transformation (Chapter 4) in exports and foreign direct investment. Moreover, we will undertake as well a very detailed study about the changes arising within the firm following its entry into export markets, analysing the evolution of a wide set of firm characteristics during the internationalization process–employment, sales, wages, contracts, unit labour costs, innovation…- (Chapter 3).

Chapter 2 is dedicated to the study of the role of management practices on the firm internationalization process. As we have previously mentioned, a number of theoretical models and empirical works have revealed the importance of factors such as productivity, firm size and innovation in explaining the firm's export decision or the firm's decision to invest abroad. However, all these variables could correspond to a deeper element at the core of the firm: the business management quality. In fact, recent empirical studies have shown the existence of a close correlation between the firm's management quality, productivity level, size and innovation intensity. This chapter demonstrates the strong association between management quality and the firm's internationalization decisions.

Hence, the contribution of this study is to demonstrate that the firm's managerial assets may be substitutes for the firm's productivity in its internationalization decisions. According to Melitz's model, only the most productive firms can obtain positive profits from exports in the presence of sunk costs. In other words, the only way to overcome these sunk costs is through productivity. Nevertheless, we have to assume that sunk costs are not at all well known, making exporting and foreign investment risky processes, more easily afforded by better managed firms. On the other hand, even if all firms face the same sunk costs on entering foreign markets, not all of them need the same fixed investment to overcome these costs. We therefore propose that management quality is one of the key variables determining the amount of fixed investment that a firm has to undertake.

Better-managed firms will find the most efficient and least costly way of internationalizing. Many aspects of firm management are crucial, like leadership, experience and the ambition of managers; human capital (the formation and capacities of employees); the monitoring of results and the elaboration of market surveys; effective relationships with suppliers and customers; being in the vanguard of innovation or being committed to the process of digitization. Firms who perform these management practices could absorb some of the sunk costs associated with exporting and, as a result, accomplish a successful export strategy, overcoming their limitations in terms of productivity. Badly managed firms, on the other hand, which do not perform these management practices, will face a fixed investment too high to obtain positive profits from exporting and will thus exit the export market.

Using our Management Quality Index (MQI) as a proxy of the good management practices in a firm, we will demonstrate two important facts regarding the internationalization process of the firm. Firstly, a management quality bonus on exporters exists, as well as a productivity bonus, and the size of the management quality bonus is greater than the size of the productivity bonus. In other words, the difference between exporters and non-exporters is greater in terms of management quality than in terms of productivity. Secondly, we have shown that a change in a firm's management quality is more closely correlated with the export decision than a change in the firm's productivity. In addition, we have seen that all these results can be extended to explain differences between multinationals (firms involved in foreign direct investment) and non-multinationals, as well as to explain a firm's decision to invest abroad.

Chapter 3 is focused on analysing what are the most relevant changes that firms experienced following their entry into export markets. Until now, the empirical literature for Spain has been primarily focused on the connection between productivity and the internationalization process of firms. Hence, we clearly know that Spanish exporters are more productive than Spanish domestic firms even before they start to export. Regarding the effects of exporting on productivity, results are mixed. However we know very little about how exporting affects other characteristics of Spanish manufacturing firms. Hence, the contribution to the literature of this chapter is to offer more evidence about the effects of exporting on firm performance. In this sense, we will analyse the six years previous to the entry into export markets and the first six years exporting of new exporter firms, and we will compare their performance with the one of domestic firms. We employ a wide set of variables in order to illustrate the main firm performance elements: labour productivity, total sales, gross operating margin, R&D expenditure, R&D probability, number of employees, wages, employment contracts, human capital and unit labour costs.

The main results show that, firstly, the differential in terms of employees and sales between exporters and non-exporters increases after the first start to export. Secondly, the productivity differential experiences a U-shaped trend, decreasing before the entry in export markets and then increasing during the years exporting. The average wage experience the same U-shaped trend and the unit labour costs in the firm

experience an inverted U-shaped trend. Thirdly, firms lose their advantage in terms of gross operating margin after they start exporting. Fourthly, despite the R&D expenditure increase after firms start exporting, the probability to perform R&D (in other words, the number of innovative firms) remain stable throughout the internationalization process. Finally, the quality of the employment contracts, measured as the percentage of workers with a permanent contract, improves after firms enter the export market

Finally, Chapter 4 investigates the role of digitization on the firm performance, with a special focus on the role of digitization in the internationalization process of firms. Numerous economists, and firm managers are alerting of the disruptive effects of digitization, foreseeing that, as in a natural selection model, only firms and countries that will reach to adapt to digitization will succeed in the times coming. It is undeniable that digitization will transform firms, customers and business models in the close future; nevertheless, the way and the degree in which this revolution will act are, at the time, unknown. Until now, research has found that exporters were larger in terms of employees, had larger sales, were more capital intensive, paid higher wages, received higher benefits, invested more per employee and showed higher labour productivity than non-exporter firms (Bernard and Jensen, 1995). At this point, we pose the following question: what about digitization? Is digitization a relevant variable in the internationalization process of firms? Are exporters firms more digitized than domestic firms? The aim of this chapter is, therefore, to try to answer these questions.

To do that, we will construct a Digitization Index that will serve as a proxy for the digitization usage in the firm. This Digitization Index is composed by 20 indicators, that can be classified in the following four sub-indexes: R&D Strategy, ICT, E-commerce and Automation. Furthermore, we will study heterogeneity in terms of digitization for a sample of Spanish manufacturing firms during the period 2010-2015. Our main results show that i) there exists a positive and significant correlation between the Digitization Index and the firm's production, total employment, labour productivity and average wage, iii) there exists a digitization premia on exporting firms compared to domestic firms, and on firm investing in foreign countries compared to the rest of firms, iv) this premia is larger on regular exporters compared to occasional exporters and on multinational firms compared to the rest of firms, v) a marginal increase in the

Digitization Index is correlated to an increase in the export probability, as well as to an increase in the export propensity (the weight of exported sales on total sales).

The contribution of this chapter to the existence literature is two-fold. Firstly, to our knowledge, this study is the first academic work exploring the digitization heterogeneity across firms within the manufacturing industry throughout a panel data sample and econometric techniques. In this sense, this study is a relevant contribution to the nascent literature focus on depicting the role of digitization on the firm performance, by providing evidence for a sample of more than 2.500 Spanish manufacturing firms. Secondly, this study shed more light to the literature focused on studying the heterogeneity of firms in international markets. We have shown that exporters firms are more digitized than domestic firms even after controlling for firm's productivity. Moreover, we indicate that the most relevant aspect of digitization in the internationalization of firms is the E-commerce practices. Therefore, if we believe on the disruptive effects that digitization may have on firms and on the business models, we cannot ignore the disruptive effects that digitization may have on international trade.

Hence, the three central chapters of this Ph.D. are interconnected to the extent that they introduce other variables and approaches in the debate about the determinants and consequences of exporting. Despite the firm productivity is a key element in the firm internationalization process, it is not the only one, and the purpose of this work is precisely to give more light about the relevance of the management practices and the digitization process in exporting and foreign direct investment. Finally, we believe that, beyond the impact on productivity, start to export may be correlated with deep transformations on a wide set of firm characteristics.

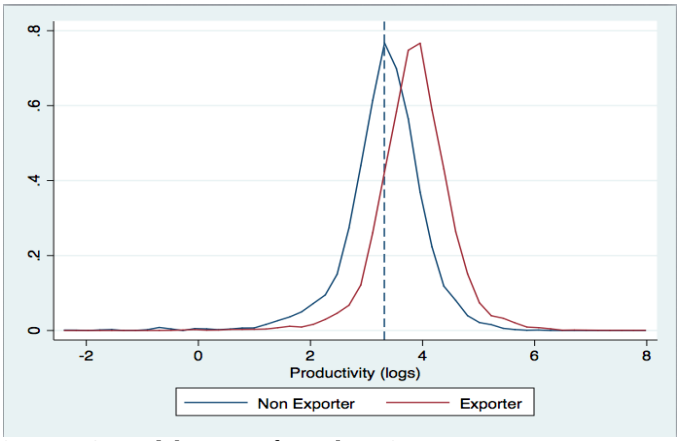
Chapter 2

Management quality and firm heterogeneity in international trade

2.1. Introduction

Recent international trade literature has primarily focused on the role of firm heterogeneity in international markets. Thanks to the increasing availability of data at firm level, research has revealed the existence of substantial differences between exporters and non-exporters. According to Bernard and Jensen (1995), exporting firms are larger, more innovative and more productive than non-exporting firms. Among these differences, productivity has been placed at the core of the firm's export decision. In his seminal work, Melitz (2003) established that only the most productive firms could obtain positive profits from exports, due to the existence of certain sunk costs on entry into international markets. Consequently, only the most productive firms will enter export markets while less productive firms will tend to remain in domestic ones. The real world, however, does not exactly reflect what Melitz (2003) proposed in his model.

Figure 2.1- Firm Productivity Distribution



Source: Own elaboration from the ESEE.

Figure 2.1 shows the Kernel productivity distribution of Spanish firms in the manufacturing sector from 2009 to 2013. The dashed line represents the average productivity level of non-exporters. As can be seen, a large number of firms of relatively low productivity, compared to non-exporters, are regularly exporting. However, these exporting firms certainly do not show negative profits each year. In fact, Spanish exports have exhibited a veritable spurt in growth from the beginning of the recession in 2008, growing at an average annual rate of 4.5% (Myro, 2015). We are conscious that the history of each firm should be taken into account in order to understand its export status in the light of its current productivity level (Armenter and

Koren, 2014). However, we consider that the productivity overlap found in the data indicates some limitations in the Melitz model. In this sense, the aim of this chapter is to try to explain the behaviour of firms in international markets by incorporating a new element into the trade literature: the management quality of the firm.

According to Melitz's model (2003), firms wishing to export must overcome certain sunk costs associated with the entry into foreign markets. These costs may be variable in nature, such as transport costs or tariffs, but can also be fixed, independent of the export volume. Among these fixed costs, Melitz stresses that "A firm must find foreign buyers, inform them about its product and learn about the foreign market. It must then research the foreign regulatory environment and adapt its product to ensure that it conforms to foreign standards (including testing, packaging, and labelling requirements). An exporting firm must also set up new distribution channels in the foreign country and conform to all the shipping rules specified by the foreign country and by the foreign customs agency". He then "assumes that a firm which wishes to export must make an initial fixed investment".

Thus, only the most productive firms can afford the sunk costs associated with the entry into export markets and obtain positive profits from exports. In other words, the only way to overcome these sunk costs is through productivity. So, facing similar sunk costs, only the firms with productivity levels above a certain threshold will be able to export. However, in our view, the quality of management must also play an important role. Better-managed firms may overcome costs associated with the set up of new distribution channels through cooperative strategies, such as alliances, partnerships or joint ventures with suppliers or customers, or even thanks to an experienced legal department within the firm, thus improving the firm's access to new export markets. They may also surmount other sunk costs such as those associated with learning about a foreign market or informing foreign buyers, at a very low marginal cost, through information technology resources. Moreover, sunk costs are never very predictable and firms must therefore always assume some risks in their export decisions. Recent research has revealed the importance of the risks that firms face when starting an international project, especially in developing economies, related to fraud, corruption or competition and regulation uncertainty. Therefore, we would expect better-managed firms to be more able to evaluate these risks and to face them in a more efficient way.

The conclusion to be drawn from this is that there is considerable room for management quality in the firm's export decision and in the activities of firms. This is our main hypothesis in the chapter, that can be formulated as follows: firms performing optimal management practices may either absorb some of the sunk costs on entry into international markets, or deal more easily with the risks associated with exporting, and, in the end, may accomplish a successful internationalization strategy despite their limitations in terms of productivity. In this sense, management quality should be seen as an instrument in the internationalization process of firms, in which better-managed firms will find the least costly and most efficient internationalization pattern.

Furthermore, some tendencies towards the reduction of sunk costs increase the relative importance of management quality against productivity. The European framework undoubtedly helps Spanish manufacturing firms to overcome the sunk costs associated with exporting. Firstly, 67% of Spanish exports go to the European Union and the European Common Market ensures the free circulation of products within the EU, so tariff costs or costs associated with the rules of foreign customs agencies disappear. Besides, the majority of sectors (e.g. electronic and electrical equipment, machinery, medical devices) are harmonised and subject to common rules across the EU. They provide a clear and predictable legal framework for businesses. If manufacturers follow these rules, their products can be sold freely in the market. In this sense, the costs associated with product modifications to conform to foreign standards are relatively small inside the EU.

Productivity is still, of course, an important element in the internationalization process of a firm, determining the firm's efficiency and its capacity to be competitive in international markets. However, as the data shows, many firms are able to overcome their limitations in terms of productivity and, through an ambitious internationalization strategy, manage to export with remarkable success. Thus, the key element in determining the export condition of the firm may not be productivity, but the courage and ambition of the firm, which are aspects of business management quality.

Until now, research has shown that the firm's internationalization decision is closely tied to its size (Bernard et al., 2003), innovation (Guarascio et al. 2016) and

productivity (Helpman et al., 2004). However, all these elements correspond to a wider characteristic of the firm: the management quality. The aim of this chapter is, therefore, to study the impact of management quality on the firm's internationalization decision. We are conscious of the fact that measuring management quality is undeniably a difficult task. We are not the first to do it however (Bloom and Van Reenen, 2007) and our indicator of management quality is based on a comprehensive and unique set of information, which has never been exploited before in this context.

Using our Management Quality Index (MQI) as a proxy for the good management practices in a firm, we will show that i) there exists a management quality bonus on exporters, as well as a productivity bonus, ii) the size of the management quality bonus is greater than the size of the productivity bonus; in other words, the difference between the management quality of exporters and non-exporters is greater than the difference in their productivity, iii) changes in the management quality of firms correlate more closely with their decisions to export than with changes in their productivity, iv) all these results can be extended to explain differences between multinationals (firms involved in foreign direct investment) and non-multinationals, as well as to explain a firm's decision to invest abroad.

The contribution of this work to the international trade literature is two-fold. Firstly, we have elaborated a comprehensive and unique index of management quality and we have used it to explain the role of the firm's management practices in its behaviour in international markets. Secondly, we demonstrate that management quality is a key element in the internationalization process of firms, perhaps more important than productivity. We show that well managed firms may overcome their limitations in terms of productivity in order to achieve a successful export strategy. The consequences of such findings from the point of view of public policy are considerable. A strategy oriented to provide advice on good management practices to firms could increase the firm's export possibilities and thus, the firm's performance. Furthermore, a public policy aimed at improving the management quality of firms would undoubtedly be less costly, more feasible and almost certainly more effective than one aimed at increasing their productivity.

The rest of the chapter is organized as follows: Section 2.2 analyses the theoretical framework which supports this research, reconciling both recent international trade literature, which focuses on explaining the firm's behaviour in international markets, as well as the management literature which focuses on evaluating the impact of management practices on the firm's economic performance. Section 2.3 describes the dataset and the methodology used in this research, as well as the econometric strategy employed to demonstrate our objectives. Section 2.4 presents the main results obtained from the econometric analysis, with the corresponding robustness checks. Finally, Section 2.5 highlights the main conclusions of this research and suggests some implications for public policy.

2.2 Theoretical framework

In the mid 1990s, the increasing availability of data at firm level showed that the Classical Models of international trade (Ricardo, 1817; Heckscher, 1919; Ohlin, 1933) as well as the New Trade Theory (Krugman, 1980; Helpman, 1984; Krugman and Helpman, 1985) had serious limitations in explaining the behaviour of individual firms in international markets. Even though these trade models incorporated appropriate elements to describe some stylized facts of international trade (comparative advantages, specialization, imperfect competition and economies of scale), "they proved inadequate to explain a range of empirical findings that emerged in the 1990s from new firm level datasets" (Helpman, 2011).

The first people to study heterogeneity empirically across firms and between industries were Bernard and Jensen (1995). Thanks to panel data of US manufacturing firms between 1976 and 1987, they found remarkable differences between exporter and domestic firms. Specifically, they discovered that exporters were larger, were more capital intensive, paid higher wages, received higher benefits, invested more per employee and showed higher labour productivity than non-exporter firms. However, the theoretical model that recognized differences between individual producers within an industry didn't arrive until Bernard et al. (2003) and Melitz (2003) broke with the classical assumption of a representative firm to incorporate firm heterogeneity in markets.

In his model, Melitz (2003) made an extension of the Krugman (1980) model with monopolistic competition and increasing returns to scale but incorporating firm level productivity differences. In the Melitz model, the key element used to explain why some firms export while others do not is productivity. According to him, there are some sunk costs associated with the entry into export markets and only the most productive firms are able to overcome these. In this sense, the least productive firms serve only the domestic market while the most productive firms can export to international markets.

Helpman et al. (2004) extended Melitz's (2003) model to include firms that invest abroad. Their results showed that multinational firms, those firms who own foreign subsidiaries or license foreign firms to produce their products, are more productive than others (exporters and domestic firms). In other words, only the most productive firms are able to become involved in foreign direct investment. The hierarchy of firms in terms of productivity presented by Melitz (2003) is extended in the Helpman et al. model: the least productive firms serve only the domestic market, firms with an intermediate productivity export, and only the most productive firms are able to become involved in FDI activities.

Regarding the empirical literature on FDI at firm level, Yeaple (2009), with a sample of U.S. multinational firms, found that the most productive multinational firms invest in a larger number of foreign countries. He also found that multinational activity was correlated to other factors such as distance between the parent company and the subsidiary, a common language or the GDP per capita of the country in which the subsidiary will operate. Moreover, the activity of multinational firms has been linked to the contract enforcement between the parent firm and the subsidiary (Antràs, 2014) or the institutional distance (Cezar et al. 2015).

As explained, much of the recent literature on international trade has focused on the role of productivity in explaining the behaviour of firms in international markets (Melitz 2003, Grazzi et al. 2016, Atkin et al. 2017). Nevertheless, both the theoretical and the empirical research have proved that the process of internationalization of firms is not only correlated to productivity, but also to firm size (Davies et al. 2015, Fariñas et al. 2007) and innovation intensity (Guarascio et al. 2016, Ito and Tanaka 2016). Further, empirical research has also discovered a close link between productivity and firm size

(Bernard and Jensen 1995, for U.S firms, Huerta and Salas 2012, for Spanish firms) and between productivity and innovation (OECD, 2014). In fact, productivity, innovation, size and internationalization could all relate to a larger factor at the core of the firm: the management quality (which of course would be increased by feed-backs from all of them).

In recent years, more and more economists have started to take up the issue of management quality in their studies. The recent literature in the field of business management has revealed that certain aspects of management practice, such as the attributes of top managers and organizational structure, determine the firm's behaviour (Bloom and Van Reenen, 2007). More precisely, these studies have found the existence of considerable heterogeneity in terms of management practices across countries, and also across firms within countries, which could be one of the causes of the divergence in performance between firms. The heterogeneity of management quality across countries is primarily due to market competition and the pattern of ownership of the firm (Bloom and Van Reenen, 2010a). Regarding market competition, in countries with less labour regulation and less trade barriers, poorly managed or unproductive firms will exit the market and, in this sense, efficiency improvements will have a larger impact on shifting market shares in these countries (OECD, 2014). Regarding the ownership of the firm, a strong relationship exists between the number of family firms (and also the number of public firms or firms in which the founder is the CEO) and the size of the tail of badly managed firms (Bloom and Van Reenen, 2010a).

The heterogeneity of management quality across firms within countries could be at the root of the heterogeneity observed in terms of productivity. The relationship between management quality and productivity has been the subject of an extensive body of literature. For example, literature places multinationals at the top of the productivity hierarchy (Helpman et al. 2004). However, according to Bloom et al. (2009), this is because multinationals are generally well managed in every country. In fact, decentralization of power within firms, a main feature of multinational companies, allows cooperation between the parent firm and affiliates. This, in turn, enables more efficient affiliates to grow in scale, ultimately improving aggregate productivity. In addition, some learning effects from cumulative entry experience exist, which allow multinational firms to reduce the expansion constraint (Gao et al. 2010), or to modify

the format of the replication of the value chain (sales and marketing) in other countries (Jonsson et al. 2011).

In general, management quality fosters productivity through two channels: human capital and innovation. Regarding the link between management practices and innovation, management quality allows the creation and diffusion of technological innovation, which "enhances the ability of firms to undertake the internal reallocations required to implement new technologies and to sustain the innovation process" (OECD, 2014). Such is the importance of management quality in the development of firm innovation that it has been compared to a kind of technology (Bloom et al. 2013). So far as human capital goes, firms with better human resource management (incentive pay, rational process of hiring and firing, works organization, team autonomy) have higher average worker skills, pay higher wages to employees (Bender et al., 2016) and are more productive (Bloom and Van Reenen, 2010). In summary, the empirical literature focused on researching the role of management quality in the behaviour of firms has concluded that better managed firms are more productive, more innovative, more profitable, have a greater survival rate and grow faster (Bloom et al. 2013).

In addition to this, literature on international business topics has also established a close connection between management capacities and the internationalization process of the firm. First of all, there exists a tight relationship between leadership abilities or the idiosyncratic attributes of the owner-manager and the different ways in which internationalization activities are orchestrated (Lamb et al. 2011, Ellis 2011). Ganotakis et al. (2012) found that the commercial and managerial experience of the founding team helped firms become exporters but it was education that had a substantially positive effect on export success. Managerial networking and social capital are also correlated to the involvement of firms in exporting and the growth of firms in international markets (Laursen et al., 2012), because "knowledge acquisition and learning provide managers with a more diverse set of tools with which to exercise their strategic choices" (Danis et al., 2010). The type of organization chosen by the manager (Malhotra et al., 2010) or the degree of product diversification and organizational capabilities (Nocke and Yeaple, 2014) are also related to the involvement of firms in foreign markets.

Public promotion policies have also underlined the role of managers' capabilities in the international involvement of firms. Shamsuddoha et al. (2009) suggest that managers who perceive the international context more positively bring more value to the company because they are more likely to become involved in international activities. Hence, government programs aiming to explore the potential of foreign markets have a greater impact on the export performance of firms than programs trying to directly affect their export behaviour, to the extent that they manage to change managers' perceptions of the international context and their commitment to international activity. Moreover, companies involved in international marketing generate greater profits and obtain better results from their international activities. Other studies have focused on the relationship between the way in which firms deal with suppliers, customers or competitors and the internationalization process. Market orientation capabilities, such as information about customers, competitors and the external environment; together with the export channel selection (hierarchical or hybrid channel structures) play an important role in firm export performance (He et al., 2010). Moreover, firms that employ cooperative strategies through alliances, partnerships or joint ventures with other firms, and which look for complementary skills or assets to enrich their knowledge base, can improve their access to new export markets (Haahti et al., 2005).

Furthermore, the "fourth industrial revolution" resulting from increased digitization, offers many possibilities to those managers who are able to take advantage of the spread of new information and communication technology (Ontiveros, 2016). Firms using information technology resources, like electronic integration or output monitoring, are able to work effectively with their key international customers (Jean et al., 2010). In addition, technologies like computer-assisted design for managers or computer assisted manufacturing for production workers bring more autonomy and a wider span of control within the organization of the firm (Bloom, Garicano et al., 2010). Also, recent literature on international business has paid attention to the relationship between innovation, management practices and internationalization. Cassiman and Golovko (2011) analysed the role of earlier innovation decisions on the current export status and Golovko and Valentini (2011) studied the impact of innovation on the firm's growth. Moreover, the relationship between headquarter knowledge and headquarter involvement in innovation processes also has an impact on the internationalization decision of the firm (Ciabuschi et al., 2011).

Until now, international business studies have analysed the relationship between the behaviour of firms in international markets and some independent aspects of management practice (the leadership of managers; collaboration of the firm with suppliers and dealers; digitization of the firm's production process and organization; innovation strategies). However, these studies, which analyse isolated aspects of management, give an incomplete vision of the role of management practices in the firm's involvement in export and FDI. Our contribution to the literature is, thus, the elaboration of a comprehensive and unique index of management quality, grouping together all the relevant aspects of firm management. For the first time, the management practices of firms will be identified and represented by one index in order to study the relationship between management quality as a whole and firm internationalization.

We must emphasise the fact that we are not the first to elaborate an index of management practices. Bloom and Van Reenen (2007) created an index of management practices when conducting a survey of 732 medium size US and European manufacturing firms. Managers were asked about 18 questions grouped under the following three headings: monitoring (tracking and reviewing worker performance), targets (type, realism and transparency of targets) and incentives (promotion criteria, pay, bonuses). Following this work, the authors created the World Management Survey Project and, thanks to the collaboration of many researchers and interviewers, they have managed to measure business practices in over 15.000 firms in 35 countries.

The aim of this chapter is, thus, to reconcile the two theories presented above: the theory of international trade, focusing on the role of firm heterogeneity in international markets, and the theory of management quality and its importance in explaining the behaviour of firms. Until now, literature has shown that the process of internationalization of the firm is closely related to productivity, firm size and innovation intensity. On the other hand, research on management quality has highlighted the fact that the business management of the firm is tightly bound to productivity, firm size and innovation. Consequently, in this chapter, we will focus on the relationship between the process of internationalization of the firm and management quality.

2.3. Data and methodology

2.3.1. Data

The data source used in this research is the Survey of Firms' Strategies (EESE) drawn up by the Spanish Ministry of Industry and the *Fundación Empresa Pública.* This data set is an annual survey, which refers to a representative sample of Spanish manufacturing firms, according to industry and size. The survey applies random sampling for firms with 10 to 200 workers and exhaustive sampling for firms with 200 or more workers. The period analysed in this research is 2009-2013 (5 years). Some firms answer every year while others do not, which makes the dataset an unbalanced panel. For our purposes, the sample used is composed of three kinds of firm: i) those that neither export nor carry out FDI in any period in which they answer the survey (*Domestic*), ii) those that export in every period but are not involved in FDI activities in any period in which they answer the survey (*Exporter*), and iii) those that export and are involved in FDI activities in every period in which they answer the survey (*Multinational*).

Table 2.1- Sample description

Observations: 7.263		
	Firms	%
Total	2.075	100
Domestic	698	34
Exporter	1.129	54
Multinational	248	12

Table 2.1 presents a summary of the sample. We have controlled by firm industry, size, human capital and foreign ownership. The activity of firms is classified into 20 different industries, according to the three-digit aggregation CNAE-09 of manufacturing industries. We have classified firm size into three categories: small (50 or less employees), medium (between 51 and 200 employees) and large (201 or more employees). The majority of firms in the sample are small (51%), followed by medium (28%) and large (21%). Human capital is measured as the percentage of workers with tertiary education. Foreign ownership is measured as the percentage of foreign capital in the social capital of the firm. Table 2.2 shows the correlation coefficients and statistics relating to the variables used in the analysis (industry variables are excluded from this table). The complete list of variables used in the model is presented in Table 2.3.

Table 2.2- Descriptive Statistics and Correlations of the Variables

Descriptive Statistics				
	Mean	Standard Deviation	Minimum	Maximum
MQI	11	7.74	0	39
Productivity	50.9	58.1	0	2665
Domestic	0.32	0.46	0	1
Exporter	0.55	0.50	0	1
Multinational	0.13	0.34	0	1
Small*	21	12	1	50
Medium*	111	44	51	200
Large*	737	1370	201	12 943
Human Capital	6.33	8.13	0	100
Foreign Ownership	0.14	0.35	0	1

Correlations										
	1	2	3	4	5	6	7	8	9	10
1- MQI	1.000									
2- Productivity	0.224	1.000								
3- Domestic	-0.468	-0.193	1.000							
4- Exporter	0.170	0.116	-0.757	1.000						
5- Multinational	0.395	0.095	-0.264	-0.431	1.000					
6- Small	-0.525	-0.221	0.486	-0.210	-0.360	1.000				
7- Medium	0.122	0.063	-0.264	0.193	0.078	-0.632	1.000			
8- Large	0.507	0.201	-0.305	0.045	0.354	-0.531	-0.322	1.000		
9- Human Capital	0.345	0.277	-0.260	0.118	0.185	-0.187	0.040	0.185	1.000	
10- Foreign Ownership	0.270	0.204	-0.265	0.137	0.163	-0.356	0.065	0.363	0.188	1.000

*number of employees

Table 2.3- Variables description

Variable	Definition
MQI	Value of the Management Quality Index
Leadership	Value of the *Leadership* indicator
Innovation	Value of the *Innovation* indicator
Collaboration	Value of the *Collaboration* indicator
Employees	Value of the *Employees* indicator
Digitization	Value of the *Digitization* indicator
Results	Value of the *Results* indicator
Productivity	Labour Productivity. Measured as the ratio of the Total Value Added, in thousands euros, to the average total number of employees
Domestic	1- if firm *i* neither exports nor carries out Foreign Direct Investment in any year 0- otherwise
Exporter	1- if firm *i* exports in every year but is not involved in Foreign Direct Investment in any year 0- otherwise
Multinational	1- if firm *i* exports and is involved in Foreign Direct Investment in every year 0- otherwise
Export	1- if firm *i* exports in year *t* 0- otherwise
FDI	1- if firm *i* invests abroad in year *t* 0- otherwise
Small	1- if firm *i* in year *t* has less than 50 employees 0- otherwise
Medium	1- if firm *i* in year *t* has between 51 and 200 employees 0- otherwise
Large	1- if firm *i* in year *t* has more than 201 employees 0- otherwise
Industry (20 industries)	1- if firm *i* belongs to industry X 0- otherwise
Foreign Ownership	1- if the foreign capital represents more than 50% of the social capital 0- otherwise
Human Capital	Percentage of workers with tertiary education, in logs

2.3.2 Management Quality Index (MQI)

The Management Quality Index (MQI) has been elaborated following Campo Martínez, S., and Yagüe Guillén, M. J. "El Capital Directivo" in MYRO, R. (dir.): *Una nueva política industrial para España.* Consejo Económico y Social, cap. 7[1]. Using this same dataset, the Survey on Firms´ Strategies (EESE), they construct the IBPD (Good Management Practices Index), selecting 46 indicators in the survey (the complete list of indicators is presented in Table 2.4), dividing them into 6 categories:

- *Leadership* (7 indicators): related to leadership and management abilities.
- *Innovation* (14 indicators): related to management operation of products, processes, or services.
- *Collaboration* (6 indicators): related to the management of partnerships and resources.
- *Employees* (7 indicators): related to the management of staff.
- *Digitization* (7 indicators): related to the digital and technological strategy.
- *Results* (5 indicators): related to the measurement of the results.

