UNIVERSIDAD COMPLUTENSE DE MADRID

FACULTAD DE CIENCIAS ECONÓMICAS Y EMPRESARIALES

DEPARTAMENTO DE ECONOMÍA APLICADA II

TESIS DOCTORAL

Essays on internationalization in the context of heterogeneous firms

Ensayos sobre internacionalización en el contexto de empresas heterogéneas

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

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ENSAYOS SOBRE INTERNACIONALIZACIÓN EN EL CONTEXTO DE EMPRESAS HETEROGÉNEAS

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A mis padres.

Por ser como son.

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Podría pensarse que esta parte de la Tesis es la más fácil de escribir. Sin embargo, no es así, pues han sido muchas las personas que me han ayudado y apoyado a lo largo de esta etapa de investigación. En estas líneas me gustaría expresar mi profundo agradecimiento a todas esas personas que han hecho posible que pudiera terminar, de forma satisfactoria, esta Tesis Doctoral.

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Igualmente quisiera dar las gracias a los cuatro evaluadores de esta Tesis Doctoral, los profesores Rafael Myro, José Carlos Fariñas, Carmen Díaz Mora y Asier Minondo. Su revisión y pormenorizada lectura han contribuido notablemente a la mejora de la misma, dando lugar a esta última versión.

Por supuesto, no puedo olvidarme de mis padres y de mi hermana, a los que admiro y quiero mucho, por el apoyo y la confianza incondicional que siempre me han

demostrado. Gracias a mis padres por haber estado apoyándome desde el primer día y por empujarme cada día a ser mejor persona. Ellos me han enseñado que trabajando duro se puede conseguir cualquier cosa. Me siento súper orgulloso de la educación que me han dado. Quisiera expresar también mi más profundo agradecimiento a mi hermana María Graciela, por sus palabras de comprensión y de ánimo cuando las cosas no salían o no iban todo lo bien que se esperaba. Por supuesto, también quiero mostrar mi gratitud a mis amigos de siempre (ellos ya saben quiénes son) por los buenos momentos que hemos pasado y por conseguir que desconectara de este reto durante el tiempo que estábamos juntos. Por fin, después de tanto tiempo, podré contestaros a todos la famosa pregunta "¿cuánto te queda para acabar la tesis?"

Por último, pero no por ello menos importante, quiero agradecérselo a una de las personas más importantes de mi vida, mi novia Yvonne. Gracias por tu apoyo incondicional, por tu paciencia en los buenos y en los malos momentos, y, por qué no decirlo, por aguantarme con todos mis defectos (y alguna que otra virtud). Además, debo también agradecerte la ayuda técnica en la programación de Stata que me has ofrecido. Ni te imaginas lo importante que ha sido para mí que estuvieras a mi lado cada día, siempre con una sonrisa diciéndome que "yo podía con todo". Al final sí que pude, sí. Gracias de corazón.

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RESUMEN

En las últimas décadas se ha asistido a un incremento sin precedentes de los volúmenes de comercio internacional. En general, los principales factores que han explicado este incremento han estado vinculados con (i) las reducciones de los costes comerciales y las barreras técnicas; (ii) las mejoras en las infraestructuras de transporte y telecomunicaciones; (iii) los avances en el sistema financiero y el aumento de la seguridad jurídica; y (iv) el desarrollo de una cultura corporativa que promueve la internacionalización de las empresas como una importante herramienta estratégica para sobrevivir y crecer.

El notable aumento de la apertura comercial ha sido también observado en la economía española. En este sentido, la entrada en vigor del Tratado de Adhesión de España a la Comunidad Económica Europea (ahora Unión Europea) en 1986 desempeñó un papel fundamental en este espectacular incremento. Adicionalmente, y debido a la profunda depresión que sufrió la demanda doméstica como consecuencia de la reciente crisis económica y financiera, el comercio exterior se ha erigido como un factor clave del proceso de recuperación de la economía española.

La literatura económica sobre comercio internacional ha intentado analizar los numerosos factores que determinan y afectan los flujos comerciales. En este sentido, la reciente literatura ha empezado a considerar a la empresa como la principal unidad de análisis para entender las causas y consecuencias del incremento de las relaciones

comerciales globales. Motivado por la creciente disponibilidad de microdatos, esta literatura hace hincapié en el papel de la heterogeneidad empresarial como el principal factor para explicar algunos hechos estilizados del comercio internacional

Esta Tesis Doctoral, titulada *Ensayos sobre Internacionalización en el contexto de empresas heterogéneas*, se enmarca dentro de esta línea de investigación sobre empresas heterogéneas y comercio internacional. En concreto, esta Tesis se centra en el análisis pormenorizado de los principales factores que son determinantes en las decisiones de venta de las empresas manufactureras españolas. Ello ha implicado la evaluación de la interacción entre las ventas domésticas y de exportación, así como de las diferentes interacciones entre las decisiones de entrada en nuevos destinos extranjeros. Por último, y considerando que la decisión de entrada puede verse afectada por diversas variables, esta Tesis se ha centrado en aquellas vinculadas con la existencia de restricciones en la capacidad productiva.