All the indicators are binaries, in other words, when asked about the use of these indicators, the firm's only possible answers are yes or no. All the indicators are constructed as follows:

$$X_{it} = \begin{cases} 1, \text{ if firm } i \text{ in year } t \text{ performs the indicator X (it has answered "yes")} \\ 0, \text{ if firm } i \text{ in year } t \text{ do not perform the indicator X (it has answered "no")} \end{cases}$$

where X is the value of the indicator, *i* is the firm and *t* is the year.

To construct each category, we enter the value of each indicator in each category, and then, to build up the Management Quality Index (MQI), we add the values of each category. The MQI thus reflects the number of good management practices the firm is performing. In other words, the higher the value of the MQI, the better the firm's management practices. Table 2.5 presents a summary of the descriptive statistics and correlations of the MQI and its components. Figures 2.2 and 2.3 present the distribution and the level of the MQI across firms, respectively. We consider a firm to have a low MQI level if it performs less than one third of all possible management practices, a

[1] We would like to thank María Jesús Yagüe Guillén for providing the management index used in this research.

medium MQI level if it performs between one and two thirds of all possible management practices, and a high MQI level if it performs more than two thirds of all possible management practices.

Table 2.4- Variables included in the ESEE and used in the creation of the MQI

Variables linked to leadership and management abilities (7 indicators)	Technological guidance or committee
	Innovation activity plan
	Use of consultants for technology information
	Owners and family support in leadership and management
	Expenditure on environmental protection
	Investment on environmental protection
	Degree of diversification
Variables linked to the operations management (processes, products and services) (14 indicators)	Product standardization
	Normalization and quality control
	Scientific and technique information systems
	Total innovations
	Product innovations
	Process innovations
	Product and process innovations
	Equipment goods acquisition for product improvement
	Organizational methods innovations
	Innovations in the external relations management
	Merchandising innovations
	Process innovations of new equipment
	Process innovations of software
	Process innovations of new techniques
Variables linked to the management of partnerships and resources (6 indicators)	Technological cooperation agreements
	Technological collaboration with customers
	Technological collaboration with competitors
	Technological collaboration with suppliers
	Collaboration with universities or technological centres
	European Union research programme
Variables linked to the management of the staff (7 indicators)	External expenditure on language training
	External expenditure on engineering and technical training
	External expenditure on sales and marketing training
	External expenditure on computer and technologies training
	External formation on training in other themes
	Hiring employees with experience in the R&D public system
	Hiring employees with experience in R&D
Variables linked to the digital and technological policy and strategy (7 indicators)	Own internet domain
	Web page on the firm server
	Online purchases from suppliers
	Online sales to final customers
	Online sales to firms
	Evaluation of alternative technologies
	Evaluation of technological change prospects
Variables linked to the measurement of results (5 indicators)	Market surveys
	Innovation performance indicators
	Online sales impact indicator
	Identification of the competitive position in the main market
	Positive evolution of the market share

Compared to the World Management Survey (WMS) elaborated by Bloom and Van Reenen (2007), our MQI covers more aspects of Management Quality; six categories (*leadership, innovation, collaboration, employees, digitization and results*) compared to their three aspects of firm management (*monitoring, targets, and incentives*). Moreover, our survey asks firms a larger number of questions (46 compared to their 18). However, our index is elaborated from self-reported questions, which may contain a degree of error due to questions not being completely understood. Nevertheless, questions in the Survey on Firms' Strategies (EESE) drawn up by the Spanish Ministry of Industry are clear enough in our opinion for a satisfactory understanding and, in this sense, we will consider the measurement error due to this factor as minimal. Another aspect in which our index presents some limitations compared to the World Management Survey (WMS) is that we employ closed questions. The use of closed questions, in which the only possible answers are yes or no, may provoke the loss of some nuances and details in managers' answers that could be useful in determining the firm's management quality (Bloom and Van Reenen, 2010b). However, we find that the closed questions bring enough information for our purposes to the extent that we are investigating the number of good management practices firms perform.

Table 2.5- Descriptive Statistics and Correlations of the MQI and its components

Number of practices performed / Total practices

	MQI	Leadership	Innovation	Collaboration	Employees	Digitization	Results
Mean	11/46	2/7	3/14	1/6	2/7	2/7	1/5
Max.	39/46	7/7	14/14	7/7	7/7	7/7	5/5
Min.	0/46	0/7	0/14	0/7	0/7	0/7	0/5
Std. Dev.	7.742	1.630	3.175	1.114	1.659	1.593	0.989

Practices performed in %

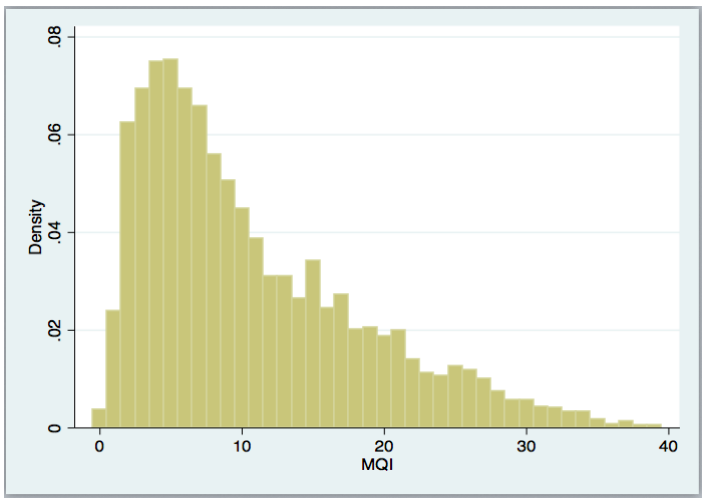
	MQI	Leadership	Innovation	Collaboration	Employees	Digitization	Results
Mean	23	32	22	11	18	31	25
Max.	85	100	100	100	100	100	100
Min.	0	0	0	0	0	0	0
Std. Dev.	16.8	23.3	22.7	19.1	23.7	22.8	19.8

Correlations

	Leadership	Innovation	Collaboration	Employees	Digitization	Results
Leadership	1.000					
Innovation	0.574	1.000				
Collaboration	0.647	0.531	1.000			
Employees	0.531	0.482	0.526	1.000		
Digitization	0.522	0.466	0.455	0.404	1.000	
Results	0.358	0.359	0.310	0.289	0.375	1.000

In general, the level of good management practice of Spanish manufacturing firms is notably low, as firms perform, on average, only 23% (11/46) of total possible management practices. More precisely, 76% of firms perform less than one third (15/46) of all possible management practices, and only 2% of firms perform more than two thirds (30/46). The MQI takes the value 0 in 28 observations, which represents 0.38% of the observations[2]. Regarding the components of the MQI, the *leadership* indicator shows the best results: on average, firms perform 32% of all possible *leadership* practices. The worst scores appear in the *collaboration* indicator, in which firms only implement 11% of all possible *collaboration* practices. Notably, the maximum number of management practices performed by one firm in one year is 39, which means that none of the 2.075 firms performed all possible management practices (46) in any one of the 5 years analysed. Furthermore, regarding the standard deviation of the indicators, we find that the highest deviation corresponds to the *employees* indicator (23.7) and the lowest to the *collaboration* indicator (19.1), which means that firms differ most in terms of staff management and are most similar in terms of collaboration with partners. Finally, correlation coefficients show that "*leadership*" strongly correlates with the majority of indicators, especially with *collaboration* (0.647), *innovation* (0.574) and *employees* (0.531), which means that strategic decisions at the core of the firm depend on the leadership level of managers. A comprehensive analysis of the MQI according to firm size and internationalization status can be found in Appendix.

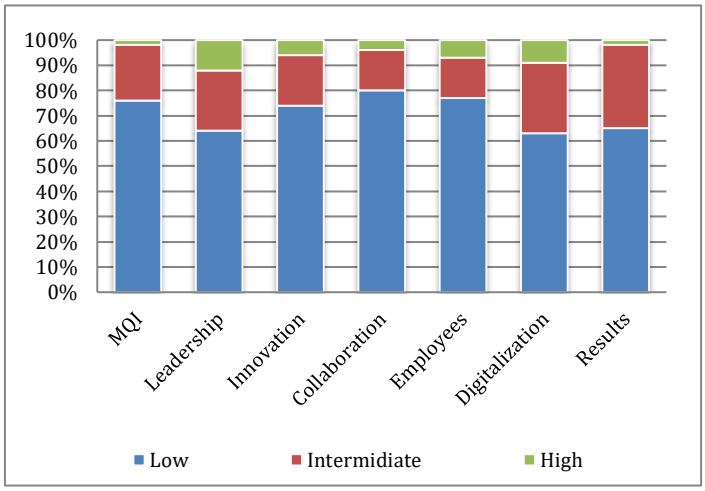
Figure 2.2- Distribution of the MQI across firms



Source: Own elaboration from the ESEE.

[2]When we use the logarithm of the MQI, these 28 observations are coded as 0.

Figure 2.3- Level of the MQI and its components across firms



Source: Own elaboration from the ESEE.

2.3.3 Methodology

For our purposes, we will proceed in two stages. Firstly, we will focus on the management quality levels across different types of firms. We will estimate the average difference, in terms of MQI, between *domestic*, *exporter* and *multinational* firms. Using a GLS Random Effects regression, we will estimate the following equations:

$$\ln(MQI_{it}) = c + \beta_1 Exporter_{it} + \beta_2 Multinational_{it} + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Others\ Controls_{it} + \varepsilon_{it} \quad (1)$$

$$\ln(Productivity_{it}) = c + \beta_1 Exporter_{it} + \beta_2 Multinational_{it} + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Others\ Controls_{it} + \varepsilon_{it} \quad (2)$$

We will compare the management quality bonuses (1) to the productivity bonus on exporters, already presented in literature (2). In addition, we will decompose the MQI into the six indicators in order to see which of the components of the MQI most determines the firm's behaviour in international markets:

$$\ln(Indicators_{it}) = c + \beta_1 Exporter_{it} + \beta_2 Multinational_{it} + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l\ Others\ Controls_{it} + \varepsilon_{it} \quad (3\text{-}4\text{-}5\text{-}6\text{-}7\text{-}8)$$

Secondly, we will focus on the firm's export and investment decision by means of a Logit model estimation in order to study which variable is more crucial to the firm's internationalization decision:

$$Export_{it} = c + \beta_1 \ln(MQI_{it}) + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Others\ Controls_{it} + \varepsilon_{it} \quad (9)$$

$$Export_{it} = c + \beta_1 \ln(Productivity_{it}) + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Others\ Controls_{it} + \varepsilon_{it} \quad (10)$$

$$Export_{it} = c + \beta_1 \ln(Indicators_{it}) + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Others\ Controls_{it} + \varepsilon_{it} \quad (11)$$

$$FDI_{it} = c + \beta_1 \ln(MQI_{it}) + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Others\ Controls_{it} + \varepsilon_{it} \quad (12)$$

$$FDI_{it} = c + \beta_1 \ln(Productivity_{it})_t + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Other\ Controls_{it} + \varepsilon_{it} \quad (13)$$

$$FDI_{it} = c + \beta_1 \ln(Indicators_{it}) + \beta_j Size\ Dummies_{it} + \beta_k Industry\ Dummies_{it} + \beta_l Other\ Controls_{it} + \varepsilon_{it} \quad (14)$$

2.4 Results

2.4.1 Management quality and productivity bonuses

Table 2.6 presents the main results of the regressions performed to estimate the management quality and productivity bonuses. The results of regression (1) prove the existence of a management quality bonus on *exporter* firms. Controlling for size and industry differences, *exporter* firms have, on average, 79% more management quality (0.582 MQI points measured in logs) than *domestic* firms. Moreover, regression (1) also indicates the existence of a management quality bonus for firms involved in foreign direct investment. *Multinational* firms have, on average, 144% (0.880 MQI points measured in logs) and 35% (0.298 MQI points measured in logs) more management

quality than *domestic* and *exporter* firms, respectively. This result is consistent with Bloom et al. (2009) who found that multinationals were generally well managed in all countries. Therefore, these results confirm the existence of a hierarchy of firms in terms of management quality.

Regression (2) exhibits a well known stylized fact (Melitz, 2003): the existence of a productivity bonus in the case of *exporter* firms. However, the size of this bonus is significantly small compared to the management quality bonus. Controlling for size and industry differences, *exporter* firms are, on average, 29% more productive (0.255 productivity points measured in logs) than *domestic* firms. The size of this bonus (0.255) coincides with the results of Mainer (2014), who found a similar productivity bonus for Spanish exporters. Similarly, regression (2) highlights the existence of a productivity bonus for multinationals located in Spain, which fits with the results obtained by Helpman et al. (2004) for U.S. multinationals. Again, the size of the productivity bonus for multinationals is notably small compared to the MQI bonus. *Multinational* firms are 36% more productive (0.311 productivity points measured in logs) than *domestic* firms but only 6% (0.056 productivity points measured in logs) more productive than *exporter* firms. However, as indicated by the F Test, we cannot ignore the fact that the productivity, at a 1% level, is the same for *exporter* and *multinational* firms. In other words, even though productivity differences exist between firms serving only domestic markets and those that also serve foreign markets, we cannot say that productivity differences exist between firms that follow different patterns of internationalization.

To sum up, *exporter* firms perform 79% more good management practices than *domestic* firms, even though they only have 29% more productivity. Moreover, this occurs again when we focus on foreign direct investment: *multinational* firms perform 35% more good management practices than *exporter* firms, while they show only 6% more productivity (a difference that is not statistically significant). Even though these two variables are not directly comparable, we have demonstrated that differences between *exporter, domestic* and *multinational* firms are greater in terms of management quality than in terms of productivity. In this sense, the hierarchy of firms is stronger in terms of management quality than in terms of productivity.

Table 2.6- GLS Estimation Results

GLS Regressions. Random Effects

Independent Variables	Dependent Variable							
	MQI (1)	Productivity (2)	Leadership (3)	Innovation (4)	Collaboration (5)	Employees (6)	Digitization (7)	Results (8)
Exporter	0.582***	0.255***	0.379***	0.279***	0.064***	0.130***	0.259***	0.158***
	(0.033)	(0.032)	(0.024)	(0.033)	(0.012)	(0.016)	(0.025)	(0.017)
Multinational	0.880***	0.311***	0.640***	0.540***	0.318***	0.318***	0.435***	0.298***
	(0.047)	(0.047)	(0.040)	(0.059)	(0.034)	(0.041)	(0.043)	(0.033)
Medium	0.256***	0.194***	0.149***	0.216***	0.088***	0.228***	0.103***	0.047***
	(0.029)	(0.035)	(0.025)	(0.035)	(0.015)	(0.022)	(0.023)	(0.018)
Large	0.469***	0.336***	0.319***	0.482***	0.212***	0.487***	0.250***	0.082***
	(0.035)	(0.041)	(0.033)	(0.047)	(0.026)	(0.033)	(0.030)	(0.024)
Human Capital	0.060***	0.053***	0.043***	0.049***	0.028***	0.051***	0.034***	0.038***
	(0.010)	(0.008)	(0.008)	(0.012)	(0.005)	(0.007)	(0.009)	(0.007)
Foreign Ownership	0.029	0.056*	-0.041	0.026	-0.028	0.141***	0.019	-0.075***
	(0.030)	(0.032)	(0.029)	(0.044)	(0.025)	(0.035)	(0.029)	(0.023)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Between R^2	0.483	0.314	0.411	0.287	0.328	0.467	0.247	0.162
F Test Exporter = Multinational	0.000	0.117	0.000	0.000	0.000	0.000	0.000	0.000

Note: In all the regressions the dependent variable is in logarithms. In all the regressions we have controlled manufacturing industry to three digits. Robust standard errors (clustered by firm) are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively. In the last row, we include the p-value obtained from the F equality Test. The Breusch-Pagan Lagrange Multiplier Test recommended the use of a Random Effects Regression against the use of a Pool OLS Estimation.

Both regressions show the importance of firm size in explaining management quality and productivity at firm level. Larger firms are more productive and better managed than relatively smaller ones. This result agrees with the literature that examines the impact of firm size on firm economic performance (Bernard et al., 2003, for U.S firms; Fariñas et al., 2007, for Spanish firms). Due to the close association between the multinational condition of the firm and the MQI, we have also tested the role of foreign ownership of the firm. For this purpose we define a firm as being foreign owned when the foreign capital exceeds 50% of the social capital. Regression (1) shows that, although foreign owned firms are better managed than national firms, this difference is not statistically significant. However, Regression (2) shows that foreign owned firms are more productive than national firms at a 10% significance level. Finally, we focus on the heterogeneity in terms of human capital and its correlation with the firm's management quality and its productivity. Regressions (1) and (2) show that human capital, measured as the percentage of workers with tertiary education, has a positive impact both on management quality and productivity.

Once we have shown that multinational and exporter firms perform more management practices than domestic firms, we will focus on the components of the MQI in order to clarify where exactly the management heterogeneity between firms comes from. Regressions (3) to (8) confirm that behind the hierarchy of firms in terms of management quality there exists a hierarchy of firms in each of the six indicators that contribute to the MQI. In other words, *exporter* firms possess more leadership and more management abilities, perform more innovation activities, collaborate more with partners and distributors, invest more in the management of their employees, have a more accurate digitization strategy and have better results measurement than *domestic* firms. This situation is reproduced when we check the differences between *multinational* and *exporter* firms.

More precisely, *exporter* firms perform 46% more practices related to *leadership* than *domestic* firms and *multinational* firms perform 30% more practices related to *leadership* than *exporter* firms. This means that having an external technology consultancy, an innovation plan, a diversified product supply or expenditures on environmental protection, captures the firm's global vision and its consciousness about its worldwide position, which clearly influences its export or foreign direct investment

activity. In addition, *exporter* firms perform 32% more practices related to *innovation* than *domestic* firms and *multinational* firms perform 30% more practices related to *innovation* than *exporter* firms. In other words, in an increasingly competitive world, a suitable innovation strategy at the core of the firm is essential for being in the technological vanguard, which, in the end, strongly correlates to the firm's capacity to export and to invest abroad.

Exporter firms perform 7% more practices related to *collaboration* than *domestic* firms and *multinational* firms perform 29% more practices related to *collaboration* than *exporter* firms. Obviously, an effective collaboration with suppliers and dealers is more crucial for *multinationals* than for *exporters*. When the processes of design, production or assembly are geographically separated, collaboration agreements with customers, competitors, suppliers or universities will undeniably improve the firm's efficiency and hence its performance in international markets. Moreover, *exporter* firms perform 14% more practices related to *employees* than *domestic* firms and *multinational* firms perform 30% more practices related to *employees* than *exporter* firms. Nowadays, human capital is at the heart of the generation of added value, with countries characterised by high levels of education and firms employing highly educated staff driving change in the context of the global economy. Hence, firms that invest in their employees (languages, engineering, sales, marketing, computing and other technologies) or hire employees with experience in strategic fields will have an advantage in terms of their competitive position at a global level. If their workers have studied abroad, speak several languages or have international experience, this will undoubtedly have an effect on the likelihood of exporting and investing abroad.

Exporter firms also perform 30% more practices related to *digitization* than *domestic* firms and *multinational* firms perform 19% more practices related to *digitization* than *exporter* firms. The possibilities offered to firms by the "Fourth Industrial Revolution" in information technologies and communication, as well as robotics and Big Data, are as yet unknown. Nevertheless, it seems clear that firms having an Internet domain will be able to easily inform foreign buyers about their products. In addition, it is less costly for firms to interact with international suppliers online than do so physically and this, in the end, will allow firms to export or invest abroad at lower cost. Finally, *exporter* firms perform 17% more practices related to

results than *domestic* firms and *multinational* firms perform 15% more practices related to *results* than *exporter* firms. Firms monitoring their performance and controlling their results will have a better perspective of the performance and potential of their company, both in the national market and abroad, which may help them to take the correct decision in terms of exporting or investing abroad.

Thus, the biggest difference between *exporter* and *domestic* firms is in terms of *leadership*, and the most significant differences between *exporter* and *multinational* firms appear not only in *leadership*, but also in *innovation* and *collaboration*. In other words, according to these results, the key element to begin exporting is improvement in terms of leadership and management capabilities. However, to begin investing abroad, this is not enough and firms need to improve, in addition, in terms of innovation of products, processes, and services and in terms of collaboration with partners and suppliers.

Moreover, the performance in each of the six indicators of the MQI also depends on the firm size. As in the case of the overall MQI, larger firms perform more management practices than smaller ones in each of the individual indicators. As the company grows in terms of number of employees, an improvement in terms of management quality is produced. Human capital is also an important factor in determining the firm's management level. Firms with relatively high numbers of educated workers perform more management practices in every one of the six MQI indicators. Surprisingly, the foreign ownership of the firm was not statistically significant in explaining the MQI as a whole. However, it is significant in explaining two indicators: *employees* and *results*. Foreign owned firms invest more in their employees and manage their staff better than nationally owned firms, regardless of the size, the industry, or the exporter condition of the firm. Nevertheless, foreign owned firms show worse result measurement than national firms.

Several robustness tests have been carried out in order to check the validity of the results. Regarding the composition of the sample, the results do not change if we restrict the sample to those firms which complete the survey in each one of the 5 years, excluding those which enter or leave during the 2009-2013 period (Table 2.7). On the other hand, if we include in the sample not only regular exporters, but occasional

exporters as well, we find a new hierarchy of firms. Regular exporters are the most productive and best-managed firms; occasional exporters have intermediate levels of management and productivity and domestic firms present the lowest levels of management and productivity. Nevertheless, we cannot ignore the fact that, at a 1% level, occasional exporters and domestic firms have the same productivity level. Focusing on foreign direct investment, results change if we analyse firms that occasionally invest abroad. Even though both occasional and regular multinational firms are more productive and better managed than any exporter firm, there is no statistical difference between occasional and regular multinational firms in terms of management or productivity (Table 2.8).

Table 2.7- Robustness check: Sample of firms that answer the survey during 5 years

GLS Regressions. Random Effects

Independent Variables	Dependent Variable	
	MQI	Productivity
	(1)	(2)
Exporter	0.571***	0.260***
	(0.047)	(0.042)
Multinational	0.853***	0.301***
	(0.061)	(0.060)
Medium	0.219***	0.158***
	(0.040)	(0.051)
Large	0.453***	0.294***
	(0.047)	(0.052)
Human Capital	0.065***	0.057***
	(0.013)	(0.010)
Foreign Ownership	0.047	0.111***
	(0.037)	(0.041)
Industry Dummies	Yes	Yes
Number of firms	936	936
Number of observations	4.680	4.680
Between R^2	0.543	0.442
F Test Exporter = Multinational	0.000	0.344

Note: In all the regressions the dependent variable is in logarithms and we have controlled manufacturing industry to 3 digits. Robust standard errors (clustered by firm) are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively. In the last row, we include the p-value obtained from the F equality Test. The Breusch-Pagan Lagrange Multiplier Test recommended the use of a Random Effects Regression against the use of a Pool OLS Estimation.

Table 2.8- Robustness check: Sample of firms including occasional exporters and occasional investors abroad

GLS Regressions. Random Effects

Independent Variables	Dependent Variable	
	MQI (1)	Productivity (2)
Occasional Exporter	0.338***	0.092**
	(0.046)	(0.045)
Regular Exporter	0.586***	0.257***
	(0.032)	(0.031)
Occasional Multinational	0.839***	0.391***
	(0.059)	(0.058)
Regular Multinational	0.885***	0.320***
	(0.045)	(0.046)
Medium	0.256***	0.197***
	(0.027)	(0.032)
Large	0.470***	0.330***
	(0.032)	(0.038)
Human Capital	0.057***	0.049***
	(0.009)	(0.008)
Foreign Ownership	0.004	0.054*
	(0.027)	(0.030)
Industry Dummies	Yes	Yes
Number of firms	2.365	2.365
Number of observations	48.540	48.540
Between R^2	0.478	0.314
F Test Occasional Multinational = Regular Multinational	0.420	0.192

Note: In all the regressions the dependent variable is in logarithms and we have controlled manufacturing industry to 3 digits. Robust standard errors (clustered by firm) are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively. In the last row, we include the p-value obtained from the F equality Test. The Breusch-Pagan Lagrange Multiplier Test recommended the use of a Random Effects Regression against the use of a Pool OLS Estimation.

Table 2.9- Robustness check: Distribution of firms according to FDI destinations

Nº of FDI destinations	0	1	2	3	4
Nº of observations	6316	510	228	125	84
Nº of firms	1827	141	58	31	18
% firms	88,05%	6,79%	2,79%	1,49%	0,87%
% cumulative	88,05%	11,95%			

Table 2.10- Robustness check: Results from the regression

GLS Regressions. Random Effects

Independent Variables	Dependent Variable	
	MQI	Productivity
	(1)	(2)
1_destination	0.394***	0.071*
	(0.041)	(0.041)
2_destinations	0.432***	0.149***
	(0.047)	(0.048)
3_destinations	0.423***	0.391
	(0.049)	(0.058)
4_destinations	0.480***	0.178**
	(0.047)	(0.087)
Medium	0.367***	0.257***
	(0.031)	(0.034)
Large	0.599***	0.407***
	(0.036)	(0.039)
Human Capital	0.079***	0.065***
	(0.010)	(0.009)
Foreign Ownership	0.076	0.077**
	(0.031)	(0.033)
Industry Dummies	Yes	Yes
Number of firms	2.075	2.075
Number of observations	7.263	7.263
Between R^2	0.419	0.298
F Test: 1 destination = 4 destinations	0.065	0.225

Note: In all the regressions the dependent variable is in logarithms and we have controlled manufacturing industry to 3 digits. Robust standard errors (clustered by firm) are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively. In the last row, we include the p-value obtained from the F equality Test. The Breusch-Pagan Lagrange Multiplier Test recommended the use of a Random Effects Regression against the use of a Pool OLS Estimation.

Regarding the measurement of foreign direct investment, instead of focusing exclusively on the multinational condition of the firm, that is, whether the firm invests abroad or not, we have investigated more closely the number of regions in which the firm invests and its relation with management quality and productivity. The survey separates the FDI destinations into 4 regions: the European Union, OECD countries, Latin America and the rest of the world (Table 2.9). According to Yeaple (2009), the

most productive firms invest in a larger number of foreign countries. Nevertheless, what Yeaple (2009) found for U.S. firms differs substantially from what we found for Spanish firms. We observe that productivity or management differences do not exist between firms that invest in one, two, three or four different destinations. In fact, we found that there are differences between firms that do not invest abroad and firms that do invest abroad (multinational versus non-multinational firms) but we do not find any effect on productivity or MQI associated with the increase in the number of investment destinations (Table 2.10).