El primer objetivo específico de la investigación trata de evaluar y cuantificar empíricamente las externalidades derivadas de la participación en actividades de exportación sobre los niveles y las tasas de crecimiento de las ventas domésticas. Más específicamente, este trabajo aborda dos preguntas principales: (i) ¿cuál es la variación en las ventas domésticas entre los exportadores y los no exportadores?; y (ii) considerando el universo de empresas que participan en actividades de exportación en algún año, ¿qué sucede con las ventas domésticas cuando esas empresas exportan? La principal hipótesis que se pretende examinar es si la exportación genera un efecto residual sobre las ventas domésticas que lleva a reducir su tasa de crecimiento.

Los principales resultados son dos. En primer lugar, los resultados confirman la hipótesis de que los exportadores tienen, en promedio, mayores ventas domésticas (volúmenes y tasas de crecimiento) que los no exportadores. En segundo lugar, los

resultados revelan que las empresas presentan mayores niveles de ventas domésticas en aquellos años en que participan en actividades de exportación. Sin embargo, también señalan que estas empresas reducen significativamente la tasa de crecimiento de sus ventas domésticas cuando deciden exportar. Este último resultado podría sugerir la existencia de una potencial relación de sustitución entre las ventas domésticas y extranjeras.

El segundo objetivo específico de la investigación pretende examinar la existencia de un patrón secuencial de entrada en los mercados de exportación en dos etapas. En la primera etapa, la empresa se plantea la decisión de exportar vendiendo en uno o en múltiples destinos. En la segunda etapa, la empresa podría decidir expandirse a nuevos destinos extranjeros. En este sentido, las decisiones previas podrían condicionar las estrategias actuales de entrada en nuevos destinos. Basado en este supuesto, la segunda investigación se centra en dos tipos de externalidades. Por un lado, las que se derivan de las decisiones previas de entrada tomadas por la propia empresa en mercados con características económicas, sociales y culturales similares a aquellos países para los que se toma una potencial decisión de nueva entrada (*externalidades geográficas*). Por otro lado, también se consideran los efectos asociados con decisiones previas de exportación llevadas a cabo por otras empresas que fabrican productos similares (*externalidades sectoriales*).

Los resultados empíricos confirman que ambas externalidades (geográficas y sectoriales) tienen un papel positivo en la explicación de las nuevas decisiones de entrada. También señalan que la presencia previa en un destino específico incrementa la probabilidad de re-entrada en ese destino específico en periodos posteriores. Por tanto, estos resultados podrían añadir nuevas evidencias sobre el supuesto de que los costes

hundidos de exportación podrían reducirse considerablemente como consecuencia de la experiencia previa en los mercados de exportación.

El último objetivo específico trata de examinar el papel de las restricciones de la capacidad productiva en la toma conjunta de decisiones de la empresa sobre exportar y realizar I+D. Basándose en el supuesto de que las empresas con restricciones no pueden ampliar libremente su producción, esta investigación estima un modelo probit bivariado para evaluar la influencia de las restricciones de capacidad (y de otras variables relevantes a nivel de empresa) sobre las decisiones exportadoras e innovadoras de las empresas. En este sentido, este capítulo define una nueva medida para determinar si las empresas se enfrentan a restricciones de capacidad, la cual incorpora heterogeneidad entre industrias y a lo largo de los años. La principal hipótesis que se desea contrastar es si las empresas con restricciones de capacidad son menos propensas a exportar o a llevar a cabo I+D.

Los resultados empíricos sugieren que la tasa de utilización de la capacidad y la existencia de restricciones en la capacidad productiva juegan un papel esencial en la participación en estas decisiones estratégicas. Por un lado, los resultados revelan que una alta tasa de utilización de la capacidad en el año anterior incrementa la probabilidad conjunta de exportar y realizar I+D. Por otro lado, los resultados señalan que la existencia de restricciones en la capacidad disminuye considerablemente la probabilidad de llevar a cabo dichas estrategias.