2.4.2 Export and FDI decisions

To more closely examine the firm's export decision, we have carried out a Logit model, where the dependent variables are the firm's export status (whether the firm exports or not) and the firm's FDI status (whether the firm is involved in FDI or not). Table 2.11 presents the main results of the Logit estimations. Regression (9) and (10) show that, controlling for size and industry differences, both the MQI and the productivity level are correlated to the firm's probability of exporting. However, the size of the coefficients suggest that a 1% increase in the MQI is more correlated to the firm's probability of exporting than a 1% increase in the firm's productivity. Regressions (12) and (13) exhibit similar results regarding the firm's decision to become involved in foreign direct investment. Controlling for size and industry differences, both the MQI and the productivity level are correlated to the firm's probability of undertaking FDI. Again, the size of the coefficients suggest that a 1% increase in the MQI is more correlated to the firm's probability of undertaking FDI than a 1% increase in the firm's productivity.

In order to test the robustness of the estimation, we have regressed a Probit model as well. The results showed in the Probit model do not differ from the results in the Logit model, and both the Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC) recommended the use of the Logit model against the use of the Probit model. In any case, results prove that the quality of the management practices correlates more closely with the firm's internationalization decision than with the firm's productivity level. However, this fact should be interpreted within the framework of the role of management quality in the firm's performance. In this sense, the quality of

management practices not only affects the firm's productivity level, as the management literature establishes, but goes beyond, to the point of determing the firm's capacity to export and invest abroad.

In regressions (11) and (14) we have introduced the six indicators of the MQI as independent variables in order to explain the firm's export status and FDI status. Regression (11) shows that, controlling for size and industry differences, each one of the four indicators *leadership, employees, digitization and results* is correlated to the firm's probability of exporting. (The *innovation* and *collaboration* indicators are not statistically significant in explaining the firm's export status.) The sizes of the coefficients associated with the indicators *employees*, *digitization* and *results* are similar. However, the component of the MQI that matters most for exporting is the firm's *leadership*. Regarding foreign direct investment, regression (14) shows that, controlling for size and industry differences, the firm's likelihood of investing abroad is correlated to the *leadership, collaboration* and *results* indicators. *However*, the *innovation*, *employees and digitization* indicators are not statistically significant in explaining the firm's probability of investing abroad. This time, the dimension of the MQI that matters the most for investing abroad is the firm's *collaboration*.

We have therefore shown that there is a close connection between improvements in productivity and management quality and the internationalization behaviour of firms. It seems that an increase in a firm's productivity is associated with a higher likelihood of the firm exporting. In addition, an increase in the number of management practices performed by firms could allow them to better evaluate and assume the implicit risks in the internationalization process and to find the least costly and the most efficient way to do it. Hence, both productivity and management quality are instruments which could help firms in their internationalization process. Furthermore, these results suggest that the ambition, courage, and, in general, the leadership of managers is essential in order to start a successful export strategy in international markets. To sum up, these results give veracity to our initial hypothesis that a firm's management quality is a crucial element, perhaps the most important one, in determining its involvement in international markets.

Table 2.11- Logit Marginal Effects Estimation Results

Logit Regression						
Independent variable	Dependent variable					
	Export (9)	Export (10)	Export (11)	FDI (12)	FDI (13)	FDI (14)
MQI	0.220*** (0.010)			0.041*** (0.004)		
Productivity		0.129*** (0.010)			0.013*** (0.003)	
Leadership			0.005*** (0.0003)			0.0004*** (0.0001)
Innovation			0.0002 (0.0003)			-0.0001 (0.0001)
Collaboration			0.0009 (0.0006)			0.0007*** (0.0001)
Employees			0.002*** (0.0004)			0.0002 (0.0001)
Digitization			0.002*** (0.0003)			0.0001 (0.0001)
Results			0.002*** (0.0003)			0.0004*** (0.0001)
Size Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.376	0.314	0.382	0.298	0.268	0.310

Note: In all the regressions, coefficients exhibit the marginal change in the dependent variable, as a result of a 1% unit change in the independent variable. In all the regressions we have controlled for 3 digits manufacturing industry and for firm size. Robust standard errors (clustered by firm) are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively. The variables Leadership, Innovation, Collaboration, Employees, Digitization and Results are normalized between 0 and 1.

2.5- Conclusions

In recent years, literature on international trade has focused on learning more about the firm's behaviour in international markets. A number of theoretical models and empirical works have revealed the importance of factors such as productivity, firm size and innovation in explaining the firm's export decision or the firm's decision to invest abroad. However, all these variables could correspond to a deeper element at the core of the firm: the business management quality. In fact, recent empirical studies have shown the existence of a close correlation between the firm's management quality, productivity level, size and innovation intensity. This chapter demonstrates the strong association between management quality and the firm's internationalization decisions.

Hence, the contribution of this chapter is to demonstrate that the firm's managerial assets may be substitutes for the firm's productivity in its internationalization decisions. According to Melitz's model, only the most productive firms can obtain positive profits from exports in the presence of sunk costs. In other words, the only way to overcome these sunk costs is through productivity. Nevertheless, we have to assume that sunk costs are not at all well known, making exporting and foreign investment risky processes, more easily afforded by better managed firms. On the other hand, even if all firms face the same sunk costs on entering foreign markets, not all of them need the same fixed investment to overcome these costs. We therefore propose that management quality is one of the key variables determining the amount of fixed investment that a firm has to undertake.

Better-managed firms will find the most efficient and least costly way of internationalizing. Many aspects of firm management are crucial, like leadership, experience and the ambition of managers; human capital (the formation and capacities of employees); the monitoring of results and the elaboration of market surveys; effective relationships with suppliers and customers; being in the vanguard of innovation or being committed to the process of digitization. Firms who perform these management practices could absorb some of the sunk costs associated with exporting and, as a result, accomplish a successful export strategy, overcoming their limitations in terms of productivity. Badly managed firms, on the other hand, which do not perform

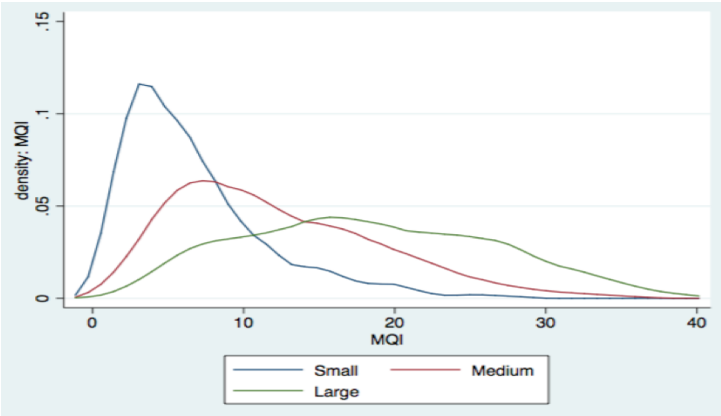
these management practices, will face a fixed investment too high to obtain positive profits from exporting and will thus exit the export market.

Using our Management Quality Index (MQI) as a proxy of the good management practices in a firm, we have demonstrated two important facts regarding the internationalization process of the firm. Firstly, a management quality bonus on exporters exists, as well as a productivity bonus, and the size of the management quality bonus is greater than the size of the productivity bonus. In other words, the difference between exporters and non-exporters is greater in terms of management quality than in terms of productivity. Secondly, we have shown that a change in a firm's management quality is more closely correlated with the export decision than a change in the firm's productivity. In addition, we have seen that all these results can be extended to explain differences between multinationals (firms involved in foreign direct investment) and non-multinationals, as well as to explain a firm's decision to invest abroad.

These results have wide implications for the design of public policy. In Spain, internal demand has been depressed since the beginning of the recession in 2008, but Spanish exports have given new life to the Spanish economy through a successful spurt in growth: in 2007 exports represented 25% of GDP whereas in 2015 they represented 33% of GDP. However, not all Spanish firms are exporting and, as shown, this is partly due to management quality. In general, small firms are those that have the lowest export propensity and also the lowest levels of management quality. A public policy oriented to provide advice on good management practices to firms could therefore increase their export propensity and thus their performance. Such a public policy would undoubtedly be less costly, more feasible and almost certainly more effective than a strategy aimed at directly affecting the productivity of firms.

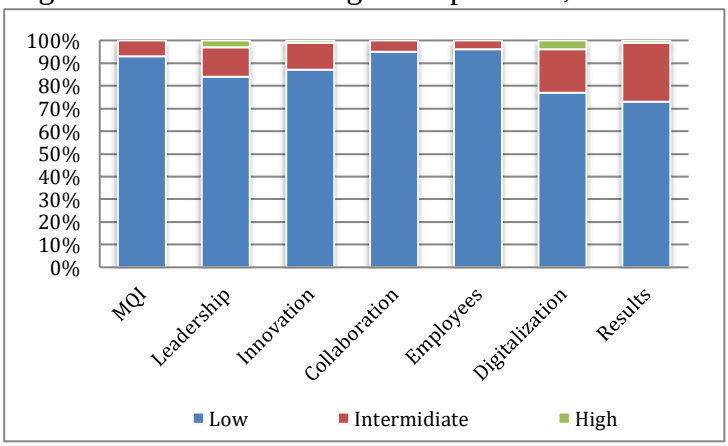
Appendix

Figure 2.4- MQI distribution according to firm size



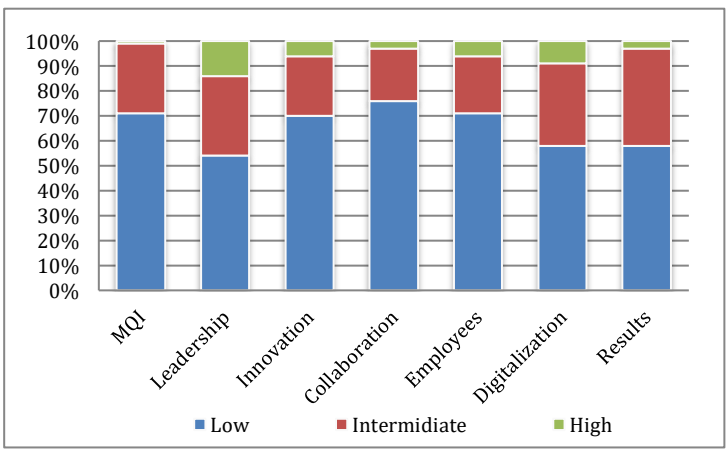
Source: Own elaboration from the ESEE.

Figure 2.5- Level of management practices, small firms



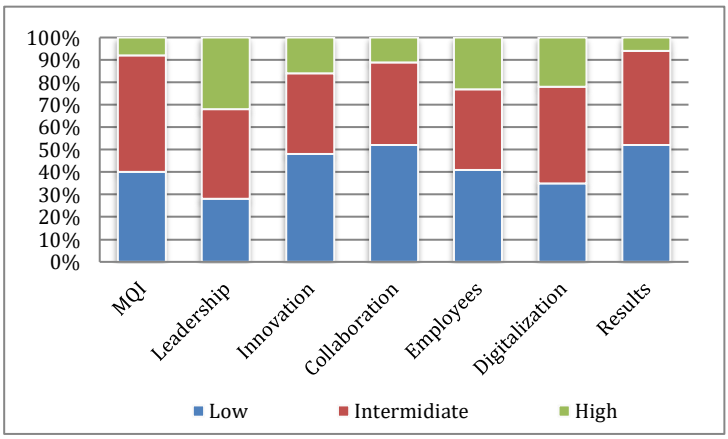
Source: Own elaboration from the ESEE.

Figure 2.6- Level of management practices, medium firms



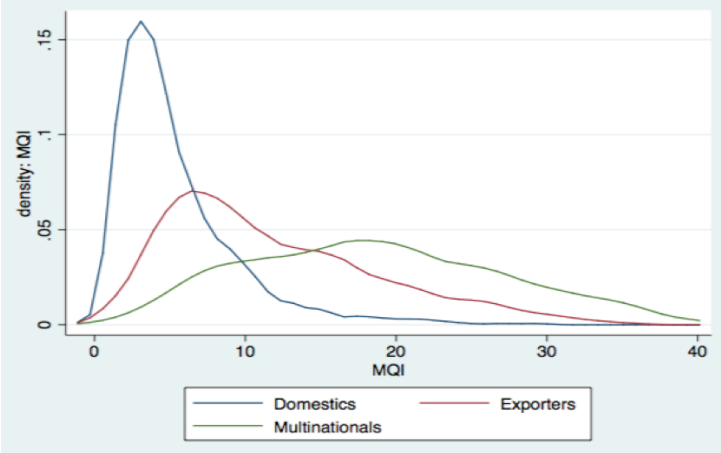
Source: Own elaboration from the ESEE.

Figure 2.7- Level of Management Practices, large firms



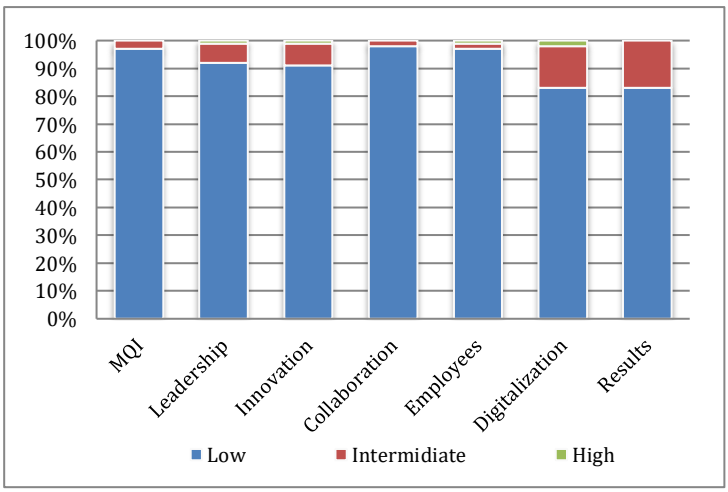
Source: Own elaboration from the ESEE.

Figure 2.8- Distribution of the MQI according to firm internationalization status



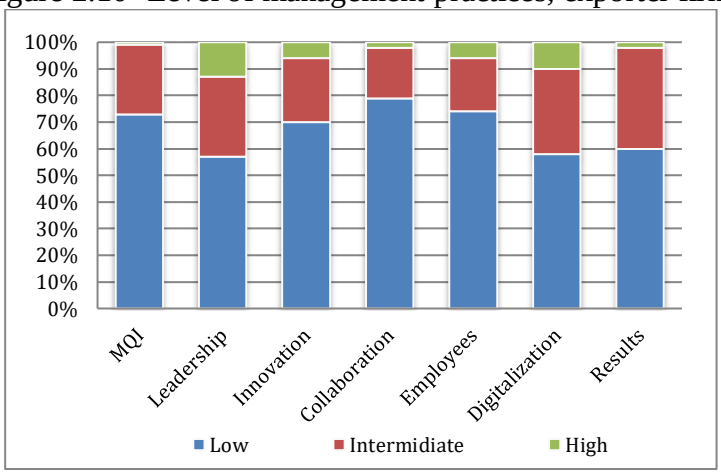
Source: Own elaboration from the ESEE.

Figure 2.9- Level of management practices, domestic firms



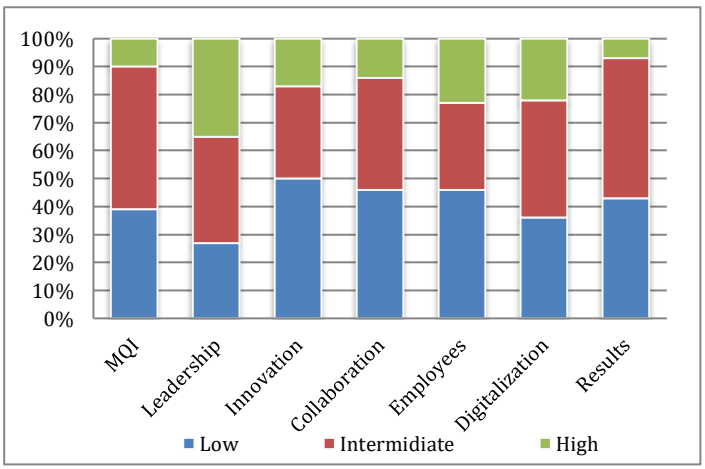
Source: Own elaboration from the ESEE.

Figure 2.10- Level of management practices, exporter firms



Source: Own elaboration from the ESEE.

Figure 2.11- Level of management practices, multinational firms



Source: Own elaboration from the ESEE.

Chapter 3

From domestic to exporter, what happens? Evidence for Spanish manufacturing firms

3.1- Introduction

Recent international trade literature has found the existence of substantial differences between exporters and non-exporters. More precisely, research has proved that exporters are bigger, more productive, more capital intensive, pay higher wages and invest more per employee compared to non-exporters. Researchers have suggested two explanations for the apparent superior performance of exporter firms. On the one hand, the self-selection hypothesis of better firms entering export markets establishes that exporters performed better compared to domestic firms even before they start to export. In fact, the existence of certain sunk costs in the entry of export markets serve as a kind of barrier that only better firms can overcome. On the other hand, the learning-by-exporting hypothesis proposes that exporters improve their performance after they start to export, because they benefit from a more competitive and dynamic export market.

The empirical literature for Spain has focused on the role of productivity in explaining the firm behaviour in international markets. Therefore, recent studies have found that Spanish exporters are more productive than Spanish non-exporters (Fariñas et al. 2007). Among the source of this superiority, the self-selection hypothesis has received more support than the learning by exporting hypothesis (Delgado et al. 2002). Nevertheless, the empirical literature for Spain has paid little attention to the evolution of other firm characteristics during the internationalization process. Hence, the main contribution of this chapter is to try to shed some light on this issue, in other words, to analyse the evolution of a set of firm's variables before and after they start to export, and how this fits with the self-selection and the learning-by-exporting hypotheses.

This analysis is particularly necessary in this period of difficulties in Spain. At the moment, the Spanish economy is immersed in a debt-relief process affecting the large majority of economic agents. On the one hand, both firms and households have reduced their investments and their acquisitions of goods and services, in order to manage the debts contracted during the boom period (1997-2007). On the other hand, the public sector is submerged in a fiscal-consolidation process imposed by the European Stability and Growth Pact, in order to reduce the huge public deficit generated during the beginning of the

recession. Only a branch of the Spanish economy has given new life to this adverse situation: the export sector. The Spanish internal demand has been depressed since the beginning of the recession in 2008, and therefore, Spanish firms must look beyond its borders in order to find more dynamic markets. So they did, and with remarkable success.

Since 2010, once the international trade collapse following the crisis outbreak was overcome, Spanish exports have grown at an annual average rate of 4.5% (Myro, 2015). Measured in volume, Spanish exports have grown 22% between 2007 and 2015. In other words, in 2007, exports represented 25% of the GDP whereas in 2015, they represented 33%. Hence, this substantial increase in exports highlights the key role that exports had and still have in the recovery of the Spanish economy. In this sense, if we are able to understand how the main firm characteristics evolve during the internationalization process, we will be able to establish an accurate policy agenda that promotes the entry of firms into the international market.

Using a survey of Spanish manufacturing firms, we analyse the six years previous to the entry into export markets and the first six years exporting of new exporter firms, and we compare their performance with that of the domestic firms. We analyse a set of 10 variables, depicting the main characteristics of the firm: total sales, number of employees, productivity, wages, unit labour costs, gross operating margin, R&D expenditure, R&D probability, permanent employment contracts and human capital. The main results show that i) the differential in terms of employees and sales between exporters and non-exporters increases after the first start to export, ii) the productivity differential experiences a U-shaped trend, decreasing before the entry to export markets and then increasing during the years exporting, iii) the average wage in the firm experiences the same U-shaped trend and unit labour costs experience an inverted U-shaped trend, iv) firms lose their advantage in terms of gross operating margin once they start exporting, v) despite the R&D expenditure increases after firms start exporting, the probability to perform R&D (in other words, the number of innovative firms) remains stable throughout the internationalization process, vi) the quality of the employment contracts, measured as the percentage of workers with a permanent contract, improves after firms enter the export market.

These findings put forward some relevant concerns regarding the design of public policy. On the one hand, from a macroeconomic point of view, the most important problem in the Spanish economy is unemployment, with an average unemployment rate of 18,6% at the end of 2016. On the other hand, from a microeconomic perspective, another relevant problem in Spain is the small size of firms. In Spain, but in many Southern European countries as well, the distribution of firms is skewed towards SMEs. In general, these firms are less competitive, less productive and less innovative than the rest of firms. Moreover, these small firms show the lower export propensity among all the firms in the country. Hence, the results of our analysis highlight that exporting may be a path for increasing the firm size, which at the end, may be correlated to a general improvement in the firm performance and competitiveness. Consequently, a public policy of export promotion among small firms, could serve to solve both macroeconomic and microeconomic problems: the creation of jobs following the internationalization process of firms could help reduce unemployment and increase firm size.

In 2012, following the recommendations of the IMF, a reform of the labour market was approved in Spain in order to improve labour flexibility and fight against unemployment. Despite the unemployment rate having decreased 8.3 percentage points in the last 4 years, another problem has arisen in the Spanish labour market: temporality. In 2016, 91% of the jobs created in Spain were temporary. Hence, we have shown that the entry into export markets is associated with an increase in the percentage of workers with a permanent employment contract. In this sense, a public policy of export promotion may improve the quality of labour conditions in Spanish manufacturing firms.

The rest of the chapter is organized as follows: Section 2 analyses the theoretical framework that supports this research, presenting the main issues of the self-selection and the learning-by-exporting hypotheses. Section 3 describes the dataset and the methodology used in this research, as well as the econometric strategy employed to demonstrate our objectives. Section 4 presents the main results obtained from the econometric analysis, with the corresponding robustness checks. Finally, Section 5 highlights the main conclusions of this research and suggests some implications for public policy.

3.2- Theoretical framework

The process of internationalisation of firms has received remarkable attention from research on international trade. During the late 1970's, Johanson and Wiedersheim-Paul (1975) and Johanson and Vahlne (1977) proposed a model that described the behaviour of multinational and exporting firms, later called the Uppsala Model. Through the study of the cases of four Swedish multinational firms, they concluded that firms experienced a process of gradual internationalization in their conquest of international markets, a process they called "The Establishment Chain". Firstly, due to the lack of knowledge about foreign countries and the propensity to avoid uncertainty, firms develop in the domestic market, selling only in the home country. Secondly, firms start to export to neighbouring countries, which are comparatively well known and they share similar business practices. And finally, they start producing or manufacturing abroad, getting involved in foreign direct investment activities. Hence, the Uppsala model suggests that the process of internationalisation of firms depends on a gradual acquisition, integration and use of knowledge about foreign markets and operations.

Recent international trade literature has primarily focused on the role of firm heterogeneity in international markets. Thanks to the increasing availability of data at firm level, research has revealed the existence of substantial differences between exporters and non-exporters. The first people to undertake an empirical study about exporting across firms and between industries were Bernard and Jensen (1995). Thanks to a panel data of US manufacturing firms between 1976 and 1987, they found remarkable differences between exporter and domestic firms. Specifically, they discovered that exporters were larger in terms of employees, had larger sales, were more capital intensive, paid higher wages, received higher benefits, invested more per employee and showed higher labour productivity than non-exporter firms.

Among these differences, productivity has been placed at the core of the firm's export decision. Despite there exists a widespread consensus about the superior productivity of exporter firms, the source of this superiority is still debated. On the one hand, some researchers affirm that exporter firms were more productive than domestic firms even before

their entry into export markets. This idea is translated into the self-selection hypothesis of better firms entering export markets. On the other hand, some economists establish that firms improve their productivity levels after start to export, suggesting that firms take advantage from a higher competition level in international markets. This concept has been called the learning-by-exporting hypothesis.

The hypothesis of self-selection of better firms entering export markets has received remarkable support. From a theoretical perspective, Melitz (2003) made an extension of the Krugman (1980) model with monopolistic competition and increasing returns to scale but incorporating firm level productivity differences. In his model, Melitz established that only the most productive firms could obtain positive profits from exports, due to the existence of certain sunk costs on entry into international markets. Consequently, only the most productive firms will enter export markets while less productive firms will tend to remain in domestic ones. The hypothesis of self-selection was supported empirically as well, by Bernard and Jensen (1999) for U.S firms, Aw et al. (2000) for Taiwanese and Korean firms, or Clerides et al. (1998) for Colombian, Mexican and Moroccan firms. Moreover, the ex-ante superiority of exporter firms was not limited to productivity, but also was present in sales, employment, innovation, human capital or wages. Hence, we can affirm that there exists a considerable consensus on the international trade literature about the veracity of the self-selection hypothesis of better firms entering export markets.

The hypothesis of learning-by-exporting has not received, however, comparable support in the international trade literature. On the one hand, some studies have found significant productivity improvements in firms after their entry into export markets, see for example, Atkin et al. (2017) for Egyptian firms, De Loecker (2007) and De Loecker (2013) for Slovenian firms or Van Biesebroeck (2005) for a sample of sub-Saharan countries. On the contrary, a considerable body of research has found no evidence of productivity improvements in firms following their entry into export markets, see for example, Wagner (2002) and Arnold et al. (2005) for German firms, or Damijan et al. (2006) for Slovenian firms. Other studies have found significant improvements in productivity but conditioned to some firms characteristics, the pre-export R&D status of firms (Dai and Yu, 2013, for Chinese firms) or the trade exposure in industries (Greenaway and Kneller, 2007, for British firms). Martins and Yang (2009) carried out a meta-analysis of more than 30 papers regarding

the learning-by-exporting hypothesis. They conclude that "the impact of exporting upon productivity is higher for developing than developed economies, and the export effect is higher in the first year that firms start exporting compared to later years". Moreover, The International Study Group on Exports and Productivity (ISGEP, 2008), through an analysis of 14 countries, found that "productivity premia on exporters is larger in countries with lower export participation rates, with more restrictive trade policies, less effective government and worse regulatory quality".

Nevertheless, the learning-by-exporting hypothesis should not be restricted only to the impact of exporting on productivity, but may be expanded to other firm characteristics. Hence, some studies have analysed the impact of exporting in other variables than productivity, such as employment, sales, or innovation. Girma et al. (2004), for a sample of British firms, found a significant improvement in the firm's employment and output after the entry into export market. Hansson and Lundin (2004) found an improvement in the output growth of Swedish firms after they start to export. Serti and Tommasi (2008), for a sample of Italian firms, found significant improvements in sales, employment and unit labour costs in those firms entering the export market.

The theoretical and empirical connection between exporting and innovation deserves a special attention. Again, there is no consensus as to whether the link between the R&D strategy and the internationalization process of firms obeys to a self-selection or a learning-by-exporting mechanism. On the one hand, some studies find that innovative firms are more likely to enter the export market (see for example, Cassiman and Martínez-Ros, 2007) and that this innovation premia is even more relevant than the productivity premia (Cassiman and Golovko, 2011), clearly validating the existence of a self-selection mechanism of more innovative firms entering the export market. On the other hand, others analysis find the opposite results, in other words, that "there is no empirical support for the hypothesis that innovation increases the likelihood of becoming an exporter, however, there is evidence that exporting increases the probability of becoming innovator" (Damijan et al. 2010, for a sample of Slovenian firms), supporting the presence of a learning-by-exporting mechanism in terms of R&D. Moreover, Coelli et al. (2016) found an increase in patenting and innovation activities in a sample of 60 countries, following the entry of firms in exports markets. Finally,

Mañez et al. (2015) found both mechanisms: that exporting affects positively innovation and vice versa.

Regarding the empirical literature for Spain, research has found that exporters are more productive, bigger in terms of sales and employment, more innovative, pay higher wages and employ more skilled workers compared to non-exporters (Fariñas et al. 2007). Mainer (2014) established this exporter productivity premia around 33%. Moreover, in the Chapter 2 of this manuscript we have shown that Spanish exporters were better managed than Spanish non-exporters.

The source of this superior performance of exporting firms has also been deeply analysed. Firstly, the self-selection hypothesis has received considerable support. Delgado et al. (2002), Fariñas et al. (2007) and Altuzarra et al. (2015) found that Spanish exporters were more productive than Spanish non-exporters even before they start to export. However, Mañez-Castillejo et al. (2013) affirm that this hypothesis is true only among small firms, not among large firms. Secondly, the learning-by-exporting hypothesis has not collected a similar consensus. On the one hand, Delgado et al. (2002) and Fariñas et al. (2007) did not find evidence of productivity improvements in firms following their entry into export markets. On the other hand, Segarra-Blasco et al. (2006) and Mañez-Castillejo et al. (2013) found evidence of an extra productivity growth in export starters. Furthermore, Manjón et al. (2010) established that the yearly average gains in productivity are around 3% for at least 4 years.

Thus, research focused on depicting the impact of exporting on the Spanish firms' performance has been focused on the role of productivity. However, we know very little about what happens to other firm characteristics during the process of internationalization of Spanish firms. This is precisely the main motivation and contribution of our analysis: to offer more evidence about the effects of exporting on a variety of firm's characteristics.

3.3- Data and Methodology

3.3.1- Data

The data source used in this research is the Survey of Firms' Business Strategies (ESEE) drawn up by the Spanish Ministry of Industry and the SEPI Foundation. This data set is an annual survey, which refers to a representative sample of Spanish manufacturing firms, according to industry and size. The survey applies random sampling for firms with 10 to 200 workers and exhaustive sampling for firms with 200 or more workers. The period analysed in this research is 1990-2013 (24 years). Some firms answer every year while others do not, which makes the dataset an unbalanced panel. For our purposes, the sample used is composed of two kinds of firms: *Domestic* and *New Exporter*.

To classify a firm as *New Exporter* at period t we require two conditions:

- the firm should not have exported during the sample periods previous to t
- the firm should export in all the periods after to t

To classify a firm as *Domestic* we require that this firm never exports during the sample.

Table 3.1 presents a summary of the sample. As it can be noticed, we dispose of a sample of 1.796 manufacturing firms, representing approximately the 7% of all the Spanish manufacturing firms with more than 10 employees (26.803). Moreover, the distribution of our sample according to size is almost exactly to the real distribution of the Spanish manufacturing firms. Finally, small firms compose the majority of both groups of *New Exporter* and *Domestic* firms, which reflects accurately the dynamics of entry and exit in export markets, where small firms dominate these dynamics. The set of variables employed in our analysis covers the main firm characteristics, with a special focus on labour aspects. Table 3.2 presents the list of variables and its definition. Table 3.3 shows the main descriptive statistics relating to the variables used in the analysis.

Table 3.1- Description and representativeness of the sample

		Firms	%
Spanish Economy in 2013			
Manufacturing firms with more than 10 employees	Between 10 and 50 employees	22.053	82%
	Between 50 and 200 employees	3.772	14%
	More than 200 employees	978	4%
	Total	26.803	100%
Our sample (12.565 observations)			
Manufacturing firms with more than 10 employees	Between 10 and 50 employees	1.435	80%
	Between 50 and 200 employees	234	13%
	More than 200 employees	127	7%
	Total	1.796	100%
	New Exporter firms	304	17%
	Domestic firms	1.492	83%
	Total	1.796	100%
New Exporter firms	Between 10 and 50 employees	184	61%
	Between 50 and 200 employees	62	20%
	More than 200 employees	58	19%
	Total	304	100%
Domestic firms	Between 10 and 50 employees	1.251	70%
	Between 50 and 200 employees	172	14%
	More than 200 employees	69	6%
	Total	1.492	100%

Table 3.2- Variables description

Sales	Production of goods and services. Total sales, in logs.
Workers	Total number of workers, in logs
Productivity	Labour Productivity, in logs. Measured as the ratio of the Total Value Added, in euros, to the average total number of employees.
Wages	Average cost of workers, in logs
Unit Labour Costs	Ratio of the average cost of workers to productivity, in logs
Margin	Gross operating margin, in logs.
R&D Expenditure	Total R&D expenditure, in logs.
R&D Probability	1- if firm *i* is undertaking R&D in year *t* 0- otherwise
Human Capital	Percentage of workers with tertiary education, in logs
Permanent workers	Percentage of workers with permanent contracts, in logs

Table 3.3- Descriptive Statistics of the Variables

	Mean	Median	Standard Deviation	Minimum	Maximum
Sales	14.435	14.139	1.618	9.169	20.730
Workers	3.304	3.091	1.138	0	8.596
Productivity	10.334	10.355	0.700	0	13.283
Wages	9.900	9.916	0.520	0	12.830
Unit Labour Costs	-0.204	-0.226	0.523	-3.840	5.531
Margin	1.764	2.041	1.183	-2.303	8.055
R&D Expenditure	1.482	0	3.919	0	18.733
R&D Probability	0.133	0	0.340	0	1
Permanent Workers	4.159	4.404	0.733	-0.148	4.605
Human Capital	0.665	0	1.010	-2.303	4.605

3.3.2- Main methodology

The aim of our study is to analyse how *New Exporter* firms differentiate from *Domestic* firms both before and after they start to export. For this purpose, the strategy employed is the following. First of all, we identify the year in which *New Exporter* firms start to export (*t*). Once we have this year, we identify the year previous to export (*t*-1) and the year later to start to export (*t*+1). Then, we continue enlarging our analysis up to (*t*-6) and (*t*+5). At the end, we will analyse the six years previous to export and the six years after start exporting (12 years in total).

In every year (*t*-6, *t*-5, *t*-4, *t*-3, *t*-2, *t*-1, *t*, *t+1*, *t+2*, *t+3*, *t+4*, *t+5*), we will compare the performance of the two groups of firms: *New Exporter* and *Domestic* firms. In the pre-entry period (*t*-6, *t*-5, *t*-4, *t*-3, *t*-2, *t*-1) we are in fact comparing firms that are not exporting and have never exported before. However, a group of firms will start to export some years later (*New Exporter)* while the other will not (*Domestic).* Thus, at this stage, we will check the hypothesis of self-selection of better firms entering the export market. In other words, we will see if *New Exporter* firms were already better than *Domestic* firms before they start to export. On the contrary, in the post-entry period (*t*, *t+1*, *t+2*, *t+3*, *t+4*, *t+5*), we will check the

hypothesis of learning-by-exporting, that is, we will analyse if the differences between *New Exporter* and *Domestic* firms increase or decrease once the first start to export.

For our purposes, we will break the panel structure in periods from t-6 to t+5 in order to estimate the following Pool OLS equation:

$$\ln (Y_{it}) = c + \beta_1 Treatment_{it} + \beta_j Year\ Dummies_{it} + \beta_k Size\ Dummies_{it} + \beta_l Industry\ Dummies_{it} + \varepsilon_{it} \quad (1)$$

where Y_{it} are the variables depicting the firm performance (*Productivity, Sales, Margin, R&D Expenditure, R&D Probability, Workers, Wages, Permanent Workers, Human Capital, Unit Labour Costs). Treatment* is a dummy variable taking value 1 for *New Exporter* firms and 0 for *Domestic* firms. We incorporate the *Year Dummies* in order to eliminate the distortions generated by the business cycle. We have classified firm size into three categories: small (50 or less employees), medium (between 51 and 200 employees) and large (201 or more employees). The activity of firms is classified into 20 different industries, according to the two-digits aggregation CNAE-09 of manufacturing industries. The differential in the *R&D Probability* has been estimated trough a Probit regression model. When we estimate the difference in terms of *Workers,* we do not include size controls in the regression.

More precisely, we will estimate the previous equation 12 times, from t-6 to t+5. In each estimation, we will pool:

- all *New Exporters* that start exporting in t
- all *Domestic* firms

Hence, in each estimation, *New exporters* will only contribute with a unique row of data, while *Domestic* firms will have several rows.

3.3.3- Robustness checks

In order to test the validity of our results we will perform several robustness checks. First of all, it should be noted that when performing the equation (1) the number of *New Exporters* firms might vary from one year to another. For instance, we dispose of 69 *New*

Exporter firms in t-6, 93 in t-5, 117 in t-4, 153 in t-3, 220 in t-2, 304 in t-1, 304 in t, 250 in t+1, 212 in t+2, 169 in t+3, 150 in t+4 and 130 in t+5. On average, we dispose of 181 *New Exporter* firms in each period. This is the consequence of some firms leaving the sample while others joining it. Hence, it may be argued that the changes in the estimated coefficients from one year to another may be the result of changes in the sample composition, the effect of some *New Exporter* firms joining and leaving the sample, rather than the effect of the internationalization process.

Table 3.4- Sample description in the Robustness Checks

	Requirements for New Exporter firms			Number of New Exporter firms	Number of Domestic firms	Econometric Estimation
	Staying in the sample at least during	Minimum number of years without exporting	Minimum number of years exporting			
Robustness Check nº1	6 consecutive years	3	3	102	1.492	OLS
Robustness Check nº2	4 consecutive years	2	2	175	1.492	OLS
Robustness Check nº3	-	-	-	304	0	GLS
Robustness Check nº4	Start exporting at some point between 2008 and 2013			88	772	OLS

Therefore, the purpose of the Robustness Check nº1 and the Robustness Check nº2 will be precisely to try to isolate this possible effect of sample composition by analyzing only *New Exporter* firms that remain in the sample during all the periods. Table 3.4 presents a summary of the samples employed in the robustness checks. Notice that the harder the requirements for *New Exporter* firms, the lower the number of *New Exporter* firms available. For instance, in the Robustness Check nº1 we dispose of 102 firms that stay in the sample at least during 6 years, 3 of which without exporting and 3 exporting. In the Robustness Check nº2, we have smoothed the requirements in order to try to enlarge our sample of *New Exporter* firms, finally obtaining 175 firms staying in the sample at least during 4 consecutive

years[3]. Hence, in each of these Robustness Checks we will repeat exactly the procedure of the equation (1), but changing the sample of *New Exporter* firms. Notice that, due to the availability of data, the years analyzed change from one Robustness Check to another. While in the Robustness Check nº1 we will analyse 6 years (*t*-3, *t*-2, *t*-1, *t, t+1, t+2*), in the Robustness Check nº2 we will analyse 4 years (*t*-2, *t*-1, *t, t+1*).

The Robustness Check nº3 is considerably different. Our purpose is to see how the internationalization process transforms firms. We will only analyse the performance of *New Exporter* firms throughout the years, by comparing the years before and after they start exporting. In this estimation we do not break the panel structure, and we estimate a panel data model by the random effects estimator. Thus, we will estimate the following equation through GLS:

$$\ln(Y_{it}) = c + \beta_1 \, Exporting\ Year_{it} + \beta_j \, Year\ Dummies_{it} + \beta_k \, Size\ Dummies_{it} + \beta_l \, Industry\ Dummies_{it} + \varepsilon_{it} \quad (2)$$

where Y_{it} are the variables depicting the firm performance (*Productivity, Sales, Margin, R&D Expenditure, R&D Probability, Workers, Wages, Permanent Workers, Human Capital, Unit Labour Costs)* and *Exporting Year* is a dummy variable taking value 1 for the years in which firms are exporting and 0 for the years in which they are not exporting.

Finally, in the Robustness Check nº4 we will focus on the performance of firms during the recent economic crisis. More precisely, we will require to *New Exporter* firms to start exporting at some point between 2008 and 2013. Due to the availability of data, we only dispose of 88 firms that start exporting during this period, and, moreover, we will analyse only 4 years, 2 years before and 2 years after start exporting. Hence, in the Robustness Check nº4 we will repeat exactly the procedure of the equation (1), but changing the sample of *New Exporter* firms. Notice that we will only analyze the period 2006-2013, and hence, the number of Domestic firms is reduced to 772.

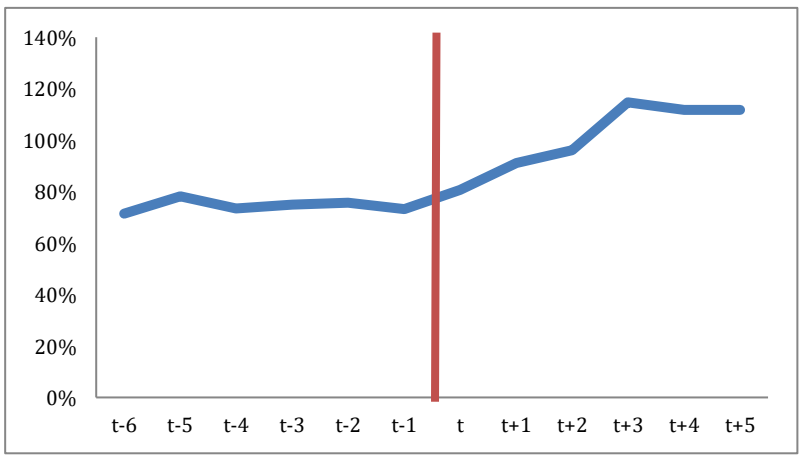
[1] Initially, we tried to perform the robustness checks with those firms staying in the sample during all the period analyzed. However, we only disposed of 23 firms staying in the sample at least during 12 years, 6 of which without exporting and 6 exporting. Moreover, we only disposed of 41 and 63 firms staying 10 and 8 years respectively, an insufficient number of firms to guarantee a minimum level of representativeness.

3.4- Results

Table 3.5 presents the main results of the OLS estimation of equation (1) that are previous to the ones corresponding to robustness checks. Coefficients in the table depict the average estimated difference between *New Exporter* and *Domestic* firms, controlling for firm industry, size and year. Coefficients corresponding to the variable *R&D Probability* depict the marginal effect of the Probit regression. To transform differences in logs into differences in percentage, we have followed the process suggested by Halvorsen and Palmquist (1980): "take the antilogarithm (base e) of the estimated coefficient of the dummy variable, subtract 1, and multiply the difference by 100".

Firstly, results show that the entry into the export market has the most significant impact on the firm's size. Regarding the variable sales, results indicate that *New Exporter* firms have a great volume of total sales compared to *Domestic* firms, both in the pre-entry and in the post-entry period. Nevertheless, the sales differential does not exhibit a constant path. In fact, while the difference in terms of total sales remains relatively constant in the pre-entry period (Figure 3.1) it begins to increase significantly after *New Exporter* firms start to export. More precisely, *New Exporter* firms' sales were, on average, 75% larger during the pre-entry period, and 101% larger during the post-entry period.

Figure 3.1- Sales



Note: Differential between New Exporter and Domestic firms.

Table 3.5- OLS Results

Average estimated difference between New Exporter (Treatment) and Domestic (Control) firms

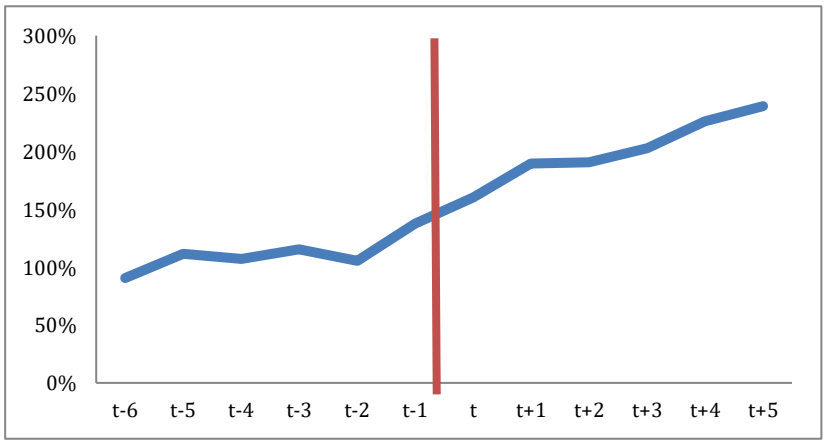
	Period											
	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
Sales	0.539*** (0.105)	0.578*** (0.098)	0.551*** (0.087)	0.559*** (0.074)	0.564*** (0.060)	0.549*** (0.052)	0.591*** (0.056)	0.647*** (0.061)	0.673*** (0.066)	0.764*** (0.076)	0.750*** (0.078)	0.750*** (0.085)
Workers	0.645*** (0.139)	0.750*** (0.133)	0.729*** (0.116)	0.766*** (0.103)	0.720*** (0.083)	0.865*** (0.073)	0.957*** (0.075)	1.063*** (0.082)	1.066*** (0.089)	1.107*** (0.101)	1.182*** (0.108)	1.221*** (0.114)
Productivity	0.277*** (0.063)	0.321*** (0.060)	0.219*** (0.064)	0.297*** (0.046)	0.231*** (0.036)	0.162*** (0.038)	0.179*** (0.038)	0.119*** (0.045)	0.202*** (0.043)	0.231*** (0.043)	0.201*** (0.049)	0.236*** (0.051)
Wages	-0.064 (0.157)	0.111*** (0.037)	0.100*** (0.034)	0.107*** (0.028)	0.094*** (0.024)	0.075*** (0.023)	0.069*** (0.022)	0.101*** (0.023)	0.123*** (0.024)	0.136*** (0.026)	0.127*** (0.028)	0.124*** (0.030)
Unit Labour Costs	-0.194*** (0.051)	-0.212*** (0.050)	-0.118** (0.055)	-0.187*** (0.036)	-0.133*** (0.030)	-0.085** (0.035)	-0.110*** (0.031)	-0.014 (0.043)	-0.077** (0.039)	-0.094** (0.040)	-0.075* (0.041)	-0.113*** (0.041)
Margin	0.365*** (0.121)	0.388** (0.092)	0.277*** (0.098)	0.320*** (0.091)	0.171*** (0.079)	0.162** (0.064)	0.100 (0.067)	0.021 (0.079)	0.020 (0.089)	0.046 (0.084)	0.063 (0.091)	0.153 (0.092)
R&D Expenditure	1.458*** (0.550)	1.319*** (0.486)	1.418*** (0.430)	1.892*** (0.400)	1.396*** (0.311)	1.609*** (0.281)	1.713*** (0.285)	1.851*** (0.316)	1.859*** (0.343)	1.849*** (0.390)	1.764*** (0.412)	2.132*** (0.475)
R&D Probability	0.096** (0.043)	0.072** (0.034)	0.073** (0.030)	0.109*** (0.030)	0.087*** (0.024)	0.098*** (0.021)	0.104*** (0.022)	0.109*** (0.024)	0.099*** (0.025)	0.096*** (0.028)	0.076*** (0.027)	0.102*** (0.033)
Permanent Workers	0.024 (0.097)	0.046 (0.082)	0.058 (0.064)	0.133*** (0.043)	0.003 (0.050)	0.083** (0.038)	0.138*** (0.027)	0.152*** (0.034)	0.123*** (0.035)	0.142*** (0.034)	0.133*** (0.036)	0.135*** (0.036)
Human Capital	0.353*** (0.124)	0.267** (0.112)	0.363*** (0.101)	0.335*** (0.087)	0.258*** (0.069)	0.213*** (0.059)	0.241*** (0.061)	0.296*** (0.068)	0.210*** (0.070)	0.281** (0.081)	0.313*** (0.087)	0.235*** (0.088)
New Exporter firms	69	93	117	153	220	304	304	250	212	169	150	130
Domestic firms	1.492	1.492	1.492	1.492	1.492	1.492	1.492	1.492	1.492	1.492	1.492	1.492

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Thus, in the case of total sales, we can appreciate both the self-selection and learning-by-exporting processes. In this sense, the results show that *New Exporter* firms benefited from starting to export, to the extent that there exists a strong correlation between the increase in the sales differential and their entry into export markets.

Furthermore, *New Exporter* firms were already larger in terms of employees compared to *Domestic* firms during the pre-entry period. Nevertheless, this differential remained relatively constant from *t*-6 to *t*-2, around 106% on average. In the year previous to the entry into the export market, however, the differential starts to increase steadily (Figure 3.2), reaching an average differential of 201% in the post-entry period. Despite *New Exporter* firms had more workers compared to *Domestic* firms in the pre-entry period, these differences considerably increase in the post-entry period. Hence, regarding the firm's size, we can appreciate both a self-selection and a learning-by-exporting process.

Figure 3.2- Workers

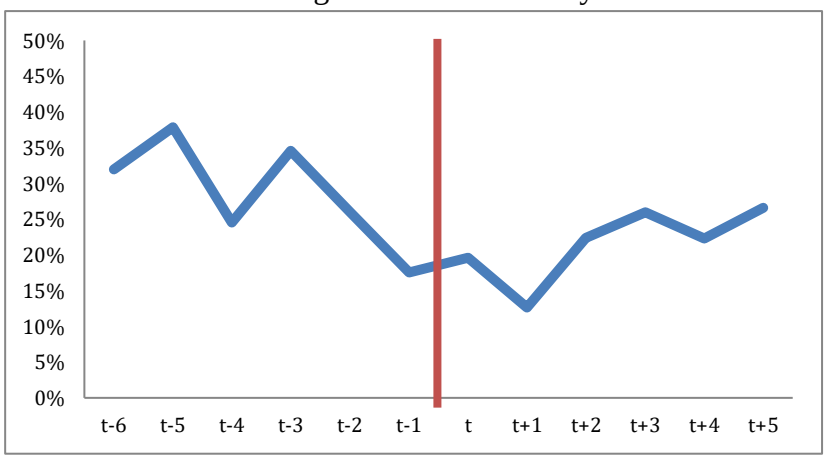


Note: Differential between New Exporter and Domestic firms.

Secondly, the results demonstrate that *New Exporter* firms are more productive than *Domestic* firms, both during the pre-entry (*t*-6, *t*-5, *t*-4, *t*-3, *t*-2, *t*-1) and during the post-entry period (*t*, *t+1*, *t+2*, *t+3*, *t+4*, *t+5*). Figure 3 shows that productivity differences between *New Exporter* and *Domestic* firms decrease in the years previous to the entry into the export market (*t*-2, *t*-1) and then they start to increase since t+1 to t+3. During the pre-entry period, on average, *New Exporter* firms were already 29% more productive than *Domestic* firms, validating the self-selection hypothesis of more productive firms entering the export markets. During the post-entry period, this differential remains, on average, on a 22%. Hence, despite

there are no productivity improvements on the overall period, we can appreciate a learning-by-exporting mechanism, because the productivity differential starts to grow after the entry into export markets. This U-shaped trend in the learning-by-exporting mechanism (Figure 3.3) was already found by Bellone et al. (2008) for French manufacturing firms. These authors suggested that the decrease in the productivity differential during the pre-entry period was driven by an increase in the capital stock and in the consumption of intermediary inputs of *New Exporter* firms, who were preparing their entry into international markets. Hence, once firms have overcome these previous investments and trade costs, the productivity differential starts to increase again.

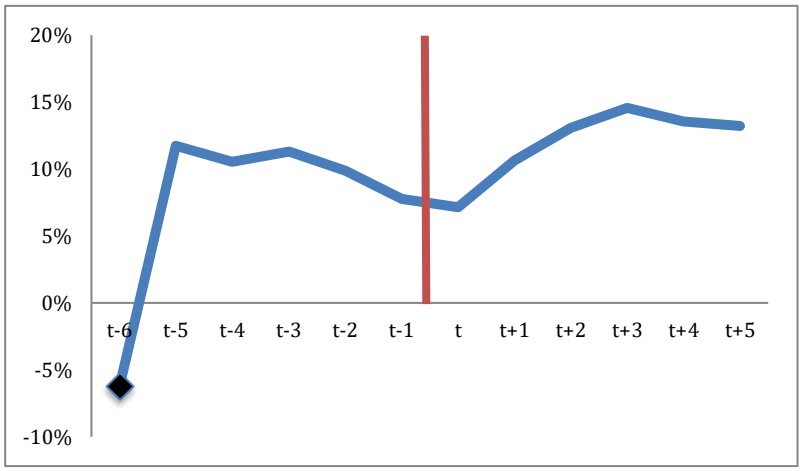
Figure 3.3- Productivity



Note: Differential between New Exporter and Domestic firms.

Thirdly, if we focus on the variable wages, results show that *New Exporter* firms pay higher wages to its employees compared to *Domestic* firms. Despite this differential not being statistically significant in *t*-6, the difference in terms of wages remains positive and significant in the following periods. During the pre-entry period, workers in *New Exporter* firms earned, on average, 13% more than workers in *Domestic* firms, validating the self-selection hypothesis of firms paying higher wages entering the export market. Moreover, regarding the post-entry effects, we can appreciate a considerable increase in the wage differential in the three years after the entry, doubling from 7.14% in t to 14.57% in t+3. Therefore we can appreciate a learning-by-exporting mechanism as well. Interestingly, the overall trend in the wage differential resembles the U-shaped trend presented in productivity (Figure 3.4). In this case, the wage differential steadily decreases in the pre-entry period, from t-5 to t, and then recovers from t to t+3.

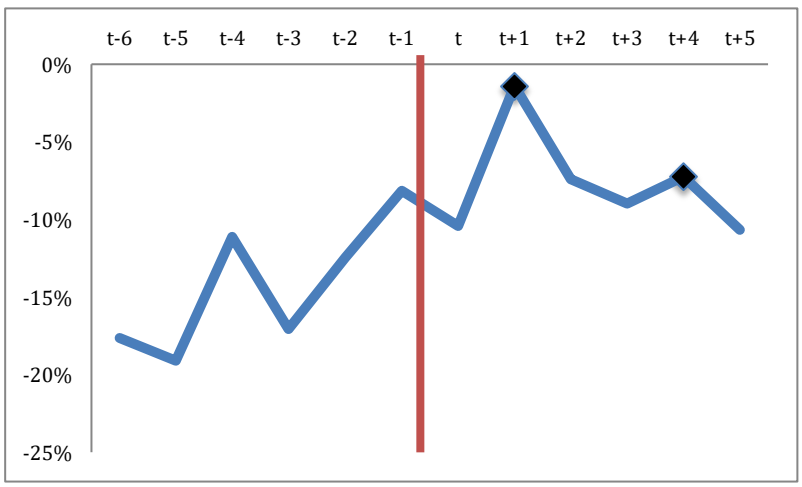
Figure 3.4- Wages



Note: Differential between New Exporter and Domestic firms.
◆ denotes not statistically significant at the 5% level.

Fourthly, the superior competitiveness of *New Exporter* firms is reflected as well in the unit labour costs. As expected, *New Exporter* firms have lower unit labour costs compared to *Domestic* firms both before and after they enter into export markets, reflecting the expected larger degree of competitiveness. Moreover, we observe the presence of an inverted U-shape in the unit labour cost trend (Figure 3.5). Giving the construction of the unit labour costs variable, his trend should obey the trends in wage and productivity. In fact, productivity and wages had a U-shaped trend, but unit labour costs have an inverted U-shaped trend.

Figure 3.5- Unit Labour Costs



Note: Differential between New Exporter and Domestic firms.
◆ denote not statistically significant at the 5% level.

The intuition behind this results is that the difference in unit labour costs for exporters as regards domestics is always negative, then, an increase in the graph means in fact a decrease in divergence, and the opposite for a decrease in the graph, differently to the differentials for productivity and wages, which are positive.

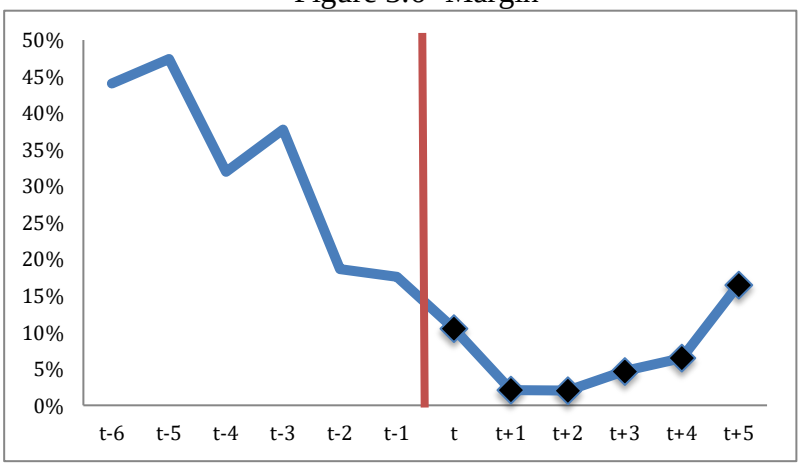
More precisely, during the pre-entry period, the unit labour costs differential between *New Exporter* and *Domestic* firms is steadily decreasing from t-6 to t+1. This convergence in terms of unit labour costs is explained by the pre-entry convergence in productivity and wages between *New Exporter* and *Domestic* firms. (because the negative differential in the figure for unit labour costs gets smaller). However, during the post-entry period, the unit labour cost differential starts to increase since t+1 to t+5 (t+4 is non-significant). The increase in differentials for productivity and wages for *New Exporter* as regards *Domestic* firms in the post-entry period explains the increase in differentials for unit labour costs in the same period (because the negative differential in the figure for unit labour costs gets larger). Hence, we can appreciate both the self-selection mechanism of firms with better unit labour costs entering the export market, and a learning-by-exporting effect of firms improving they unit labour costs after start exporting.

The analysis of the variable margin throws some different results. On the one hand, *New Exporter* firms had a larger gross operating margin compared to *Domestic* firms during the pre-entry period. Despite the margin differential is steadily decreasing throughout this period, it is positive and statistically significant. Figure 3.6 depicts that during the pre-entry period, the gross operating margin of *New Exporter* firms was, on average, 33% larger compared to *Domestic* firms. Nevertheless, this difference disappears in the entry year (*t*) and it remains not significant in the following years[4]. The previous investment in capital stock or intermediary inputs, a more competitive environment in the international markets, or the presence of sunk costs associated to the export market (Mañez et al. 2008) may be the root cause of this decrease in the gross operating margin differential. Therefore, this result validates the hypothesis of self-selection of more profitable firms entering the export market,

[4] In order to prove the validity of this result, we have analysed the gross operating margin of regular exporters as well. Results show that, during the post-entry period, the gross operating margin of *New Exporter* firms is not statistically different from the one of regular exporters. In other words, during this period, all the firms analysed (Regular exporters, *New Exporter* and *Domestic* firms) share a common gross operating margin.

but there is no evidence of a learning-by-exporting mechanism regarding the gross operating margin.