Los resultados empíricos obtenidos en la presente Tesis también ofrecen diversas recomendaciones e implicaciones económicas relacionadas con las políticas de promoción exterior. En primer lugar, el capítulo segundo promueve el desarrollo de políticas de apoyo a la exportación centradas en las entradas persistentes, con el fin de reducir los potenciales efectos residuales sobre las ventas domésticas. En segundo lugar,

y considerando la influencia positiva de las externalidades geográficas y sectoriales en las decisiones de entrada, el capítulo tercero sugiere la implementación de políticas y estrategias de internacionalización que apoyen la entrada en países pertenecientes a nuevas regiones geográficas en los que empresa no tenía una presencia previa, dado que la entrada inicial podría fomentar la expansión a nuevos destinos de la nueva región. Por último, el capítulo cuarto apoya el desarrollo de políticas conducentes a mejorar las tasas de utilización de la capacidad de las empresas para conseguir un mejor ajuste entre los niveles de producción y los potenciales niveles de demanda.

ABSTRACT

The significant increase in global trade flows in last decades has been one of the main features of the globalization process that started in the 1950s. In general, the main factors behind this increase were linked to (i) the significant reductions of trade costs and technical barriers; (ii) the improvements in transport infrastructure and telecommunications; (iii) the progress of the international financial system and the increasing legal certainty; and (iv) the development of a corporate culture that promotes the internationalization of firms as a strategic tool in order to survive and to grow.

The remarkable increase of trade openness has also been observed in the Spanish economy. In this regard, it is clear that the entry into force of the Treaty of Accession of Spain to the European Economic Community (now the European Union) in 1986 played a main role in this dramatic increase. In addition, and because of the deep depression of domestic demand caused by the global financial and economic crisis that started in 2008, the external trade has become a key driver in the economic recovery of the Spanish economy.

The literature on International Trade has tried to assess the numerous factors that determine export flows and performance. In this regard, recent researches about this

topic have increasingly taken into account firm-level decisions in understanding the causes and consequences of the increase in global trade relations. Motivated by the increasing availability of micro-level data, this literature emphasizes the role of firm heterogeneity as a key driver in explaining stylized facts of international trade flows.

This PhD Thesis, entitled *Essays on Internationalization in the context of heterogeneous firms*, is framed within the line of research on heterogeneous firms and international trade. Specifically, this Dissertation focuses on the analysis of the determinants and externalities derived from export decisions for Spanish manufacturing firms. This implies the assessment of the interactions between domestic and foreign sales, and also the analysis of the interconnections among entry decisions into new foreign markets. Finally, though entry decisions are certainly the result of many firm characteristics, this Thesis has focused on those related to capacity constraints.

The first specific objective of the research is related to the analysis and the empirical quantification of the spillover effects generated by participation in export activities on both volumes and growth rates of domestic sales. More specifically, this paper addresses two main questions: (i) what is the variation in domestic sales between exporters and non-exporters; and (ii) for the universe of firms that export in some year, what happens with domestic sales when these firms engage in exporting? The main hypothesis to be tested is whether exporting has a residual effect on domestic sales by reducing their growth rates.

The empirical results obtained are twofold. On the one hand, and by applying the diff-in-diff methodology, the findings confirm the hypothesis that exporters have, on average, higher domestic sales (volumes and growth rates) than non-exporters. On the other hand, the results suggested by the fixed and random effects models reveal that firms present higher volumes of domestic sales in those years in which they are engaged

in exporting. Notwithstanding, they also point out that firms significantly reduce growth rates when they are involved in export activities, which may suggest the presence of residual effects associated with participation in export markets. This result adds new evidence in support of the potential existence of a substitutability relationship between domestic and export sales.

The second specific objective of the research is to examine the potential existence of a sequential pattern of entry into new foreign markets. More specifically, this analysis is based on the framework of a two-stage sequential pattern of entry. In the first stage, the firm decides to enter export activity by selling in one or multiple destinations. In the second stage, the firm could decide to expand to new foreign markets. In this way, previous export decisions could condition current entry strategies. With this framework, the second research paper of this Thesis focuses on externalities derived from previous export decisions made by the firm or by other firms in the same industry. In this context, the externalities considered are twofold. Firstly, those external effects coming from previous entry decisions in countries with similar economic, social or cultural characteristics to those for which a potential entry decision is made (*geographical spillovers*). Secondly, those effects associated with previous export decisions made by others firms that manufacture similar products (*industrial spillovers*).