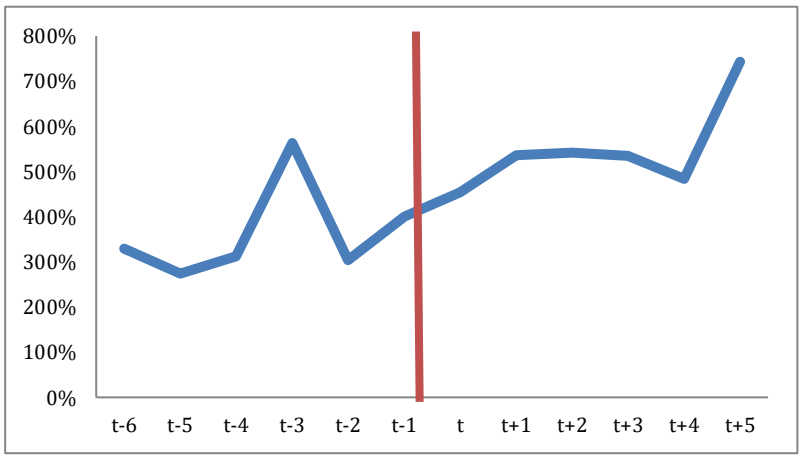
Figure 3.6- Margin



Note: Differential between New Exporter and Domestic firms.
◆ denotes not significance at the 5% level.

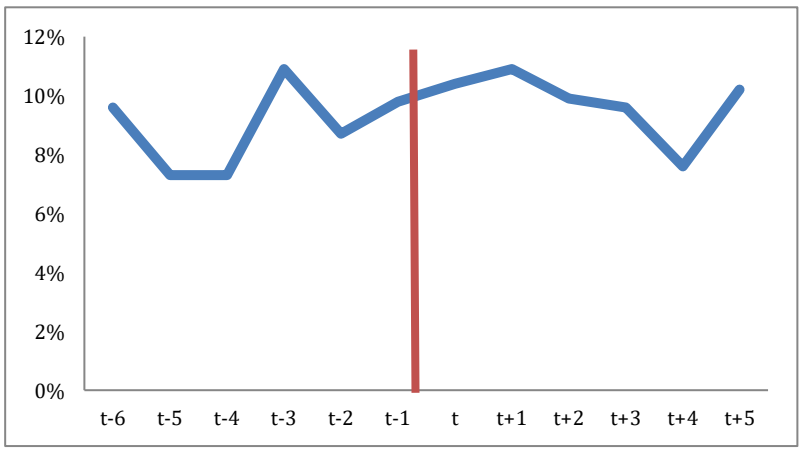
In addition, differences between these two groups of firms are also present in the R&D strategy. On the one hand, during the pre-entry period, *New Exporter* firms spent, on average, 364% more in R&D compared to *Domestic* firms, being their probability to perform R&D a 10% higher, on average, during this period. Therefore, we can appreciate a self-selection mechanism of more innovative firms entering the export market. On the other hand, during the post-entry period, the R&D expenditure differential increases to 549%, on average, but the probability differential remains around 10%. In other words, even if *New Exporter* firms spend more in R&D in the post-entry years, the number of innovative firms does not change significantly (Figures 3.7 and 3.8). Hence, we can appreciate the existence of a learning-by-exporting mechanism as well, because, despite starting to export does not make more firms to perform R&D, it makes *New Exporter* firms already investing in R&D to increase the expenditure differential with respect to *Domestic* firms. During the pre-entry period the R&D differential remained quite stable (except in t-3, a pick that looks like driven by the effect of some outlier in terms of R&D expenditures), however, it starts to increase sharply since t-1 to t+5.

Figure 3.7- R&D Expenditure



Note: Differential between New Exporter and Domestic firms.

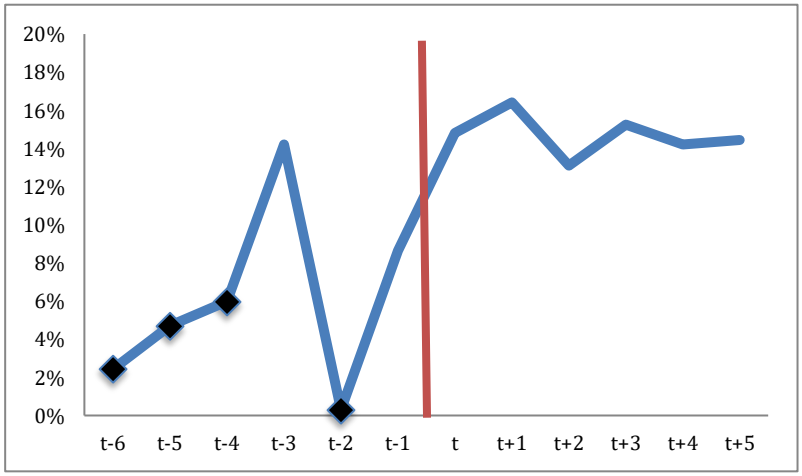
Figure 3.8- R&D Probability



Note: Differential between New Exporter and Domestic firms.

Moreover, the entry into export markets is also correlated to an improvement in the quality of employment contracts, measured as the percentage of workers with permanent contracts. During the pre-entry period, the percentage of workers with a permanent contract was not statistically different between *New Exporter* and *Domestic* firms (except in t-3). However, since t-1 the difference starts to become statistically significant and it steadily increases until t+6. More precisely, *New Exporter* firms had during the years they export, on average, 15% more workers with permanent contracts compared to *Domestic* firms (Figure 3.9). Therefore, the nature of the employment contract is the only variable analysed in which the self-selection hypothesis is no validated, but the learning-by-exporting is. Hence, we can observe that the entry into export markets is associated with a strong improvement in the quality of employment contracts.

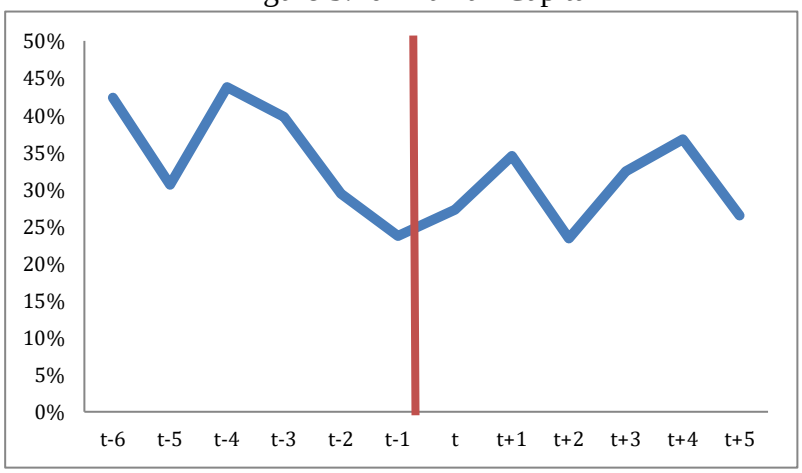
Figure 3.9- Permanent Workers



Note: Differential between New Exporter and Domestic firms.
◆ denotes not statistically significant at the 5% level.

Finally, focusing on the skill composition of workers, measured as the percentage of workers with tertiary education within the firm, results show that, yet again, workers in *New Exporter* firms are more qualified than workers in *Domestic* firms. More precisely, during the pre-entry period, the average skill differential was 35%, while during the post-entry period it was around 30%. In other words, differences in terms of skill composition between *New Exporter* and *Domestic* firms remain relatively constant throughout the years (Figure 3.10). Therefore, we can appreciate a self-selection effect of firms with more skilled workers entering the export market, but there is no evidence of a learning-by-exporting effect.

Figure 3.10- Human Capital



Note: Differential between New Exporter and Domestic firms.

The results from the robustness checks are present in tables 3.6, 3.7, 3.8 and 3.9 and they depict the average estimated difference between *New Exporter* and *Domestic* firms issued from the Robustness Checks nº1, nº2, nº3 and nº4, respectively. Moreover, the differences in percentage between *New Exporter* and *Domestic* firms issued from the Robustness Checks nº1 and nº2 are illustrated on Figures 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19 and 3.20. On every figure, we depict the results from the robustness checks and the original estimation as well, precisely in order to test the validity of this original estimation.

Table 3.6- OLS Results from the Robustness Check nº1

Average estimated difference between New Exporter (Treatment) and Domestic (Control) firms						
	Period					
	t-3	t-2	t-1	t	t+1	t+2
Sales	0.614***	0.643***	0.680***	0.656***	0.691***	0.663***
	(0.093)	(0.090)	(0.089)	(0.095)	(0.092)	(0.094)
Workers	0.829***	0.841***	0.877***	0.962***	0.968***	0.949***
	(0.128)	(0.130)	(0.126)	(0.131)	(0.133)	(0.133)
Productivity	0.297***	0.238***	0.258***	0.249***	0.225***	0.231***
	(0.054)	(0.052)	(0.058)	(0.063)	(0.062)	(0.067)
Wages	0.116***	0.136***	0.140***	0.155***	0.155***	0.179***
	(0.033)	(0.034)	(0.032)	(0.034)	(0.034)	(0.034)
Unit Labour Costs	-0.183***	-0.103**	-0.114**	-0.090*	-0.068	0.049
	(0.043)	(0.043)	(0.052)	(0.053)	(0.058)	(0.062)
Margin	0.329***	0.074	0.209**	0.169	0.150	0.156
	(0.108)	(0.117)	(0.106)	(0.117)	(0.119)	(0.127)
R&D Expenditure	2.218***	1.594***	1.695***	2.087***	2.119***	1.900***
	(0.488)	(0.444)	(0.469)	(0.499)	(0.486)	(0.486)
R&D Probability	0.123***	0.085***	0.088***	0.116***	0.117***	0.096***
	(0.037)	(0.032)	(0.034)	(0.037)	(0.036)	(0.032)
Permanent workers	0.155***	0.111*	0.142**	0.163***	0.177***	0.108**
	(0.051)	(0.062)	(0.061)	(0.049)	(0.045)	(0.046)
Human Capital	0.342***	0.401***	0.387***	0.397***	0.465***	0.402***
	(0.099)	(0.101)	(0.101)	(0.105)	(0.108)	(0.107)
New Exporter firms	102	102	102	102	102	102
Domestic firms	1.492	1.492	1.492	1.492	1.492	1.492

Note: Robust standard erros are given in parentheses. *,**,** denote significance at the 10%, 5% and 1% levels, respectively.

Table 3.7- OLS Results from the Robustness Check nº2

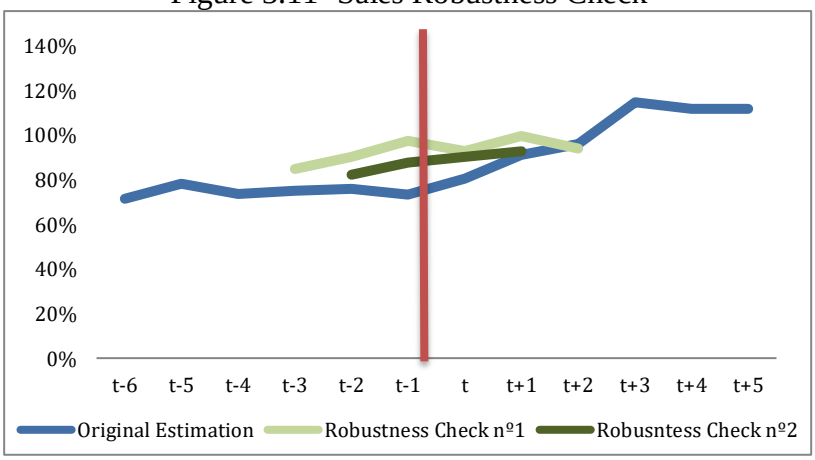
Average estimated difference between New Exporter (Treatment) and Domestic (Control) firms				
	Period			
	t-2	t-1	t	t+1
Sales	0.600***	0.630***	0.643***	0.656***
	(0.068)	(0.067)	(0.070)	(0.071)
Workers	0.794***	0.817***	0.941***	0.956***
	(0.096)	(0.097)	(0.097)	(0.097)
Productivity	0.203***	0.226***	0.227***	0.121**
	(0.041)	(0.042)	(0.047)	(0.056)
Wages	0.095***	0.112***	0.098***	0.119***
	(0.025)	(0.030)	(0.026)	(0.027)
Unit Labour Costs	-0.104***	-0.114***	-0.124***	0.000
	(0.034)	(0.040)	(0.039)	(0.054)
Margin	0.110	0.177**	0.184**	0.060
	(0.088)	(0.081)	(0.087)	(0.092)
R&D Expenditure	1.419***	1.594***	1.780***	1.551***
	(0.343)	(0.361)	(0.365)	(0.351)
R&D Probability	0.085***	0.097***	0.110***	0.089***
	(0.026)	(0.028)	(0.028)	(0.027)
Permanent workers	0.042	0.067	0.140***	0.103**
	(0.051)	(0.053)	(0.035)	(0.042)
Human Capital	0.297***	0.286***	0.312***	0.374***
	(0.077)	(0.077)	(0.080)	(0.081)
New Exporter firms	175	175	175	175
Domestic firms	1.492	1.492	1.492	1.492

Note: Robust standard erros are given in parentheses. *,**,** denote significance at the 10%, 5% and 1% levels, respectively.

Firstly, the robustness of the results should be interpreted as follows: in every figure, the closer the green lines are to the blue line, the more robust the result is. In other words, this would imply that the changes in the trend (the changes in the average estimated difference between *New Exporter* and *Domestic* firms) would be the result of temporal changes inside the firms, not the consequence of changes in the sample composition (some firms entering and leaving the sample in every period). At a first glance, we can appreciate that all the green lines (all the robustness checks) follow a similar path to the one of the blue line (the original estimation), translating that the overall trend is the result of changes inside the majority of firms, and that the results from the original estimation are robust to changes in the sample composition.

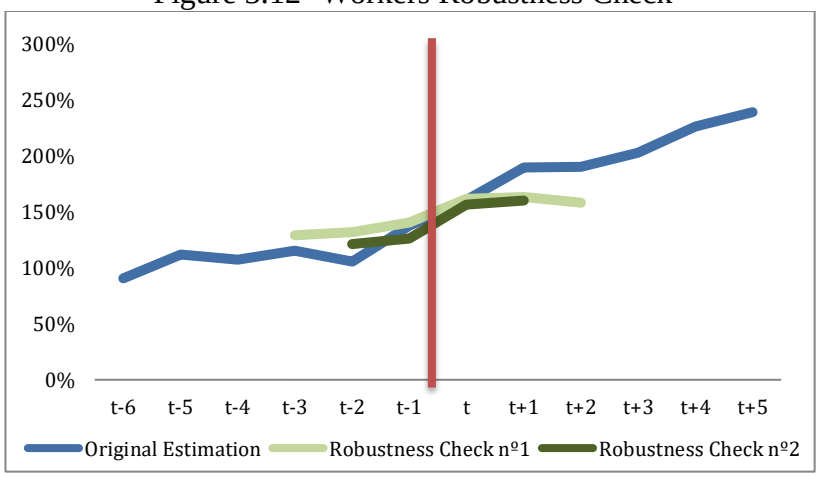
Nevertheless, the reader may note as well that the dispersion between the lines is not negligible. The average estimated difference between *New Exporter* and *Domestic* firms is larger in the Robustness Checks in terms of sales, productivity, wages and human capital. In other words, firms staying in the sample during 4 or 6 consecutive years are bigger, more productive, pay higher wages and employ more skilled workers compared to *Domestic* firms, This result may be due to the fact when analysing the performance of firms staying in the sample during some consecutive years, we are in fact analysing firms with a high survival probability, element that is strongly correlated with a good performance in the firm.

Figure 3.11- Sales Robustness Check



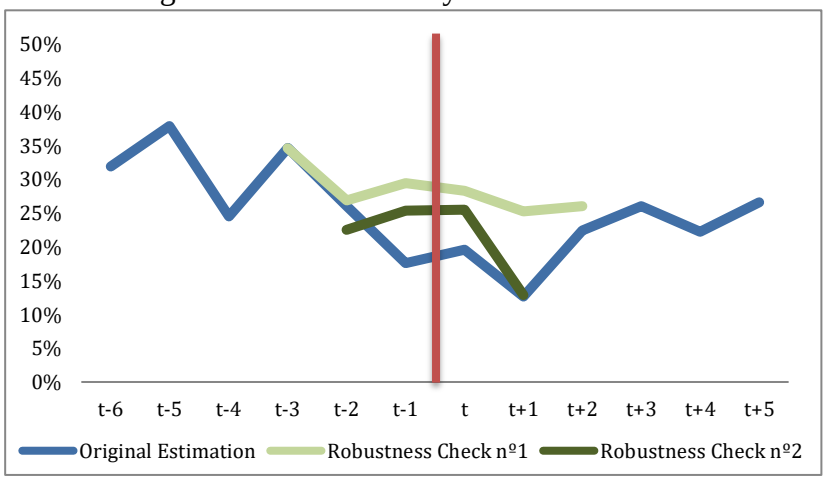
Note: Differential between New Exporter and Domestic firms.

Figure 3.12- Workers Robustness Check



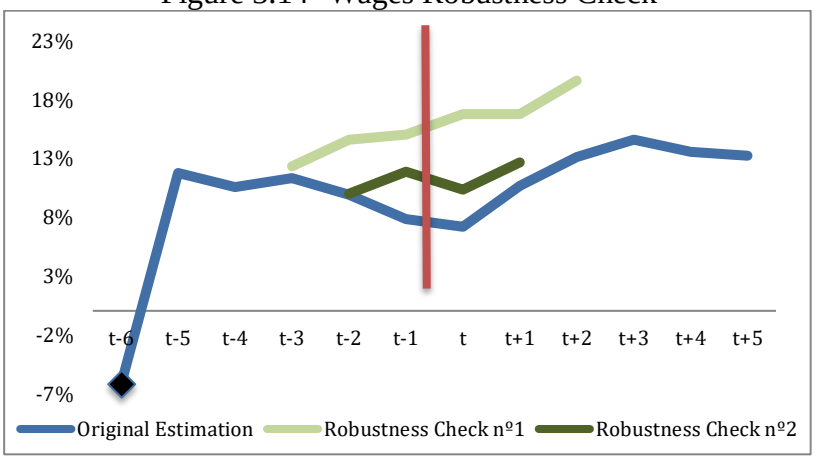
Note: Differential between New Exporter and Domestic firms.

Figure 3.13- Productivity Robustness Check



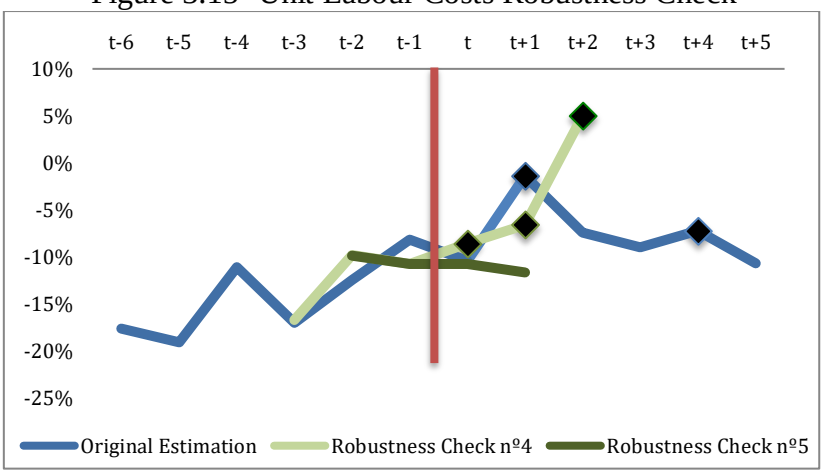
Note: Differential between New Exporter and Domestic firms.

Figure 3.14- Wages Robustness Check



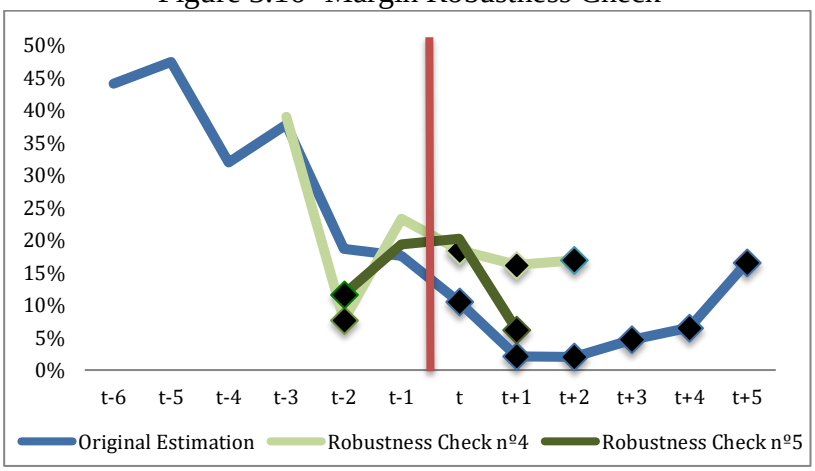
Note: Differential between New Exporter and Domestic firms.
◆ denotes not statistically significant at the 5% level.

Figure 3.15- Unit Labour Costs Robustness Check



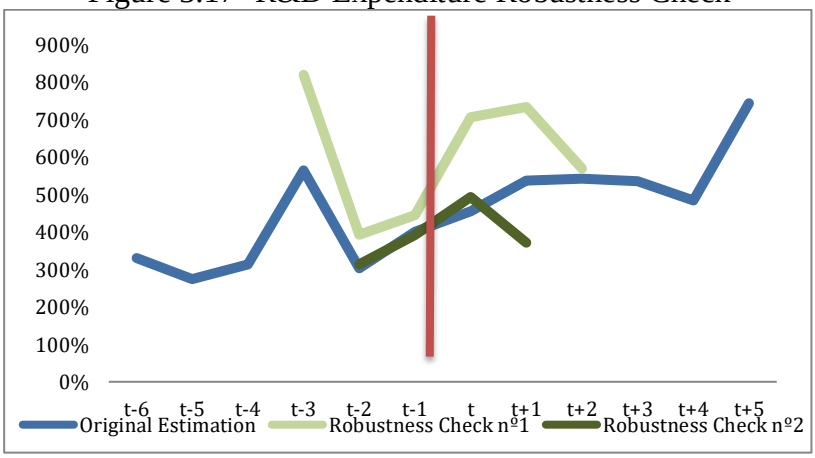
Note: Differential between New Exporter and Domestic firms.
◆ denotes not statistically significant at the 5% level.

Figure 3.16- Margin Robustness Check



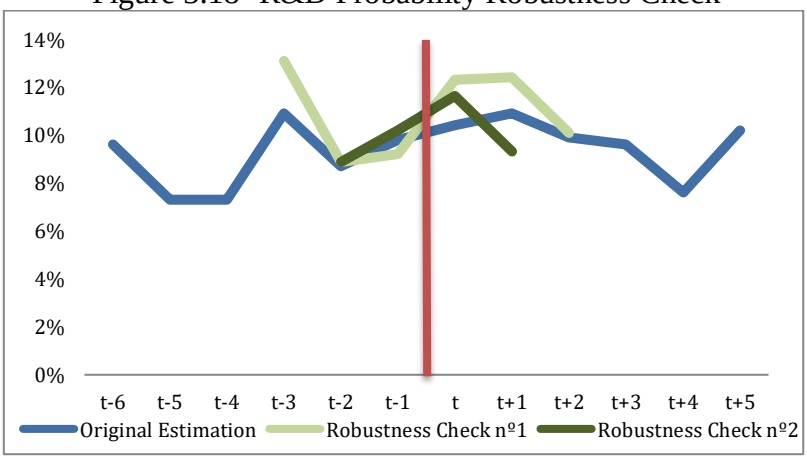
Note: Differential between New Exporter and Domestic firms.
◆ denotes not statistically significant at the 5% level.

Figure 3.17- R&D Expenditure Robustness Check



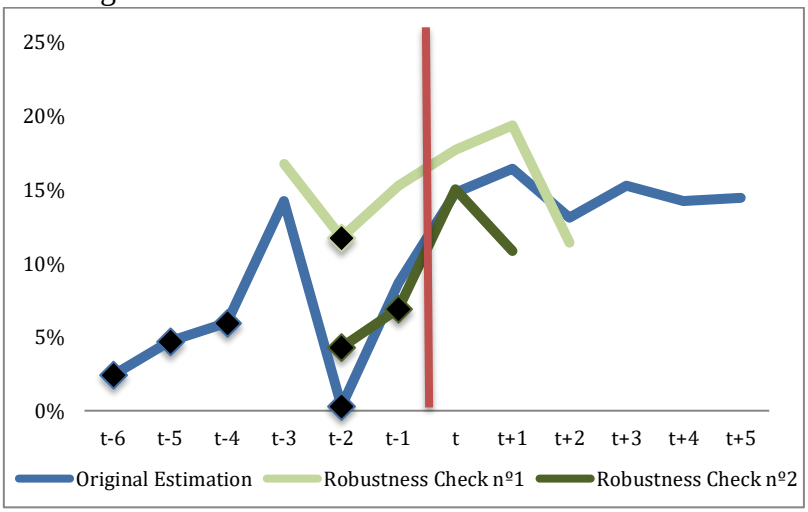
Note: Differential between New Exporter and Domestic firms.

Figure 3.18- R&D Probability Robustness Check



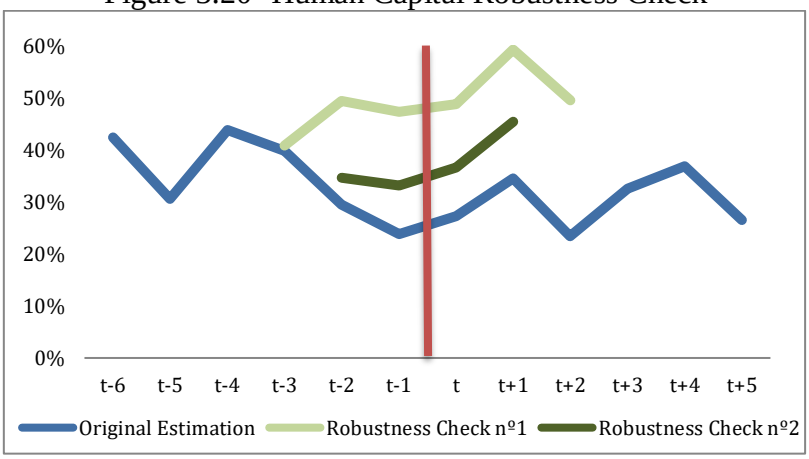
Note: Differential between New Exporter and Domestic firms.

Figure 3.19- Permanent Workers Robustness Check



Note: Differential between New Exporter and Domestic firms.
◆ denotes not statistically significant at the 5% level.

Figure 3.20- Human Capital Robustness Check



Note: Differential between New Exporter and Domestic firms.
denotes not statistically significant at the 5% level.

The results from the Robustness Check nº3 (Table 3.8) confirm again what we have obtained in the original estimation. *New Exporter* firms experienced a very positive and significant increase in size, both in terms of sales and employees, following their entry into the export market. During the first six years exporting, *New Exporter* firms increased their sales by 10% and the total number of employees by 45% on average, compared to the previous six years. Moreover, the entry of firms into export markets is accompanied by an improvement in the quality of employment contracts. Hence, the share of workers with a permanent contract increased by 10% after *New Exporter* firms started to export.

Table 3.8- GLS Results from the Robustness Check nº3

	Average Difference between the pre-entry and post-entry period for New-Exporter firms
Sales	0.093**
	(0.040)
Workers	0.372***
	(0.055)
Productivity	-0.034
	(0.027)
Wages	0.016
	(0.018)
Unit Labour Costs	0.042*
	(0.023)
Margin	-0.168***
	(0.052)
R&D Expenditure	0.377*
	(0.019)
R&D Probability	0.032*
	(0.019)
Permanent Workers	0.096***
	(0.027)
Human Capital	-0.036
	(0.047)
New Exporter firms	304

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Regarding the firm's gross operating margin, we witness a significant decrease during the post-entry period. More precisely, the margin of *New Exporter* firms' decreases by 15% on average after they start to export compared to the pre-entry period. The share of employees with tertiary education does not change following the entry of firms into export markets. Despite the table showing a small decrease of 3%, it is not statistically significant at a 5% level. Regarding the R&D strategy of *New Exporter* firms, we find that during the first six years exporting, these firms increased their R&D expenditure a 46% compared to the previous six years. However, this difference is only significant at the 10% level. Regarding the R&D probability, we witness a small improvement of 3%, but this difference is not statistically significant at a 5% level.