The empirical findings confirm that both types of externalities (geographical and industrial) play a positive role in explaining entry decisions in new export markets. They also point out that previous presence in a specific foreign country facilitates re-entry into that specific destination. Accordingly, these last results provide new evidence on the assumption that sunk entry costs could be reduced substantially as a result of prior experience in export markets.

Finally, the last specific objective of this PhD Thesis is to examine the critical role that capacity constraints play in the firm's joint decisions to export and perform R&D activities. Based on the assumption that capacity-constrained firms cannot freely expand their production, the third research paper of the Dissertation estimates a bivariate probit model to evaluate the potential influence of capacity constraints (and other variables related to plant characteristics and the state of demand) in explaining export and innovation decisions of firms. In this regard, we propose a more refined measure to determine if firms face physical capacity constraints based on the capacity utilization rate of the firm, which incorporates heterogeneity across industries and years. The main hypothesis to be tested is whether capacity-constrained firms (those companies that produce at full capacity or above a certain capacity threshold) are less prone to engage in exporting and R&D.

The empirical findings suggest that firms' capacity utilization rate and capacity constraints play an essential role in participation in these strategic decisions. On the one hand, results reveal that a high capacity utilization rate in the preceding year increases the joint likelihood of exporting and performing R&D. On the other hand, they also point out that the existence of capacity constraints significantly reduces the probability of carrying out these activities.

Furthermore, the empirical results of this PhD Thesis also provide some recommendation and economic implications for governments related to export promotion policies. Firstly, Chapter 2 promotes the development of export promotion policies focused on persistent entries into export markets in order to reduce potential residual effects from exporting. Secondly, and taking into account the positive influence of geographical and industrial spillovers in entry decisions, Chapter 3 suggests the implementation of policies and strategies of internationalization that support entry into

countries belonging to new geographical regions in which the firm had not previously exported to. In this regard, the initial entry could encourage additional entries into neighboring destinations of the new geographical area. Finally, Chapter 4 recommends the development of policies that lead firms to improve their capacity utilization rate in order to achieve a better adjustment between production and potential demand levels.

CHAPTER I

INTRODUCTION

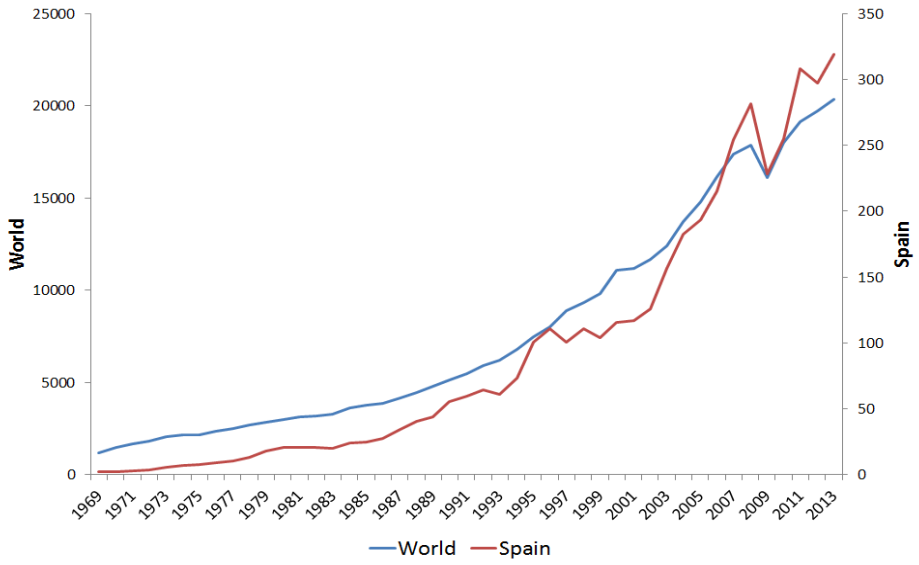
1.1 Justification

The significant increase in global trade flows in last decades has been one of the main features of the globalization process that started in the 1950s. As is well known, this process refers to the growing interdependence of countries resulting from the increasing integration of trade, finance, people, and ideas in one global marketplace. Regarding trade flows, for instance, the total volume of world exports in goods and services increased eighteen fold from $1100 billion in 1969 to $20300 billion in 2013, in spite of the sharp contraction of trade caused by the economic crisis in 2009 (see Figure 1.1 for more details). This spectacular increase in the last decades reflects profound changes in the international economic relations between countries, which are related to greater trade openness and larger interconnections among them.