On the other hand, all the variables that showed a U-shaped trend (labour productivity and average wage) or an inverted U-shaped trend (unit labour costs) in the original estimation do not show a positive impact in this second analysis. In fact, in the previous section we established that *New Exporter* firms enjoyed a learning-by-exporting mechanism in terms of productivity, wages and unit labour costs by focusing only in the post-entry period. In other words, we detected an improvement of their performance only in the years exporting: from t+1 to t+3 in terms of productivity, from t to t+3 in terms of wages and from t+1 to t+5 in terms of unit labour costs. However, this *New Exporter* firms used their learning-by-exporting improvements to recover the performance they have lost in the pre-entry period. Hence, in this robustness check, when we compare the performance of the two periods, we do not obtain an overall improvement in these firm characteristics.

Finally, the Robustness Check nº4 (Table 3.9) shows how *New-Exporter* firms performed during the economic crisis period 2008-2013. First, firms that started to export during this period were already larger even before they started exporting, both in terms of sales and employees, compared to *Domestic* firms and they increased these differentials after their entry into export markets, especially in terms of employees. However, it can be noted that the size of this differential varies from the original estimation. In the original estimation, the sales differential showed a gradual increase from 75% in t-2 to 90% in t+1. Nevertheless, in the crisis period, this differential was much more sharp, increasing from 57% in t-2 to 100% in t+1. This phenomenon may be explained by the fact that, during the first years of the crisis, the Spanish internal demand collapsed, equalizing more all the firms in terms of sales (57% in t-2). However, those firms that started to sell to international markets during those years increased their sales quite easily and differentiated rapidly from domestic firms (100% in t+1).

Focusing on the number of employees in the firm, we find the opposite result. While the increase in the employees differential was very sharp in the original estimation (from 105% in t-2 to 190% in t+1), the increase in the crisis period was much more slow (from 130% in t-2 to 158% in t+1). Thus, this may be the result of the high employment destruction (and low employment creation during the recession), when firms were more cautious in hiring workers. Regarding the labour productivity, it can be appreciated that *New-Exporter* firms

experienced as well a U-shaped trend in their productivity level during their internationalization process; however, the decrease in the differential between *New-Exporter* and *Domestic* firms was less pronounced during the crisis period. The analysis of the variable wages offers some different results compared to the original estimation. Now, during the 2008-2013 crisis period, firms entering the export market did not pay higher wages to their employees compared to *Domestic firms.* In t+1, however, the differential becomes statistically significant, around 11%, the same amount than in the original estimation. The explanation of this fact may be the wage contraction policy undertook by many Spanish manufacturing firms during the recession years, aiming at reducing costs and maintaining their competitiveness in such an adverse context.

The gross operating margin of *New-Exporter* firms during this period was not statistically different from the one of *Domestic firms,* similar result to the one obtained in the original estimation. Moreover, the involvement of these firms in R&D was more important compared to *Domestic* firms, both in terms of R&D expenditure and in the probability of performing such activities. The differential in the probability of performing R&D is larger during this period (from 13% to 20%) compared to the original estimation (from 9% to 10%). Moreover, the differential in the R&D expenditure is slightly larger in the crisis period (from 400% to 600%) compared to the original estimation (from 300% to 500%). These facts may be due to the key role that innovation plays in the digitization era in which we are entering, where firms have considerably increased their participation and expenditure in innovation activities.

Regarding the percentage of workers with a permanent contract in the firm, the situation slightly varies during the recent economic crisis compared to the original estimation. In the original estimation, the average estimated difference in terms of permanent workers ranged from 0,3% in t-2 to 16% in t+1, starting to be significant since t-1. However, during the recession, the differential is considerable lower (from 2,6% in t-2 to 12% in t+1) been significant only since t+1. This situation during the period 2008-2013 may be the result of the resistances of managers and employers to transform temporal contracts into permanent ones due, on the one hand, to the large supply of labour force, and, on the other hand, to the uncertainty regarding the future of the market and the economy.

Table 3.9- OLS Results from the Robustness Check nº4

Average estimated difference between New Exporter (Treatment) and Domestic (Control) firms, in logs and in percentage				
	Period			
	t-2	t-1	t	t+1
Sales	0.453*** (0.102) 57.3%	0.530*** (0.095) 69.89%	0.544*** (0.106) 72.29%	0.697*** (0.126) 100.77%
Workers	0.833*** (0.143) *130.02%*	0.837*** (0.119) 130.94%	0.872*** (0.128) 139.17%	0.951*** (0.136) 158.83%
Productivity	0.203*** (0.057) 22.51%	0.194*** (0.062) 21.41%	0.149** (0.064) 16.07%	0.171** (0.082) 18.65%
Wages	0.040 (0.035) 4.08%	0.041 (0.030) 4.19%	0.022 (0.035) 2.22%	0.104** (0.041) 10.96%
Unit Labour Costs	-0.152*** (0.047) -14.10%	-0.144** (0.059) -13.41%	-0.119** (0.060) -11.22%	-0.058 (0.097) -5.64%
Margin	0.096 (0.165) 10.08%	0.143 (0.137) 15.37%	0.180 (0.128) 19.72%	0.185 (0.164) 20.32%
R&D Expenditure	1.957*** (0.551) 607.8%	1.626*** (0.495) 408.3%	1.597*** (0.498) 393.8%	1.771*** (0.574) 487.7%
R&D Probability	0.159*** (0.051) 17.23%	0.132*** (0.043) 14.11%	0.127*** (0.043) 13.54%	0.178*** (0.059) 19.48%
Permanent Workers	0.026 (0.037) 2.63%	0.053 (0.032) 5.44%	0.028 (0.032) 2.84%	0.112*** (0.029) 11.85%
Human Capital	0.221* (0.130) 24.73%	0.299*** (0.112) 34.85%	0.321*** (0.111) 37.85%	0.407*** (0.131) 50.23%
New Exporter firms	69	88	88	62
Domestic firms	772	772	772	772

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Finally, regarding the percentage of skilled workers in the firm, we find that, again, *New-Exporter* firms employed more skilled workers compared to *Domestic* firms. However, there is a sharp increase in the differential during the crisis period, doubling from 24% in t-1 (not significant) to 50% in t+1. This phenomenon may be related to the fact that, during the first years of the crisis, the employment destruction was focused on low-skilled, low-paid and

low-protected jobs. Hence, while low-skilled workers leaved the firm, high-skilled ones remained on it, consequently increasing the average skilled level in the firm.

3.5- Conclusions

In recent years, literature on international trade has focused on learning more about the firm's behaviour in international markets. A number of theoretical models and empirical works have revealed the superior performance of exporters compared to non-exporters. Research has suggested two possible sources of this superiority: the self-selection and the learning-by-exporting hypotheses. While the self-selection hypothesis has collected a remarkable consensus among economists, results regarding the learning-by-exporting hypothesis are far from conclusive.

The empirical literature for Spain has been primarily focused on the connection between productivity and the internationalization process of firms. Hence, we clearly know that Spanish exporters are more productive than Spanish domestic firms even before they start to export. Regarding the effects of exporting on productivity, results are mixed. However we know very little about how exporting affects other characteristics of Spanish manufacturing firms. Hence, the contribution of this chapter is to offer more evidence about the effects of exporting on firm performance.

Using a survey of Spanish manufacturing firms, we analyse the six years previous to the entry into export markets and the first six years exporting of new exporter firms, and we compare their performance with the one of domestic firms. We employ a wide set of variables in order to illustrate the main firm performance variables: labour productivity, total sales, gross operating margin, R&D expenditure, R&D probability, number of employees, wages, employment contracts, human capital and unit labour costs.

The main results show that, firstly, the differential in terms of employees and sales between exporters and non-exporters increases after the first start to export. Secondly, the productivity differential experiences a U-shaped trend, decreasing before the entry in export markets and then increasing during the years exporting. The average wage experience the

same U-shaped trend and the unit labour costs in the firm experience an inverted U-shaped trend. Thirdly, firms lose their advantage in terms of gross operating margin after they start exporting. Fourthly, despite the R&D expenditure increase after firms start exporting, the probability to perform R&D (in other words, the number of innovative firms) remain stable throughout the internationalization process. Finally, the quality of the employment contracts, measured as the percentage of workers with a permanent contract, improves after firms enter the export market.

These results have wide implications for the design of public policy. On the one hand, from a macroeconomic point of view, the most important problem in the Spanish economy is unemployment. At the end of 2016, the average unemployment rate in the country was 18,6%, and in some regions exceeded 28% (Andalucía, Extremadura). On the other hand, from a microeconomic perspective, another relevant problem in Spain is the small size of firms. The average number of employees per employer (a common measure of firm size) was 14.6 in 2010 (Huerta et al. 2014), significantly smaller compared to firms in Germany (18,4), France (19,8) or United Kingdom (31,9). Therefore, we have shown that the entry into export markets is associated to a significant increase in firm size, measured as the number of employees. Hence, a public policy of export promotion among small firms, could serve to solve both macroeconomic and microeconomic problems: the creation of jobs following the internationalization process of firms could help to reduce unemployment and increase firm size.

In 2012, following the recommendations of the IMF, a reform of the labour market was approved in Spain in order to improve labour flexibility and fight against unemployment. Despite the unemployment rate having decreased 8.3 percentage points in the last 4 years, another problem has arisen in the Spanish labour market: temporality. In 2016, 91% of the jobs created in Spain were temporary. Moreover, according to Eurostat, Spain is the second EU member with the highest temporality rate (24%), only behind Poland (28%). The EU average is 14%. Hence, we have shown that the entry into export markets is associated with an increase in the percentage of workers with a permanent employment contract. In this sense, a public policy of export promotion may improve the quality of labour conditions in Spanish manufacturing firms.

Chapter 4

Digitization, firm performance and international trade

4.1- Introduction

"Digitization is not a time of change, but a change of time, bigger than the industrial revolution". These were the words employed by the CEO of *Teléfonica*, the third biggest Spanish firm, after been asked about the implications that the digital revolution may have on the global economy. Indeed, numerous economists, and firm managers are alerting of the disruptive effects of digitization, foreseeing that, as in a natural selection model, only firms and countries that will reach to adapt to digitization will succeed in the times coming. It is undeniable that digitization will transform firms, customers and business models in the close future; nevertheless, the way and the degree in which this revolution will act are, at the time, unknown.

The recent interest on digitization has opened many questions, the first one, clearly: what we understand for digitization? On a recent survey carried out by PwC (Curran et al., 2017) to firm's CEOs from 53 countries, 32% of them answered, "Digitization refers to all technology innovation-related activities". This was the most common answered, followed by "Digital is synonymous with IT" (29% of answers). Furthermore, the World Economic Forum (Baller et al., 2016) defines it as "a transition to a new set of systems that bring together digital, biological, and physical technologies in new and powerful combinations" and Roland Berger (Biecheler et al., 2016) as "the adaptation of the values chains of the different sectors of the economy to the disruptive effect starting with the digital customer". Furthermore, in manufacturing, digitization has been referred as the Industry 4.0 or the Fourth Industrial Revolution. This Industry 4.0 "allows the connection of the physical world -devices, materials, products, machinery and infrastructures- to the digital one –systems" (Spanish Ministry of Industry, 2015). At the firm level, the Fourth Industrial Revolution is translated into the "fundamental idea of boosting efficiency via sensible automation and the existence of the smart factory, that controls the fast-growing complexity and improves production efficiency" (Heng, 2014).

The process of digital transformation is not a recent issue, but in fact, digitization started decades ago. According to Google, there have been four waves of digital transformation until nowadays. The first wave started in the 1980's with the introduction of

the first personal computers in the firm, and when many administrative and productive operations were automatized. The second digitization wave began in the 1990's with the creation of the Internet, the E-commerce and the consequent revolution in sectors such music and travel. The third wave of digital transformation started in 2007 with the launching of the iPhone, and it is related to the increasing use of the smartphones apps. Nevertheless, we are still experiencing the disruptive effects of the global mobile revolution and the fourth digital transformation wave has already begun: the artificial intelligence revolution. This wave of digitization is translated into the irruption of virtual assistants in phones, in the connected house or in the connected car. Moreover, the machine learning revolution, the Big Data, autonomous cars, virtual reality, augmented reality, 3D print or robotics are others examples of the fourth digital transformation wave. The difference with respect past waves is that all these technologies are developing at the same time, and, hence, the disruptive effects of this transformations are still unknown.

The aim of this chapter is to study the role of digitization on the firm performance, with a special focus on the role of digitization in the internationalization process of firms. Until now, research has found that exporters were larger in terms of employees, had larger sales, were more capital intensive, paid higher wages, received higher benefits, invested more per employee and showed higher labour productivity than non-exporter firms (Bernard and Jensen 1995). Among these differences, productivity has been placed at the core of the firm's export decision (Melitz, 2003). Moreover, in the Chapter 2 of this thesis we proved that exporters were better managed than non-exporters and that the difference between exporters and non-exporters was larger in terms of management-quality than in terms of productivity. At this point, we pose the following question: what about digitization? Is digitization a relevant variable in the internationalization process of firms? Are exporters firms more digitized than domestic firms? The aim of this chapter is, therefore, to try to answer these questions.

To do that, we will study heterogeneity in terms of digitization for a sample of Spanish manufacturing firms during the period 2010-2015. We will construct a Digitization Index that will serve as a proxy for the digitization usage in the firm. This Digitization Index is composed by 20 indicators, that can be classified in the following four sub-indexes: R&D

Strategy, ICT, E-commerce and Automation. For our purposes, first of all, we will explore the overall digitization level of Spanish manufacturing firms, in order to obtain a picture of the current situation in terms of digitization in the Spanish economy. Secondly, we will study the link between the Digitization Index and the main variables related to the firm performance: production, number of employees, labour productivity and average wage. Then, we will study how firms differentiate in terms of the Digitization Index according to their internationalization status (domestic, occasional exporter, regular exporter, multinational…). More precisely, we want to see if there exists a digitization premia on more internationalized firms, as well as if there exists a correlation between digitization and the probability of exporting. Finally, in order to test the robustness of our results, we have analysed the role of each of the four digitization sub-indexes both on the firm performance and on the firm internationalization process.

Our main results show that i) the digitization level of Spanish manufacturing firms is medium-low, with a relatively high level on ICT practices and a relatively low level in the Innovation Strategy, ii) there exists a positive and significant correlation between the Digitization Index and the firm's production, total employment, labour productivity and average wage, iii) there exists a digitization premia on exporting firms compared to domestic firms, and on firm investing in foreign countries compared to the rest of firms, iv) this premia is larger on regular exporters compared to occasional exporters and on multinational firms compared to the rest of firms, v) a marginal increase in the Digitization Index is correlated to an increase in the export probability, as well as to an increase in the export propensity (the weight of exported sales on total sales), vi) among the four sub-indexes composing the Digitization Index, the ICT sub-index has the larger impact on firm production and productivity, the R&D strategy sub-index is the most significant in explaining wages and employment and the E-commerce sub-index is the most relevant in order to explain the internationalization status of firms.

The contribution of our chapter to the existence literature is two-fold. Firstly, to our knowledge, this study is the first academic work exploring the digitization heterogeneity across firms within the manufacturing industry throughout a panel data sample and econometric techniques. In this sense, this research is a relevant contribution to the nascent

literature focus on depicting the role of digitization on the firm performance, by providing evidence for a sample of more than 2.500 Spanish manufacturing firms. Secondly, this chapter shed more light to the literature focused on studying the heterogeneity of firms in international markets. We have shown that exporters firms are more digitized than domestic firms even after controlling for firm's productivity. Moreover, we indicate that the most relevant aspect of digitization in the internationalization of firms is the E-commerce practices. Therefore, if we believe on the disruptive effects that digitization may have on firms and on the business models, we cannot ignore the disruptive effects that digitization may have on international trade, and according to our results, this effects are starting throughout the E-commerce.

The rest of the chapter is organized as follows: Section 2 analyses the theoretical framework that supports this research, presenting the main research lines in the technology and international trade field. Section 3 presents the data and methodology employed in this research. It contains a complete description of the dataset and the sample, as well as the methodology used in the econometric analysis. Moreover, we present a description of the main characteristics of the Digitization Index and we introduce others measures of digitization present in the literature. Section 3 presents the main results obtained from the econometric analysis, with the corresponding robustness checks. Finally, Section 5 highlights the main conclusions of this research and suggests some implications for public policy.

4.2- Theoretical framework

Despite digitization has received an enormous interest from international organisms and consultancy reports, few academic studies have approached this issue at the firm level. Digitization is a relatively recent term and the interest on its disruptive effects on the business models is a relatively recent phenomenon. However, since the appearance of the first personal computers in the 1980's and the launching of the Internet in the 1990's, many scholars have tried to analyse the impact of such new technologies on the economy. Among all the literature regarding ICT, two main issues have focused the interest of the research in this field. On the one hand, scholars have investigated the role of ICT on the labour market, more precisely, the impact of the ICT adoption on employment, skills and wages. On the other hand, research has

tried to account for the impact of ICT on productivity, both at the firm and at the country level.

Regarding the impact of ICT adoption on the labour market, recent academic research have found a complementary effect between technology and workers in both upper and lower extremes of the skill distribution, and a substitution effect in intermediate skill level (Autor 2015, Acemoglu and Autor 2012), resulting in a subsequent job polarization. However, these results may depend on the industry and the period analysed (OECD 2012a, OECD 2016). Regarding the effect of ICT on productivity, we expect, from a theoretical point of view, a positive impact of ICT both on TFP and on labour productivity, precisely due to the efficiency improvement following the adoption of such reducing costs technologies. Nevertheless, results regarding the link between ICT and productivity are mixed. Some studies found a positive effect of ICT investment on productivity, see Kretschmer (2012) for a literature review, while others find some limited results (Acemoglu et al. 2014, Jorgenson et al. 1999, Jorgenson et al. 2011). Finally, some studies have as well measure the impact of the E-commerce practices on the firm's productivity (Criscuolo 2003, OECD 2004), the firm's growth (OECD 2012b) and the performance of SMEs (OECD 2005).

More recent research has been focused on the concept of digitization as a whole and its effects on the firm performance. Diermeier and Goecke (2017), for a sample of EU countries, analysed the relationship between digitization, technology diffusion and productivity. They established that the current low TFP growth is driven by the fact that digitization is still lacking productivity-enhancing complementarity innovations, concluding furthermore that digitization will be the driving force behind future productivity progress. In this line, Labaye et al. (2015), for the sample of the G-20 countries, outlined the potential for digital technologies and business innovations to raise productivity and increase employment. Maiti and Kayal (2017), for a sample of Indian SMEs, found that digitization improves the performance of those firms, trough the automation of products and processes, resulting in a general increase in the quality of products. Moreover, they indicated that digitization improves the access to finance to Indian SMEs by providing alternative financing options, which is ultimately correlated to an improvement in the profitability and productivity of those firms.

Other studies have focused on the heterogeneity of digitization practices across industries. Manyika et al. (2016) found that the most digital companies, in terms of digital usage, are leaving the rest behind. “Digital engagement between companies and their suppliers and users is five time larger in the leading sectors than in others”, and concluding that this divergence in terms of digitization is translated into divergence in terms of productivity growth. More precisely, Grossman (2016) identified the leading and lagging sectors. On the one hand, the leading sectors are the media, the telecom, the consumer financial services, music and travel. The last two industries were hit early by the digital competition and have already undergone profound transformation (Westerman et al., 2013). On the other hand, the manufacturing sector presents the lower level of digital usage, precisely due to the lower competition level coming from higher barriers to entry, and the perception that a smaller part of their business can be digitized (Grossman, 2016).

On the other hand, regarding recent international trade literature, research has primarily focused on the role of firm heterogeneity in international markets. Thanks to the increasing availability of data at firm level, research has revealed the existence of substantial differences between exporters and non-exporters. The first people to undertake an empirical study about exporting across firms and between industries were Bernard and Jensen (1995). Thanks to a panel data of US manufacturing firms between 1976 and 1987, they found remarkable differences between exporter and domestic firms. Specifically, they discovered that exporters were larger in terms of employees, had larger sales, were more capital intensive, paid higher wages, received higher benefits, invested more per employee and showed higher labour productivity than non-exporter firms.

Hence, literature regarding digitization or ICT has been focused on the role of such phenomenon of the global firm performance. However, we know very little about the disruptive effects that digitization may have on international trade. This is precisely the main motivation and contribution of our analysis: to offer more evidence about the role of digitization heterogeneity in the internationalization process of firms.

4.3- Data and methodology

4.3.1- Data

The data source used in this research is the Survey of Firms' Business Strategies (ESEE) drawn up by the Spanish Ministry of Industry and the SEPI Foundation. This data set is an annual survey, which refers to a representative sample of Spanish manufacturing firms, according to industry and size. The survey applies random sampling for firms with 10 to 200 workers and exhaustive sampling for firms with 200 or more workers. The period analysed in this research is 2010-2015 (6 years). Some firms answer every year while others do not, which makes the dataset an unbalanced panel.

Table 4.1- Sample description and representativeness

Year	Nº of observations	Percentage
2010	2.006	18,99%
2011	1.816	17.19%
2012	1.869	17,69%
2013	1.683	15,93%
2014	1.525	14,43%
2015	1.666	15,77%
Total	10.565	100%

Presence in the sample during	Nº of firms	Percentage
1 year	500	19,75%
2 years	232	9,16%
3 years	149	5,88%
4 years	321	12,68%
5 years	110	4,34%
6 years	1.220	48,18%
Total	2.532	100%

Spanish Economy in 2015		Firms	%
Manufacturing firms with more than 10 employees	Between 10 and 50 employees	21.236	82%
	Between 50 and 200 employees	3.627	14%
	More than 200 employees	974	4%
	Total	25.837	100%

Our sample		Firms	%
Manufacturing firms with more than 10 employees	Between 10 and 50 employees	1.342	53%
	Between 50 and 200 employees	756	30%
	More than 200 employees	434	17%
	Total	2.532	100%

Table 4.1 presents a summary of the sample and its representativeness, showing the distribution of observations across years and the persistence of firms in the sample. As it can be noted, all the calendar years from 2010 to 2015 are approximately equally represented in the sample. Moreover, almost 50% of the firms are present in the sample during all the period analysed (6 years). Finally, our sample (2.532 firms) represents approximately the 10% of all the universe of Spanish manufacturing firms with more than 10 employees (25.837). Regarding the distribution of firms according to the number of employees, our sample is slightly biased towards large firms, precisely due to this exhaustive sampling for large firms performed by the ESEE.

4.3.2- Digitization Index

The Digitization Index is a multi-dimensional index covering all the aspects related to the digitization process within the firm. It has been elaborated trough the variables present in Survey of Firms' Business Strategies (ESEE). The Digitization Index contains 20 indicators that may be divided into the following four sub-indexes, according to the four dimensions of digitization within the firm:

- *Innovation Strategy*: 4 indicators
- *ICT*: 5 indicators
- *E-commerce*: 6 indicators
- *Automation*: 5 indicators

All the indicators are binaries, in other words, when asked about the use of these indicators, the firm's only possible answers are yes or no. All the indicators are constructed as follows:

$$X_{it} = \begin{cases} 1, \text{ if firm } i \text{ in year } t \text{ performs the indicator X (it has answered "yes")} \\ 0, \text{ if firm } i \text{ in year } t \text{ does not perform the indicator X (it has answered "no")} \end{cases}$$

where X is the value of the indicator, *i* is the firm and *t* is the year.

To construct each sub-index, we enter the value of each indicator in each sub-index, and then, to build up the Digitization Index, we add the values of each sub-index. The Digitization Index thus reflects the number of digitization practices performed by the firm, and it ranges between 0 and 20. In other words, the higher the value of the Digitization Index, the more the firm's digitization level.

Our Digitization Index is not the first index that has been elaborated to measure the level of digitization on firms or countries. In 2016, the McKinsey Global Institute (MGI) measured the level of digitization on a sample of US firms. They employed 27 indicators divided in three categories: *digitization of assets* (connected machines, smart buildings, big data, investment in software…); *digitization of operations* (digital payments, digital marketing, e-commerce platforms, social networks…); and *digitization of the workforce* (worker use of digital tools, digitally skilled workers, new digital jobs and roles…).

Moreover, the European Commission, in its Digital Transformation Scoreboard Report (2017), analysed digitization across firms in the 28 EU Member States on the automotive, mechanical engineering, healthcare and pharmaceutical industries. They identified 7 key technologies (social media, mobile services, cloud technologies, Internet of things, ciber-security solutions, robotic and automated machinery, big data and data analytics), dividing all the digitization aspects into *enablers* (digital infrastructure, investments and access to finance, supply and demand of digital skills, e-leadership, entrepreneurial culture) and *outcomes* (ICT start-up, Integration of Digital technology).

The ADEI observatory (2014) elaborated a Firm Digitization Index, including 14 indicators from Eurostat and the Digital Agenda Scoreboard (European Commission). This index was divided into 6 categories: *accessibility* (firms with broadband access, persons employed using computers with access to the Internet, persons employed with a portable device that allows a mobile connection to the Internet); *affordability* (monthly price of Fixed Broadband standalone Internet Access offers); *reliability* (total investment in networks by the electronic communications sector); *capacity* (quality of Broadband Services in the EU); *utility* (firms purchasing online, firms selling online, last online purchase, firms sending and/or receiving e- invoices, firms using the Internet for interacting with public authorities, use any

social media); *human resources* (firms that employed ICT/IT specialists, firms that provided training to develop/upgrade ICT skills of their personnel).

Roland Berger (Biecheler et al., 2016) carried out a survey to 130 Spanish firms (both IBEX-35 firms and leading medium companies) about their digitization practices. The survey asked about four aspects: *Automation* (robotics, production integrated systems, 3D print), *Connectivity* (cloud, broadband, smart electric network), *Digital Information* (Big Data, Internet of Things, augmented reality, wearable), *Digital Access to Customers* (social networks, Phone App).

Finally, Katz and Callorda (2016) measured the digitization level of the production process on a sample of Iberoamerican countries (Spain, Portugal, Chile, Argentina, Brazil and Mexico). Their Industrial Digitization Index measured the digitization level across the firm value chain. The Index is divided into 4 categories, precisely corresponding to four stages of the value chain: *Infrastructure* (use of computers, Internet, Intranet, Extranet and LAN); *Inputs* (online access to information about good and services, online access to information about the government, online interaction with the government, online banking access, online delivery of inputs purchase orders); *Processing* (% of workers using computers, % of workers using Internet, % of workers using email, use of video call, use of IM and Bulletin Boards, online training, online recruiting); *Distribution* (web page existence, online reception of purchase orders, use of Internet for product delivery, online customer support).

Table 4.2 presents a summary of our Digitization Index, the four sub-indexes, and the 20 indicators. Hence, our Digitization Index combines some elements present in other indexes in the literature: our *Innovation Strategy* sub-index is closely related to the e-leadership enabler element present in the European Commission index. Our *ICT* sub-index is related to the *digitization of assets* category, in the index elaborated by the McKinsey Global Institute. Our *E-commerce* sub-index is linked to the *digitization of operations* category in the McKinsey index, to the *utility* category in the ADEI index, and to the *Distribution* stage in the Katz and Callorda index. Finally, our *Automation* sub-index can be compared to the *Automation* category in the Roland Berger Index. Table 4.3 presents the main descriptive statistics and correlations of our Digitization Index and the sub-indexes.

Table 4.2- Summary of the Digitization Index

Index	Sub-Index	Indicator	Category
Digitization Index	Innovation Strategy	Technological guidance or committee	Dummy
		Evaluation of technological change prospects	Dummy
		Evaluation of alternative technologies	Dummy
		Performs R&D activities	Dummy
	ICT (Information and Communication Technologies)	Process innovations of software	Dummy
		Investment in computer equipment	Dummy
		External expenditure on computer and communication technologies training	Dummy
		Computer programming services	Dummy
		Computer package implementation services	Dummy
	E-commerce	Online sales to firms	Dummy
		Online sales to final customers	Dummy
		Online purchases from suppliers	Dummy
		Web page on the firm server	Dummy
		Own internet domain	Dummy
		Online sales impact indicator	Dummy
	Automation	Local Area Network (LAN) on production	Dummy
		Computer Aid Design	Dummy
		Robotics	Dummy
		Numerical Control Machine Tools	Dummy
		Integrated Systems	Dummy

Table 4.3- Descriptive statistics and correlations of the Digitization Index and the sub-indexes

Variable	Mean	Median	Min	Max	St. Dev	Innovation Strategy	ICT	E-commerce	Automation
Digitization Index	7.635	7	0	20	3.884				
Innovation Strategy	1.022	0	0	4	1.421	1.000			
ICT	2.587	3	0	5	1.074	0.447	1.000		
E-commerce	2.088	2	0	6	1.433	0.224	0.273	1.000	
Automation	1.938	2	0	5	1.644	0.350	0.372	0.233	1.000

Figures 4.1 and 4.2 present the distribution of the Digitization Index according to firm's size and firm's productivity. As it can be appreciated, there is a positive linear correlation between the digitization level and the number of employees in the firm. However, the link between productivity and digitization is not so clear. Figure 4.3 offers the level of digitization on the 2.532 Spanish manufacturing firms present in our sample. It can be noticed that the majority of firms (46%) have a Digitization Index ranged between 5-10, representing a medium-low digitization level. Noticed as well that only 31% of firms perform more than 10 (the half) digitization indicators and only 5% more than 15 indicators. Therefore, it can be deduced, together with the information present in Table 4.3, that the overall digitization level on Spanish manufacturing firms is medium-low.

Figure 4.1- Digitization Index and Firm Size

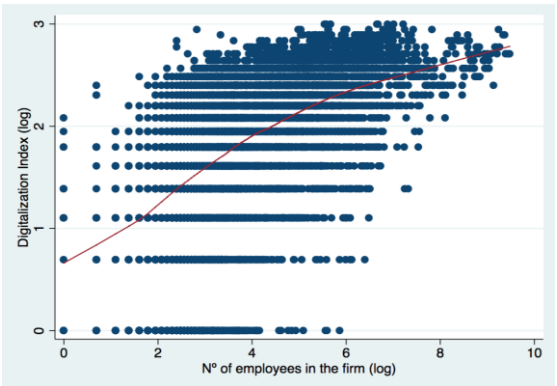


Figure 4.2- Digitization Index and Productivity

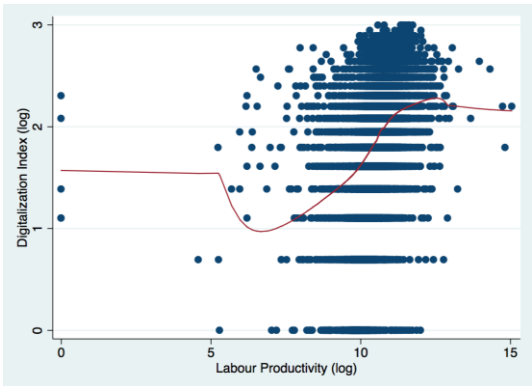


Figure 4.3- Digitization Index on Spanish firms

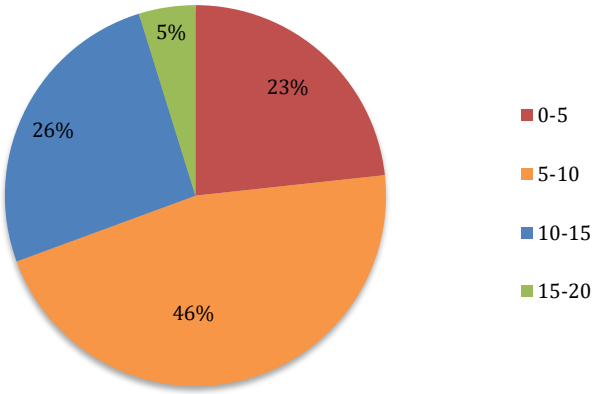
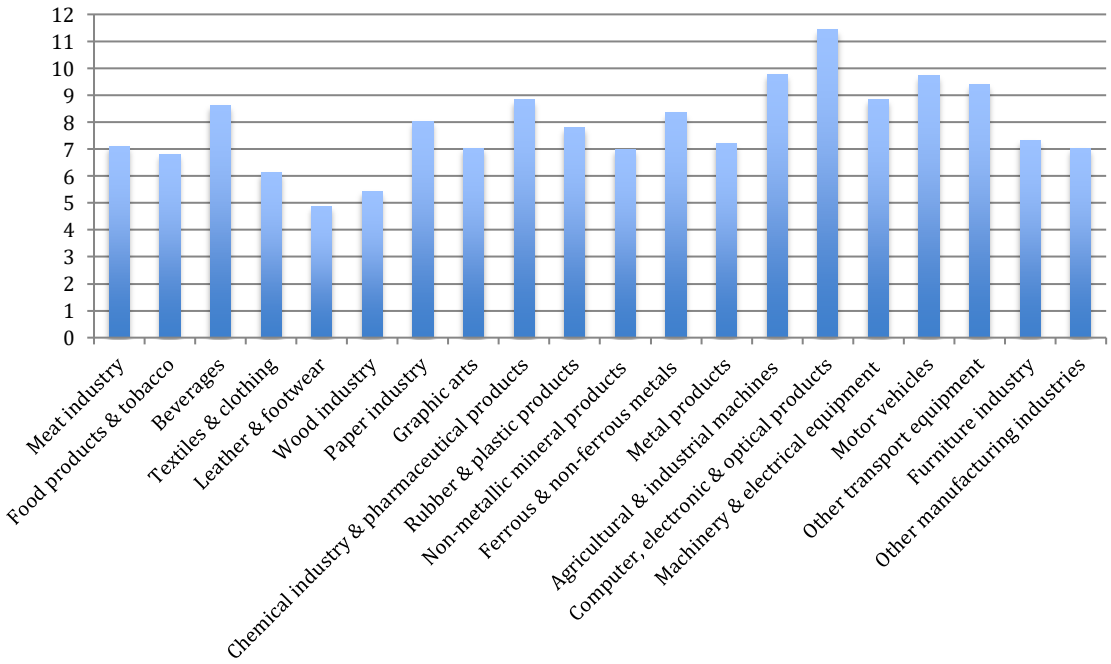


Figure 4.4 presents the average Digitization Index across industries. It can be noticed that there exists a considerable level of heterogeneity in terms of digitization across industries. The most digitized industry is "Computer, electronic and optical products" with an average Digitization Index of 11.4. The following top industries in terms of digitization are "Agricultural and Industrial machines" (9.8), "Motor vehicles" (9.7) and "Other transport equipment" (9.4). At the other side of the distribution, "Leather and Footwear" (4.9) and "Wood industry" (5.4) are the industries less digitized in the Spanish economy.

Figure 4.4- Average Digitization Index across industries



Figures 4.5 to 4.8 present the level of digitization regarding the four sub-indexes present in the Digitization Index. As it can be appreciated, the *Innovation Strategy* sub-index offers the lower performance, where 82% of firms perform less than half of all the possible indicators, and 69% only perform 0 or 1 indicators. On the contrary, the *ICT* sub-index presents the best performance, where 50% of firms perform more than 2 indicators and only 11% perform 0 or 1. Finally, firms show an intermediate performance in the *E-commerce* and the *Automation* sub-indexes, where 62% and 65% of firms performing less than 2 indicators, respectively.

Figure 4.5- Innovation Strategy on Spanish firms

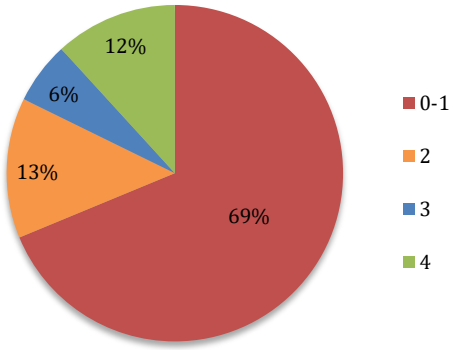


Figure 4.6- ICT on Spanish firms

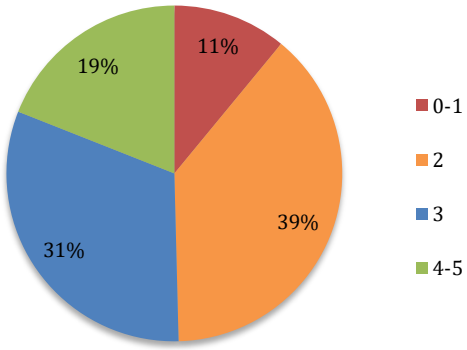


Figure 4.7- E-commerce on Spanish firms

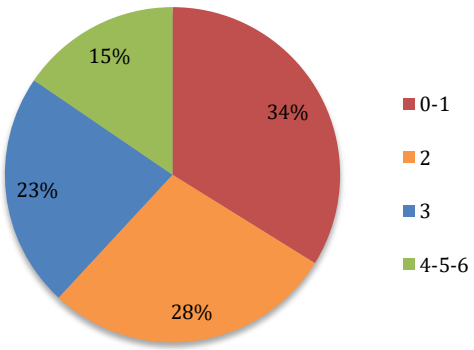
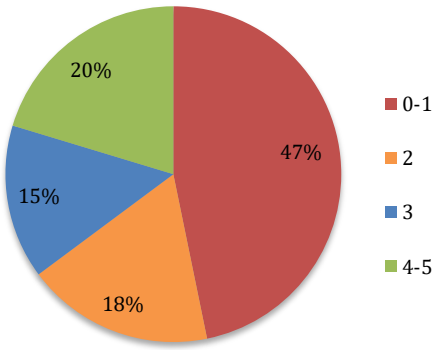


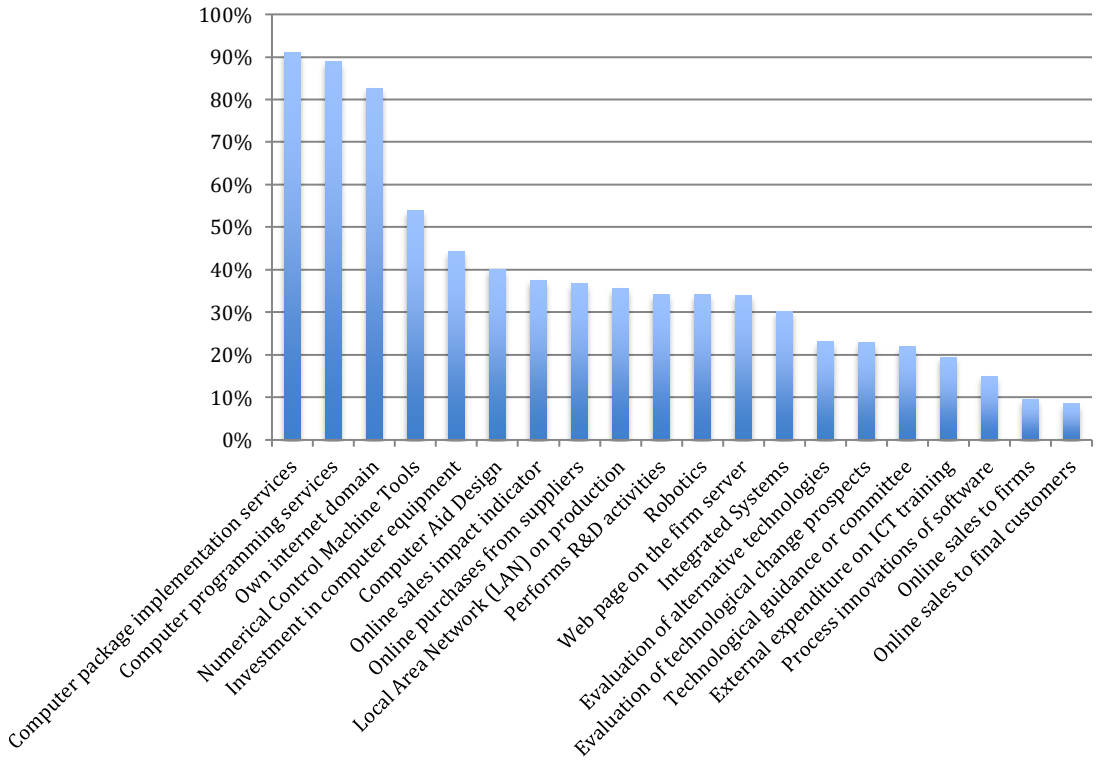
Figure 4.8- Automation on Spanish firms



Finally, Figure 4.9 reflects the presence of the 20 indicators conforming the Digitization Index within Spanish firms. There are three indicators present in almost all the firms in the sample: “Computer package implementation services” (present in 91% of the firms), “Computer programing services” (89%), and “Own internet domain” (83%). The gross part of the distribution appears after these elements, where the majority of indicators are performed by 30-50% of the firms. At the bottom of the distribution are present two variables

belonging to the *E-commerce* sub-index: "Online sales to firms" (9,5%) and "Online sales to final customers" (8,5%).

Figure 4.9- Digitization indicators present on Spanish firms



4.3.3-Methodology

The aim of this chapter is to analyse the role if digitization in the firm performance with a special interest on the role of digitization in the firm internationalization process. First of all, we will study the connection between digitization and the main firm characteristics: production, total employment, labour productivity and the average wage in the firm.

- Digitization Index and main firm characteristics (GLS random effects estimation):

$\ln(Y_{it}) = c + \beta_1 \ln(Digitization\ Index_{it}) + \beta_1 \ln(X_{it}) + \beta_j\, Industry\ Dummies_{it} + \varepsilon_{it}$

where Y_{it} represents the four firm characteristics (production, employment, productivity and wage) and X_{it} represent a set of controls (capital, employment, capacity utilization, production, human capital, wage, capital per worker and size dummies)

Once we have accounted for the role of digitization within the firm, we will proceed to estimate the role of digitization on the internationalization process. Firstly, we will explore if there exists a digitization bonus or premia on exporter firms, compared to domestic firms and on firms investing on foreign countries compared to the rest of firms. Moreover, we will extent this analysis in order to compare firms according to their internationalization status: regular exporter vs. occasional exporters; small exporters vs. large exporters (in terms of export propensity).

- Digitization Index and internationalization status (GLS random effects estimation):

$$\ln(\textit{Digitization Index}_{it}) = c + \beta_1 \ln(X_{it}) + \beta_2 \ln(\textit{Productivity}_{it}) + \beta_3 \ln(\textit{Human Capital}_{it}) + \beta_j \textit{Size Dummies}_{it} + \beta_k \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

where X_{it} represent the different stages of firms regarding the internationalization process (domestic, exporter, foreign investor, occasional exporter, regular exporter, multinational, big exporter and small exporter).

Then, we will check if there exists a connection between a marginal increase in the Digitization Index and the probability of exporting.

- Digitization Index and Export Probability (Logit random effects estimation):

$$\ln(\textit{Export}_{it}) = c + \beta_1 \ln(\textit{Digitization Index}_{it}) + \beta_2 \ln(\textit{Productivity}_{it}) + \beta_3 \ln(\textit{Human Capital}_{it}) + \beta_j \textit{Size Dummies}_{it} + \beta_k \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

Furthermore, we will account for the link between a marginal increase in the Digitization Index and the export propensity.

- Digitization Index and Export Propensity (GLS random effects estimation):

$$\ln(\textit{Export Propensity}_{it}) = c + \beta_1 \ln(\textit{Digitization Index}_{it}) + \beta_2 \ln(\textit{Productivity}_{it}) + \beta_3 \ln(\textit{Human Capital}_{it}) + \beta_j \textit{Size Dummies}_{it} + \beta_k \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

Table 4.4 presents a summary of all the variables that will be employed in our analysis, together with their definition. Finally, in order to test the robustness of our results, we will

repeat all the estimations made with the Digitization Index, to the four sub-indexes (Innovation Strategy, ICT, E-commerce and Automation):

- Digitization sub-indexes and main firm characteristics (GLS random effects estimation):

$$\ln(Y_{it}) = c + \beta_1 \ln(X_{it}) + \beta_2 \ln(K_{it}) + \beta_j \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

where Y_{it} represent the three firm characteristics (production, employment, productivity and wage), X_{it} represents the four digitization sub-indexes (Innovation Strategy, ICT, E-commerce and Automation), and K_{it} represent a set of controls (capital, employment, capacity utilization, production, human capital, wage, capital per worker and size dummies)

- Digitization sub-indexes and internationalization status (GLS random effects estimation):

$$\ln(Y_{it}) = c + \beta_1 \ln(X_{it}) + \beta_2 \ln(\textit{Productivity}_{it}) + \beta_3 \ln(\textit{Human Capital}_{it}) + \beta_j \textit{Size Dummies}_{it} + \beta_k \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

where Y_{it} represents the four digitization sub-indexes (Innovation Strategy, ICT, E-commerce and Automation) and X_{it} represents the different stages of firms regarding the internationalization process (domestic, exporter, foreign investor, occasional exporter, regular exporter, multinational, big exporter and small exporter).

- Digitization sub-indexes and Export Probability (Logit random effects estimation)

$$\ln(\textit{Export}_{it}) = c + \beta_1 \ln(X_{it}) + \beta_2 \ln(\textit{Productivity}_{it}) + \beta_3 \ln(\textit{Human Capital}_{it}) + \beta_j \textit{Size Dummies}_{it} + \beta_k \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

where X_{it} represents the four digitization sub-indexes (Innovation Strategy, ICT, E-commerce and Automation).

- Digitization sub-indexes and Export Propensity (GLS random effects estimation):

$$\ln(\textit{Export Propensity}_{it}) = c + \beta_1 \ln(X_{it}) + \beta_2 \ln(\textit{Productivity}_{it}) + \beta_3 \ln(\textit{Human Capital}_{it}) + \beta_j \textit{Size Dummies}_{it} + \beta_k \textit{Industry Dummies}_{it} + \varepsilon_{it}$$

where X_{it} represents the four digitization sub-indexes (Innovation Strategy, ICT, E-commerce and Automation).

Table 4.4- Variables employed in the analysis and their definition

Digitization Index	Value of the Digitization Index.
Innovation Strategy	Value of the Innovation Strategy Sub-Index
ICT	Value of the ICT Sub-Index
E-commerce	Value of the E-commerce Sub-Index
Automation	Value of the Automation Sub-Index
Production	Value of the production of good and services, in €
Employment	Average number of employees
Productivity	Labour Productivity, in constant € of 2010, deflated by 2-digit industry aggregation. Value added per worker, measured as the sum of sales, change in inventories and other management costs, minus the purchases and the external services; divided by the average number of employees.
Wages	Average wage in the firm, in €
Capital	Total value of the fixed assets, minus the accumulated depreciation and provisions, in €
Capacity Utilization	Annual average use of the firm standard production capacity
Human Capital	Share of workers with tertiary education, in percentage
Small	1- if firm *i* has less than 50 employees in year *t* 0- otherwise
Medium	1- if firm *i* has between 50 and 200 employees in year *t* 0- otherwise
Large	1- if firm *i* has more than 200 employees in year *t* 0- otherwise
Export	1- if firm *i* export in year *t* 0- otherwise
FDI	1- if firm *i* perform FDI activities in year *t* 0- otherwise
Domestic	1- if firm *i* neither exports nor carries out FDI in any year 0- otherwise
Occasional Exporter	1- if firm *i* export some years and others do not 0- otherwise
Regular Exporter	1- if firm *i* exports in every year but is not involved in FDI in any year 0- otherwise
Multinational	1- if firm *i* exports and is involved in FDI in every year 0- otherwise
Small Exporter	1- if firm *i* exports less than 20% of the sales in year t 0- otherwise
Big Exporter	1- if firm *i* exports more than 20% of the sales in year t 0- otherwise
Export Propensity	Share of exported sales, in percentage

4.4 - Results

Table 4.5 presents the main results regarding the role of digitization on a set of firm characteristics. It can be noticed that the Digitization Index is tightly connected to all the variables related to the firm performance. More precisely, a 1% increase in the Digitization Index is correlated to a 0.12% increase in total production[5], a 0.07% increase in the employment in the firm, a 0.12% increase in the firm labour productivity and a 0.06% increase in the firm average wage. All these results are statistically significant at the 1% level, after controlling for a set of firm's characteristics. Hence, the digitization process itself is a source of improvement of the firm performance, both in terms of production and employment growth, and in terms of competitiveness (labour productivity) and staff commitment (average wage). Indeed, an increase in the Digitization Index has the larger and positive effect on the firm's production and productivity and a lower effect on the firm's average wage and total employment

Table 4.6 offers the main results regarding the role of digitization on the internationalization process of the firm. Regression (1) shows that firms exporting have a Digitization Index that is 21% larger compared to firms that are not exporting[6]. Moreover, Regression (2) indicates that firms investing in foreign markets have a Digitization Index that is 11% larger compared to firms that do not invest in foreign markets. Regarding the regularity in the internationalization status, Regression (3) signals that occasional exporters (firms exporting some years and others do not), regular exporters (firms exporting all the years) and multinational firms (firms exporting and performing FDI all the years) are more digitized compared to domestic firms. More precisely, compared to domestic firms, occasional exporters have a Digitization Index 43% larger, regular exporter have a Digitization Index 66% larger, and multinational firms have a Digitization Index 101% larger.

[5] Equation (1) offers a simplified version of a production function, including labour, capital and capacity utilization.

[6] To transform differences in logs into differences in percentage, we have followed the process suggested by Halvorsen and Palmquist (1980): "take the antilogarithm (base e) of the estimated coefficient of the dummy variable, subtract 1, and multiply the difference by 100".

Table 4.5- Digitization Index and main firm characteristics.
Results from the GLS random effects estimation.

	Production (logs) (1)	Employment (logs) (2)	Productivity (logs) (2)	Wage (logs) (3)
Digitization Index (logs)	0.120*** (0.016)	0.068*** (0.011)	0.121*** (0.018)	0.065*** (0.009)
Capital (logs)	0.051*** (0.009)			
Employment (logs)	0.922*** (0.027)			
Capacity Utilization (logs)	0.313*** (0.039)			
Human Capital (logs)	0.046*** (0.008)	-0.066 (0.006)	0.032*** (0.009)	0.040*** (0.005)
Production (logs)		0.605*** (0.011)		
Wage (logs)		-0.557*** (0.030)	0.385*** (0.049)	
Capital per worker (logs)			0.040*** (0.009)	
Productivity (logs)				0.056*** (0.009)
Medium			0.198*** (0.027)	0.033** (0.015)
Large			0.315*** (0.034)	0.068*** (0.020)
Industry Dummies	YES	YES	YES	YES
R^2	0.890	0.879	0.347	0.406

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Finally, regarding the export propensity, Regression (4) highlights that both small exporters (firms exporting less than 20% of total sales) and large exporters (firms exporting more than 20% of total sales) have a larger Digitization Index compared to domestic firms. However, these differences (21% and 22%) are not statistically different, in other words, despite there exists a digitization difference between exporters and domestic firms, there is no a digitization difference among exporters according to the share of exported sales. All the previous results are statistically significant at the 1% level after controlling for firm productivity, human capital, size and industry. Noticed as well that there exists a connection between productivity and digitization, where a 1% increase in productivity increases the Digitization Index around 4.6%. Moreover, in all the regressions the size dummies (Medium

and Large) are positive and statistically significant, suggesting that larger firms, in terms of employment, are as well more digitized.

Table 4.6- Digitization Index and Internationalization.
Results from the GLS random effects estimation.

	Digitization Index (logs)			
	(1)	(2)	(3)	(4)
Export	0.192***			
	(0.018)			
FDI		0.100***		
		(0.022)		
Occasional exporter			0.359***	
			(0.037)	
Regular exporter			0.507***	
			(0.030)	
Multinational			0.696***	
			(0.038)	
Small exporter				0.189***
				(0.018)
Big exporter				0.201***
				(0.021)
Productivity (logs)	0.044***	0.047***	0.039***	0.044***
	(0.008)	(0.008)	(0.008)	(0.008)
Human Capital (logs)	0.053***	0.058***	0.043***	0.053***
	(0.009)	(0.009)	(0.009)	(0.009)
Medium	0.250***	0.270***	0.187***	0.249***
	(0.026)	(0.027)	(0.026)	(0.027)
Large	0.395***	0.415***	0.303***	0.393***
	(0.026)	(0.027)	(0.027)	(0.026)
Industry Dummies	YES	YES	YES	YES
Differences between coefficients			Occasional exporter/Regular exporter: 0.000 Regular exporter/Multinational: 0.000	Small Exporter/Big Exporter: 0.351
R^2	0.417	0.373	0.425	0.417

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 4.7 presents the results regarding the role of digitization in the probability of exporting and in the export propensity. Regression (1) indicates that a 1% increase in the Digitization Index is correlated to a 2.8% increase in the export probability. In addition, Regression (2) signals that a 1% increase in the Digitization Index is correlated to a 0.19% increase in the export propensity. Notice that all this results are positive and statistically significant at the 1% level after controlling for firm productivity, human capital size and industry.

Table 4.7- Digitization Index, Export Probability and Export Propensity. Results from the Logit random effects estimation (1) and the GLS random effects estimation (2)

	Export Probability (logs) (1)	Export Propensity (logs) (2)
Digitization Index (logs)	2.838***	0.190***
	(0.261)	(0.034)
Productivity (logs)	0.544***	0.010
	(0.179)	(0.021)
Human Capital (logs)	0.913***	0.098***
	(0.170)	(0.019)
Medium	4.025***	0.627***
	(0.510)	(0.071)
Large	6.403***	0.823***
	(0.706)	(0.083)
Industry Dummies	YES	YES
R^2	-	0.313

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

In order to test the validity of our results, we have performed several robustness checks. More precisely, the aim of the robustness checks is to explore whether the importance of digitization on the firm performance and on the firm internationalization process is focused on a single digitization aspect, or, on the contrary, is presented on all the digitization aspects conforming our Digitization Index. Therefore, we will repeat all the previous estimations on Tables 4.5, 4.6 and 4.7, but now, instead of analysing the overall Digitization Index, we will introduce in the regressions the four sub-indexes: Innovation Strategy, ICT, E-commerce and Automation.

Table 4.8 offers the results regarding the link between firm size and the four digitization sub-indexes. The firm size is measured as the firm's production on Regressions (1) to (4) and as the firm's total employment on Regressions (5) to (8). Regressions (1) to (4) show that all the sub-indexes are correlated to the firm's production, after controlling for a set of firm's characteristics. More precisely, a 1% increase in the R&D Strategy sub-index is correlated to a 0.05% increase in the firm's production. Moreover, a 1% increase in the ICT sub-index is correlated to a 0.08% increase in the firm's production. In addition, a 1% increase in the E-commerce sub-index is correlated to a 0.02% increase in the firm's production. Finally, a 1% increase in the Automation sub-index is correlated to a 0.06% increase in the firm's production.

Table 4.8- Firm Size and Digitization Sub-Indexes.
Results from the GLS random effects estimation.

	Production (logs)				Employment (logs)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R&D Strategy (logs)	0.053*** (0.013)				0.053*** (0.011)			
ICT (logs)		0.079*** (0.014)				0.032*** (0.011)		
E-commerce (logs)			0.022** (0.010)				0.014** (0.007)	
Automation (logs)				0.063*** (0.012)				0.043*** (0.009)
Capital (logs)	0.053*** (0.009)	0.053*** (0.009)	0.054*** (0.009)	0.053*** (0.009)				
Employment (logs)	0.935*** (0.027)	0.933*** (0.027)	0.940*** (0.027)	0.933*** (0.027)				
Capacity Utilization (logs)	0.313*** (0.039)	0.311*** (0.039)	0.313*** (0.039)	0.314*** (0.040)				
Human Capital (logs)	0.050*** (0.008)	0.051*** (0.008)	0.051*** (0.008)	0.050*** (0.008)	-0.004 (0.006)	-0.004 (0.006)	-0.004 (0.006)	-0.005 (0.006)
Production (logs)					0.612*** (0.011)	0.612*** (0.011)	0.614*** (0.011)	0.618*** (0.012)
Wage (logs)					-0.554*** (0.030)	-0.563*** (0.030)	-0.553*** (0.030)	-0.556*** (0.029)
Industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.888	0.889	0.888	0.888	0.880	0.879	0.878	0.880

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Regarding the connection between the sub-indexes and the employment in the firm, it can be noticed in Regressions (5) to (8) that, again, an increase in any of the four digitization sub-indexes is correlated to an increase in the firm employment. More precisely, 1% increases in the R&D Strategy, ICT, E-commerce and Automation sub-indexes are correlated to 0.05%, 0.03%, 0.01% and 0.04% increases, respectively, in the firm total employment. Hence, it can be noticed that among the four sub-indexes, the ICT has the larger impact on firm's production and the R&D strategy has the larger impact on the firm's total employment. Moreover, the E-commerce sub-index is the one that has the lower impact in the firm production and the firm's total employment.

Table 4.9- Productivity, Wages and Digitization Sub-Indexes.
Results from the GLS random effects estimation.

	Productivity (logs)				Wages (logs)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R&D Strategy (logs)	0.046**				0.047***			
	(0.018)				(0.007)			
ICT (logs)		0.143***				0.022**		
		(0.021)				(0.009)		
E-commerce (logs)			0.036**				0.012**	
			(0.015)				(0.006)	
Automation (logs)				0.046***				0.040***
				(0.015)				(0.007)
Wage (logs)	0.396***	0.397***	0.400***	0.396***				
	(0.049)	(0.049)	(0.049)	(0.049)				
Capital per worker (logs)	0.045***	0.043***	0.046***	0.045***				
	(0.009)	(0.009)	(0.009)	(0.009)				
Productivity (logs)					0.058***	0.058***	0.059***	0.058***
					(0.009)	(0.009)	(0.009)	(0.009)
Human Capital (logs)	0.039***	0.033***	0.039***	0.039***	0.043***	0.044***	0.044***	0.043***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
Medium	0.231***	0.209***	0.236***	0.227***	0.045***	0.049***	0.052***	0.043***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.015)	(0.015)	(0.015)	(0.015)
Large	0.360***	0.333***	0.373***	0.356***	0.083***	0.094***	0.099***	0.082***
	(0.034)	(0.032)	(0.033)	(0.033)	(0.020)	(0.020)	(0.019)	(0.020)
Industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.341	0.350	0.342	0.342	0.437	0.432	0.430	0.434

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 4.9 offers the same results regarding the link between the digitization sub-indexes, productivity and wages. On the one hand, Regressions (1) to (4) show that marginal

increases on the four digitization sub-indexes are correlated to positive and significant increases on firm's labour productivity, after controlling for a set of firm's characteristics. More precisely, 1% increases the R&D Strategy, ICT, E-commerce and Automation sub-indexes are correlated to 0.05%, 0.14%, 0.04% and 0.05% increases, respectively, in the firm labour productivity. On the other hand, Regressions (5) to (8) analyse the impact of the digitization sub-indexes on the firm average wage. It can be noticed that 1% increases in the R&D Strategy, ICT, E-commerce and Automation sub-indexes are correlated to 0.05%, 0.02%, 0.01% and 0.04% increases, respectively, in the firm average wage. All these results are robust and statistically significant after controlling for a set of firm's characteristics. Therefore, among the four digitization sub-indexes, ICT has the larger impact on productivity and the R&D Strategy has the larger impact on wages. On the contrary, the E-commerce sub-index is the one with the lower impact both on productivity and wages.

Tables 4.10, 4.11 and 4.12 offer the main results from the robustness checks regarding the role of the four digitization sub-indexes on the internationalization process of firms. Hence, we have repeated the analysis performed on Tables 4.6 and 4.7 but now, we have substituted the Digitization Index for the four sub-indexes, R&D Strategy, ICT, E-commerce and Automation, in order to identify the most relevant aspect of digitization in the internationalization process of firms.

Table 4.10 presents the results regarding the R&D strategy sub-index, the ICT sub-index and internationalization. All the following results are robust and statistically significant after controlling for firm's productivity human capital, size and industry. On the one hand, regarding the R&D Strategy sub-index, Regression (1) shows that firms exporting have an R&D Strategy sub-index 8% larger compared to domestic firms and Regression (2) shows that firms investing on foreign markets have an R&D Strategy sub-index 16% larger compared to the rest of firms. Furthermore, it can be appreciated on Regression (3) that occasional exporter, regular exporter and multinational firms have larger R&D Strategy sub-indexes compared to domestic firms, more precisely, a 5%, 13% and 44% larger, respectively. Finally, Regression (4) shows that, despite small and large exporters have statistically larger R&D Strategy sub-indexes compared to domestic firms, there is no statistical difference between them (8% and 9%).

Table 4.10- R&D Strategy, ICT and Internationalization.
Results from the GLS random effects estimation.

	R&D Strategy (logs)				ICT (logs)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export	0.079*** (0.017)				0.101*** (0.013)			
FDI		0.146*** (0.027)				0.094*** (0.015)		
Occasional exporter			0.052** (0.022)				0.140*** (0.023)	
Regular exporter			0.124*** (0.018)				0.205*** (0.019)	
Multinational			0.367*** (0.039)				0.309*** (0.025)	
Small exporter				0.076*** (0.017)				0.102*** (0.013)
Big exporter				0.088*** (0.019)				0.098*** (0.016)
Productivity (logs)	0.021*** (0.006)	0.023*** (0.007)	0.020*** (0.006)	0.021*** (0.006)	0.045*** (0.007)	0.048*** (0.007)	0.042*** (0.007)	0.045*** (0.007)
Human Capital (logs)	0.033*** (0.006)	0.035*** (0.007)	0.029*** (0.007)	0.032*** (0.007)	0.030*** (0.006)	0.033*** (0.006)	0.024*** (0.006)	0.030*** (0.006)
Medium	0.163*** (0.018)	0.164*** (0.018)	0.134*** (0.019)	0.161*** (0.019)	0.181*** (0.016)	0.193*** (0.017)	0.150*** (0.017)	0.182*** (0.017)
Large	0.366*** (0.027)	0.357*** (0.027)	0.316*** (0.028)	0.364*** (0.027)	0.278*** (0.018)	0.284*** (0.018)	0.231*** (0.019)	0.278*** (0.018)
Industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES
Differences between coefficients			Occasional exporter/ Regular exporter: 0.003 Regular exporter/ Multinational: 0.000	Small Exporter/ Big Exporter: 0.429			Occasional exporter/ Regular exporter: 0.002 Regular exporter/ Multinational: 0.000	Small Exporter/ Big Exporter: 0.782
R^2	0.2785	0.297	0.295	0.286	0.288	0.271	0.292	0.288

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

On the other hand, regarding the ICT sub-index, Regression (5) shows that exporting firms have an ICT sub-index 11% larger compared to domestic firms and Regression (6) indicates that firms investing in foreign countries have an ICT sub-index 10% larger compared to the rest of firms. Moreover, Regression (7) signals that occasional exporters, regular exporters and multinational firms have an ICT sub-index, 15%, 23% and 36% larger,

respectively, compared to domestic firms. Finally, Regression (8) shows that both small and larger exporters have a larger ICT sub-index compared to domestic firms; however, the difference is the same for both kinds of firms (10%). All these results are robust and statistically significant after controlling for firm's productivity, human capital, size and industry

Table 4.11 offers the main results regarding the connection between the E-commerce sub-index, the Automation sub-index and the internationalization process of firms. On the one hand, regarding the E-commerce sub-index, Regression (1) shows that exporting firms have an E-commerce sub-index 18% larger compared to domestic firms and Regression (2) indicates that firms investing in foreign countries have an E-commerce sub-index 6% larger (only significant at the 5% level) compared to the rest of firms. Moreover, Regression (3) signals that occasional exporters, regular exporters and multinational firms have an E-commerce sub-index, 21%, 33% and 54% larger, respectively, compared to domestic firms. Notice as well, that in this regression, despite productivity and size controls are not statistically significant, the R^2 shows the higher value among the four regressions, suggesting that the internationalization stage is the key element in order to explain the E-commerce differences across firms. Finally, Regression (4) shows that despite small and larger exporters have a significantly larger E-commerce sub-index compared to domestic firms, 18% and 19% respectively, the difference between them is not statistically significant.

On the other hand, regarding the Automation sub-index, Regression (5) highlights that exporting firms have an Automation sub-index 9% larger compared to domestic firms and Regression (6) indicates that firms investing in foreign countries have an Automation sub-index 5% larger compared to the rest of firms, however, this difference is not statistically significant at the 10% level. Furthermore, Regression (7) signals that occasional exporters, regular exporters and multinational firms have an Automation sub-index, 15%, 26% and 36% larger, respectively, compared to domestic firms. All this results are statistically significant, after controlling for firm's productivity, human capital, size and industry. Finally, Regression (8) shows that despite small and larger exporters have a significantly larger Automation sub-index compared to domestic firms, the difference between them is the same (9%).

Table 4.11- E-commerce, Automation and Internationalization.
Results from the GLS random effects estimation.

	E-commerce (logs)				Automation (logs)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export	0.166*** (0.019)				0.085*** (0.020)			
FDI		0.060** (0.015)				0.052 (0.039)		
Occasional exporter			0.193*** (0.032)				0.136*** (0.035)	
Regular exporter			0.289*** (0.026)				0.233*** (0.028)	
Multinational			0.434*** (0.043)				0.311*** (0.048)	
Small exporter				0.163*** (0.020)				0.084*** (0.020)
Big exporter				0.176*** (0.022)				0.090*** (0.026)
Productivity (logs)	0.008* (0.008)	0.029*** (0.008)	0.012 (0.008)	0.014* (0.008)	0.025*** (0.007)	0.027*** (0.007)	0.022*** (0.007)	0.025*** (0.007)
Human Capital (logs)	0.033*** (0.007)	0.039*** (0.008)	0.028*** (0.007)	0.033*** (0.007)	0.032*** (0.012)	0.035*** (0.012)	0.027*** (0.012)	0.032*** (0.012)
Medium	0.058*** (0.019)	0.087*** (0.019)	0.025 (0.020)	0.056*** (0.019)	0.218*** (0.027)	0.229*** (0.027)	0.185*** (0.028)	0.217*** (0.027)
Large	0.094*** (0.025)	0.126*** (0.025)	0.042 (0.026)	0.091*** (0.025)	0.407*** (0.033)	0.419*** (0.033)	0.360*** (0.034)	0.406*** (0.033)
Industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES
Differences between coefficients			Occasional exporter/Regular exporter: 0.002 Regular exporter/ Multinational: 0.000	Small Exporter/ Big Exporter: 0.417			Occasional exporter/Regular exporter: 0.007 Regular exporter/ Multinational: 0.055	Small Exporter/ Big Exporter: 0.718
R^2	0.108	0.081	0.115	0.108	0.261	0.252	0.260	0.261

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 4.12 depicts the main results regarding the link between the digitization sub-indexes and the probability of exporting (regressions 1, 2, 3 and 4) and the export propensity (regressions 5, 6, 7 and 8). Regressions 1 to 4 show that all the digitization sub-indexes are statistically significant (at the 1% level) in order to explain the probability of exporting, after

controlling for firm's productivity, human capital, size and industry. More precisely, 1% increases in the R&D Strategy, the ICT, the E-commerce and the Automation sub-index are correlated to 1.4%, 1.2%, 1.8% and 1.1% increases in the probability of exporting, respectively.

Table 4.12- Export Probability, Export Propensity and Digitization.

	Export Probability (Logit random effects estimation)				Export Propensity (logs) (GLS random effects estimation)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R&D Strategy (logs)	1.372*** (0.360)				0.109*** (0.037)			
ICT (logs)		1.228*** (0.267)				0.054* (0.032)		
E-commerce (logs)			1.801*** (0.231)				0.126*** (0.028)	
Automation (logs)				1.134*** (0.290)				0.066** (0.033)
Productivity (logs)	0.654*** (0.185)	0.639*** (0.180)	0.694*** (0.188)	0.679*** (0.187)	0.015 (0.021)	0.016 (0.021)	0.016 (0.021)	0.016 (0.021)
Human Capital (logs)	1.114*** (0.190)	1.081*** (0.180)	1.095*** (0.182)	1.108*** (0.191)	0.104*** (0.019)	0.106*** (0.019)	0.102*** (0.018)	0.104*** (0.019)
Medium	5.104*** (0.733)	4.970*** (0.662)	5.152*** (0.626)	4.974*** (0.677)	0.655*** (0.070)	0.663*** (0.071)	0.661*** (0.071)	0.656*** (0.070)
Large	7.996*** (0.873)	7.908*** (0.817)	8.109*** (0.792)	7.942*** (0.845)	0.869*** (0.083)	0.881*** (0.084)	0.880*** (0.082)	0.866*** (0.082)
Industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES
R^2	-	-	-	-	0.300	0.297	0.301	0.297

Note: Robust standard errors are given in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Furthermore, regarding the firm's export propensity (the weight of exported sales on total sales), regressions 5 to 8 indicate that there exists a thigh connection between the digitization sub-indexes and the firm's export propensity. With the exception of the ICT sub-index, the other three sub-indexes are statistically significant (at the 1% level) in explaining the export propensity, after controlling for firm's productivity, human capital, size and industry. A 1% increase in the R&D Strategy sub-index is correlated to a 0.11% increase in the export propensity, a 1% increase in the E-commerce sub-index is correlated to a 0.13% increase in the export propensity and a 1% increase in the Automation sub-index is correlated

to a 0.07% increase in the export propensity (this correlation is only significant at the 5% level).

Thus, all the previous results put forward the relevance of the E-commerce practices in order to accomplish a successful internationalization strategy. Differences between domestic, exporting firms, occasional exporters, regular exporters and multinational firms are larger in terms of the E-commerce usage compared to the other digitization aspects. Moreover, in some cases, differences in the E-commerce usage are more relevant than differences in terms of productivity or employment (Regression 3 on Table 4.11), highlighting the crucial role of such practices in the internationalization process of Spanish firms in the period 2010-2015. On the other hand, the ICT practices are the most relevant aspect in order to explain the firm's production and labour productivity within the firm and the R&D strategy is the most crucial aspect in explaining the wage and the employment level in the firm.

4.5- Conclusions

Many people identify digitization with 3D printing, Big Data, Internet of Things or Phones App. However digitization is more than that and it is related to the whole digital usage within the firm. Despite there are numerous definitions and references to the digitization process, such as Industry 4.0 or the Fourth Industrial Revolution, the disruptions that this phenomenon will bring to the whole economy are undeniable. These transformations will not only improve the firm's efficiency, productivity and competitiveness, but it will imply a complete rethink of the current business models, in order to reach a gradually more digitized final customer.

Firstly, in this chapter, we have elaborated a Digitization Index, to serve as a proxy of the digitization usage within the firm. We have selected 20 indicators related to the digitization practices in the firm, indicators related to the following sub-indexes: Innovation Strategy, ICT, E-commerce and Automation. Results show that Spanish manufacturing firms presented a medium-low level of digitization between 2010 and 2015. The average Digitization Index is 7.6/20, and firms present the lower performance on the Innovation Strategy aspect (1/4) and the better performance on the ICT usage (2.6/5). On the one hand,

the more common digital practices in the firm are “Computer package implementation services” (present in 91% of the firms) and “Computer programing services” (89%). On the other hand, the less usual digitization practices within the firm are “Online sales to firms” (9,5%) and “Online sales to final customers” (8,5%).

Secondly, we have analysed the role of the Digitization Index on the firm performance and, more precisely, on the firm internationalization process. Results show that the Digitization Index is positive and significantly correlated to the firm’s production, labour productivity, total employment and average wage. Moreover, regarding the internationalization status of firms, results show that there exists a digitization premia on firms exporting compared to domestic firms, on firms investing on foreign countries compared to the rest of firms, on regular exporters compared to occasional exporters, and on multinational firms compared to the rest of firms. Finally, we have found that a marginal increase in the Digitization Index is positively correlated to a marginal increase in the export probability and the export propensity, after controlling for firm size, productivity and industry.

Thirdly, in order to test the robustness of our results, we have repeated the previous analysis but introducing the fourth digitization sub-indexes (Innovation Strategy, ICT, E-commerce and Automation). Results show that all the fourth sub-indexes are positively correlated to both the firm performance and the firm internationalization status. More precisely, we have found that the most important digitization aspect in order to improve the firm’s production and productivity is the ICT sub-index, while the most relevant aspect in explaining the wage and the employment level within the firm is the R&D strategy sub-index. Nevertheless, regarding the internationalization status, firms differentiate more in terms of the E-commerce usage, in other words, differences between domestic, exporters, and multinational firms are larger in terms of the E-commerce usage compared to the rest of sub-indexes. Moreover, a marginal increase in the E-commerce practices is as well the most correlated to a marginal increase in the firm’s export probability and the firm’s export propensity.

The contribution of our research to the existence literature is two-fold. Firstly, to our knowledge, this study is the first academic work exploring the digitization heterogeneity across firms within the manufacturing industry throughout a panel data sample and econometric techniques. In this sense, this chapter is a relevant contribution to the nascent literature focus on depicting the role of digitization on the firm performance, by providing evidence for a sample of more than 2.500 Spanish manufacturing firms. Secondly, this chapter shed more light to the literature focused on studying the heterogeneity of firms in international markets. We have shown that exporters firms are more digitized than domestic firms even after controlling for firm's productivity. Moreover, we indicate that the most relevant aspect of digitization to the internationalization of firms is the E-commerce practices.

These results suggest some implications for the design of public policy. Firstly, exports have had and still have a key role in the recovery of the Spanish economy. Since 2010, once the international trade collapse following the crisis outbreak was overcome, Spanish exports have grown at an annual average rate of 4.5% (Myro, 2015). In other words, in 2007 exports represented 25% of the GDP whereas in 2015, they represented 33%. Secondly, we have found in our analysis that the digitization level in a firm is closely correlated to its international status, especially trough the usage of the E-commerce tools. Nevertheless, our results highlight as well that, on average, Spanish manufacturing firms present a medium-low level of digitization. Therefore, a public policy oriented to provide support in the field of digitization to Spanish manufacturing firms will benefit them by increasing their export participation and thus, their performance.

Chapter 5

Conclusions

In 2008, Spain was hit by the biggest economic crisis since 1929. The Great Recession destroyed the 9% of the Spanish GDP, caused the burst of the housing bubble, and 3.6 millions of Spaniards lost their jobs. However, while the big majority of macroeconomic indicators were falling (consumption, investment), a branch of the Spanish economy was surprisingly rising: exports. During the last years, Spanish manufacturing firms must look beyond its borders in order to find more dynamic markets and be able to survive. In fact, since 2009, the exports of goods and services have grown at an average annual rate of 5.5%, when the GDP has only grown at an average annual rate of 0.7% during this same period. In volumes, Spanish exports have grown a 44% between 2009 and 2017. Nowadays, one out of three euros produced in Spain is sold abroad.

This is what has happened in Spain in the last years. From this point, what instruments dispose the Spanish economy in order to foster the economic recovery? What can Spain do to underpin the employment creation and to strength the economic growth? Well, from the demand side, not too much. On the one hand, the monetary policy does not offer many solutions. In 2014, the European Central Bank fixed the long-term interest rate for the Eurozone in 0.5%, and two years later, in 2016, it fixed it in 0%. Indeed, from a monetary perspective, the European Union is in a situation of nearly liquidity trap, with low inflation rates, interest rates close to 0%, a huge excess of savings, and a low investment demand.

On the other hand, the fiscal policy neither offers many solutions. The Spanish public budget has accumulated huge deficits since the beginning of the Great Recession in 2008. Consequently, the gross public debt has steadily increased in the last decade until reach the 100% of the GDP in 2016. Currently, despite the austerity policy and the big efforts in order to reduce the fiscal imbalances, the Spanish fiscal deficit remains in the 3% of the GDP. Therefore, in the absence of a common European budget, idea that is under negotiation nowadays, the southern European countries, and especially Spain, do not dispose of fiscal instruments in order to effectively affect the economic recovery.

As a result of the impossibility to undertake demand side policies, the only possible solution for Spain is to apply supply side policies in order to foster the economic growth. This has been the line followed in the last years by the European Commission and the FMI in their

recommendations for the Spanish economy. Therefore, the Spanish government undertook several reforms in the labour market aiming at increase the flexibility in the hiring and firing and reduce the chronic duality of the Spanish labour market. Regarding the product market, reforms have been oriented to foster the productivity, the efficiency and the competitiveness of Spanish firms. Hence, given that the export sector is the most dynamic sector in the Spanish economy and one with the most growth potential, it could be interesting to apply supply side policies in this sector and foster the internationalization process of Spanish firms. In other words, despite the spurt of Spanish exports in the last years, the external balance of goods is still negative (Spain imports more goods than those it exports) and, in this sense, there is still some room for improvements in the field.

Hence, in a context where the Spanish internal demand is still weak and that many Spanish firms have undertook several sunk exporting costs during their internationalization process in the last years, it could be interesting to exploit the potentials of the export sector and to foster the establishment of Spanish firms in foreign markets. In other words, given that many Spanish firms have reach to overcome the initial entry barrier in international markets in the last years, it could be a good strategy to take advantage of this situation and to try to strength the export promotion policy, especially to the most distant, but more dynamic, Asian and North American markets.

Indeed, this considerable spurt in the Spanish exports, which many researchers have referred as the Spanish export miracle, highlights the key role that the external sector had and still has in the recovery of the Spanish economy. Therefore, this constitutes the main motivation of this Ph.D. thesis. The aim of this research has been to analyse what are the most important variables during the internationalization process of firms, not only to better understand the current economic trends at the firm level, but also to offer future recommendations to the agents involve in international trade. In this Ph.D. thesis we have focused on the behaviour of Spanish firms in the last decade and our goal has been to understand why some firms decide to export while others do not, what elements a firm must dispose in order to accomplish a successful export strategy, and how exporting transforms firms.

The literature focused on analysing the process of internationalization of firms has made huge advances in the last decades regarding the behaviour of firms in international markets. Thanks to the great availability of data at the firm level, now we know that exporter firms are larger, more productive, more innovative and pay higher wages than non-exporter firms. Among all these differences, productivity has been placed at the core of the firm export decision. There exists a considerable consensus in the literature that only the most productive firms reach to export. In fact, the presence of some sunk costs at the entry of export markets make that only most productive firms could overcome these sunk costs and obtain positive profits.

Nevertheless, we believe that all the elements that literature has revealed having an impact on internationalization (productivity, size, innovation) are related to a wider element at the core of the firm: business management. In other words, the decision to innovate is a management decision. The decision to hire employees and expand the firm is a management decision. The decisions to rationalize the schedule in the firm or to bet on new materials in order to affect productivity are management decisions. Moreover, and most important, the decision to export or to invest on a foreign country are management decisions.

Existent literature has already revealed that management has an impact on productivity, on firm size and on innovation. Moreover, all these elements constitute a virtuous circle and, at the same time, larger, more productive and more innovative firms are as well better managed. Nevertheless, the literature has not yet focused on the connection between management and internationalization. Hence, this has been precisely the focus and contribution of the Chapter 2 of this manuscript.

The results of the Chapter 2 put forward that a management quality bonus on exporters exists, as well as a productivity bonus, and the size of the management quality bonus is greater than the size of the productivity bonus. In other words, the difference between exporters and non-exporters is greater in terms of management quality than in terms of productivity. Secondly, we have shown that a change in a firm's management quality is more closely correlated with the export decision than a change in the firm's productivity. In addition, we have seen that all these results can be extended to explain differences between

multinationals (firms involved in foreign direct investment) and non-multinationals, as well as to explain a firm's decision to invest abroad.

With this result we are not suggesting that management quality is more important than productivity in order to accomplish a successful internationalization strategy. The success in export market is determined by the general competitiveness level in the firm. This competitiveness may be translated into lower production or labour costs, larger innovation intensity, or larger productivity levels compared to the rest of competitors. Our hypothesis is that this competitiveness may be obtained as well trough good management practices. In other words, management quality may be seen as a substitute of productivity, where better-managed may overcome their limitations in term of productivity in order to accomplish a successful export strategy.

Despite the interest on others new variables like management, productivity is still, of course, a key element in the internationalization process of a firm. In this framework, researchers knew that exporters were more productive than domestic firms but they did not know why. As a result, a huge body of literature has been dedicated on analysing what is the impact of exporting on productivity. Results has shown that exporters were already more productive than domestic firms even before they started to export. This phenomenon, translated into the self-selection hypothesis of more productive firms entering export markets, has received a remarkable consensus among researchers.

The other alternative is that exporters learn from more dynamic and competitive export markets and they obtain productivity improvements following their entry into export markets. This hypothesis of learning-by-exporting has not received, however, a remarkable support from the literature. In other words, results are mixed regarding the veracity of the learning-by-exporting hypothesis. However few studies have analysed what a firm may learn from exporting other than productivity. We knew very little about the impact of exporting on other firm characteristics and the firm performance as a whole. In the case of Spanish firms, there was a complete lack of research regarding these issues. Therefore, the goal of the Chapter 2 of this Ph.D. thesis has been to fill this gap and to offer more light regarding the transformation of firms during the internationalization process.

The main results showed that, firstly, start to export is correlated to a significant increase in the firm size, measured as the number of employees or the amount of total sales. Secondly, we find that the productivity level of firms that start exporting shows experiences a U-shaped trend, decreasing before the entry in export markets and then increasing during the years exporting. Thirdly, the average wage experience the same U-shaped trend and the unit labour costs in the firm experience an inverted U-shaped trend. Fourthly, firms lose their advantage in terms of gross operating margin after they start exporting. Fifthly, despite the R&D expenditure increase after firms start exporting, the probability to perform R&D (in other words, the number of innovative firms) remains stable throughout the internationalization process. Finally, the quality of the employment contracts, measured as the percentage of workers with a permanent contract, improves after firms enter the export market.

Finally, the Chapter 4 of this Ph.D. thesis has been dedicated to introduce a new variable in the debate regarding the determinants of exporting: digitization. In the last years, numerous economists and firm managers are alerting of the disruptive effects of digitization, foreseeing that, as in a natural selection model, only firms and countries that will reach to adapt to digitization will succeed in the times coming. It is undeniable that digitization will transform firms, customers and business models in the close future; nevertheless, the way and the degree in which this revolution will act are, at the time, unknown. Hence, if we believe on the disruptive effects that digitization may have on firms and on the business models, we cannot ignore the disruptive effects that digitization may have on international trade. This has been precisely the main goal of this chapter: to analyse the role of the digital transformation in the internationalization process of firms.

Our main results showed that, first, there exists a positive and significant correlation between the digital level in the firm and the firm's production, total employment, labour productivity and average wage. Second, there exists a digitization premia on exporting firms compared to domestic firms, and on firm investing in foreign countries compared to the rest of firms. Third, this premia is larger on regular exporters compared to occasional exporters and on multinational firms compared to the rest of firms. And fourth, a marginal increase in the digitization level is correlated to an increase in the export probability, as well as to an increase in the export propensity (the weight of exported sales on total sales),

The contribution of this chapter to the existence literature is two-fold. Firstly, to our knowledge, this research is the first academic work exploring the digitization heterogeneity across firms within the manufacturing industry throughout a panel data sample and econometric techniques. In this sense, this analysis is a relevant contribution to the nascent literature focus on depicting the role of digitization on the firm performance, by providing evidence for a sample of more than 2.500 Spanish manufacturing firms. Secondly, this work shed more light to the literature focused on studying the heterogeneity of firms in international markets. We have shown that exporters firms are more digitized than domestic firms even after controlling for firm's productivity. Moreover, we indicate that the most relevant aspect of digitization in the internationalization of firms is the E-commerce practices.

Hence, the three central chapters of this Ph.D. were interconnected to the extent that they introduced other variables and approaches in the debate about the determinants and consequences of exporting. Despite the firm productivity is a key element in the firm internationalization process, it is not the only one, and the purpose of this work has been precisely to give more light about the relevance of the management practices and the digitization process in exporting and foreign direct investment. Finally, we have shown that, beyond the impact on productivity, start to export is correlated with deep transformations on a wide set of firm characteristics.

This Ph.D. thesis has been empirical in nature, offering diverse results for a sample of Spanish manufacturing firms. Giving the good representativeness of our sample of firms, our results may be extrapolated to the whole universe of Spanish manufacturing firms in order to offer some recommendations in terms of public policy. Broadly, we have shown that both management practices and digitization affect positively and significantly the internationalization process of firms. Moreover, it seems reasonable that management practices positively affect and determine the digitization level of firms.

Nevertheless, we have seen that both the digitization and the management level in Spanish manufacturing firms are medium-low, and therefore, there is a huge room for improvements in these two key areas. Despite the good performance in international markets

of Spanish firms in the last decade, not all Spanish firms are exporting, and there is room as well for a public policy of export promoting. According to our results, a public policy oriented to provide advice in terms of business management and digitization on Spanish firms could therefore increase their export propensity and thus their performance.

Furthermore, the results from the Chapter 3 highlighted that the entry into export markets is associated to a significant increase in the firm size and an improvement in the firm labour conditions, measured as the percentage of workers with permanent contracts. Hence, a public policy of export promotion among small firms, could serve to increase the job creation and foster the economic recovery by reducing unemployment. Moreover, such a public policy of export promotion may improve as well the quality of labour conditions in Spanish manufacturing firms by reducing the labour temporality, which is one of the most serious of the Spanish labour market.

To finally conclude, we can affirm that this Ph.D. thesis has offer new evidences regarding the process of internationalization of Spanish manufacturing firms, in the context of firm heterogeneity. Nevertheless, despite all the findings, that not only this research, but all the literature on this field has revealed, there are still many uncertainties regarding the behaviour of firms in international markets. In the second chapter of this manuscript we have shown that exporter firms are better managed than domestic firms. However, we do not know if this firms were already better managed even before they start to export, or, on the contrary, if the abilities of their managers improved after their entry into international markets. The study of the management practices trough a self-selection/learning-by-exporting analysis would be a very enriching research. In this line, this kind of exercise could be repeated as well in order to give more light regarding the role of the digital transformation in international markets.

All these findings will expand our knowledge regarding the behaviour of firms in international markets and will allow us to better understand the future economic trends. In addition, this knowledge may be employed as recommendations for the firms, and, if we are lucky, it may serve to improve their performance, which is the main purpose of the applied research.

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