In general, the main factors behind the increase in global trade flows in the last decades were linked to (i) the significant reductions of trade costs and technical barriers; (ii) the improvements in transport infrastructure and telecommunications; (iii) the progress of the international financial system and the increasing legal certainty; and (iv) the

development of a corporate culture that promotes the internationalization of firms as a strategic tool in order to survive and to grow. All these facts have facilitated an unprecedented world-trade growth, which has reached higher growth rates than world output growth. In addition, it has also generated new research questions related to new internationalization strategies which have also motivated the formulation and development of this Dissertation.

Figure 1.1: Exports in goods and services (volume in US Billion Dollars)



Source: Author's elaboration from the OECD database.

This chapter starts by presenting the main empirical facts that have contributed to the definition of the Dissertation. The second Section is dedicated to the explanation of those arguments that support the relevance of the research and it also describes different research papers related to the principal objective of the Thesis. The main objectives, contributions and hypotheses of the research are detailed in Section three. Afterward, the fourth Section introduces the main databases and methodologies that have been used

and, finally, the fifth Section contains the structure of the Dissertation and a brief summary of the main papers that compose the Thesis.

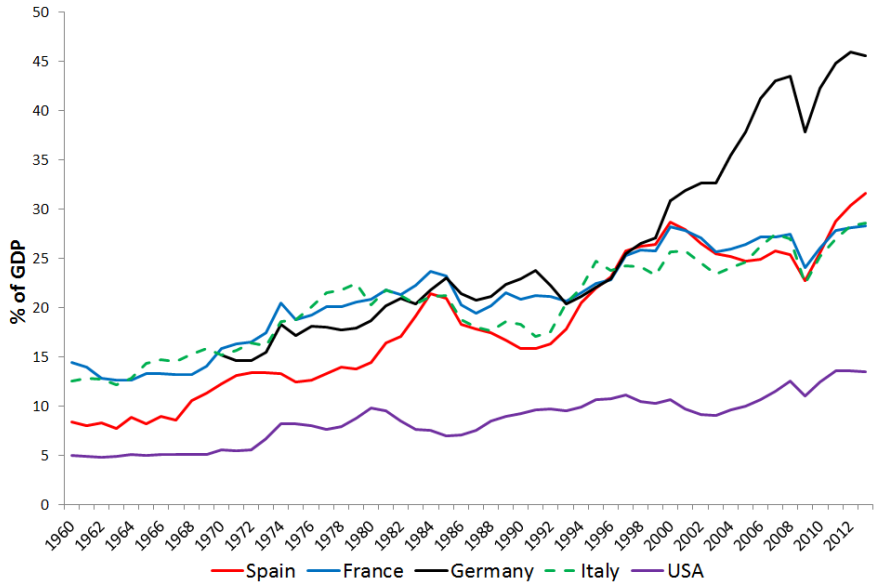
The recent remarkable increase of trade openness –within a progressive liberalization of international economic relations– has also been observed in the Spanish economy, in spite of starting off from low levels of economic integration as a result of Franco's autarky until the sixties (see also Figure 1.1).[1] In particular, the volume of Spanish exports in goods and services increased 168 fold from $1.9 billion in 1969 to $319.3 billion in 2013. In this regard, it is clear that the entry into force of the Treaty of Accession of Spain to the European Economic Community (now the European Union) in 1986 played a main role in this dramatic increase. Before 1986, the involvement of the Spanish companies in foreign markets was scarce. However, from that year onwards, the situation changed radically as a result of the expanding political and economic alliances among European nations that triggered the fall of trade barriers and tariff reductions. Later, with the introduction of a single currency at the end of the nineties, Spanish firms began to launch new global strategies that allowed them to compete successfully in foreign markets. More recently, and because of the deep depression of domestic demand caused by the global financial and economic crisis that started in 2008, the external sector has played an essential role in the economic recovery of the Spanish economy (Myro, 2012).

The results of the great effort made by the Spanish firms in order to expand and consolidate their international competitive position have been highly satisfactory. As can be seen in Figure 1.2, Spanish exporters have been gradually increasing their position in international markets to reach the level of exports of goods and services (expressed by percentage of the GDP) of other neighboring countries. In addition, this

[1] The degree of openness (Exports + Imports/GDP) of the Spanish economy has evolved from 8.8% in 1960 to 26% in 1985 and 60% in 2013.

successful convergence process has been particularly intense in the second half of the nineties when Spanish firms began to internationalize.[2]

Figure 1.2: Exports of goods and services (% of GDP)



Source: Author's elaboration from The World Bank database.

One of the characteristics of the Spanish internationalization process is related to the geographical and product concentration of export flows. Regarding geographical concentration, more than two thirds of total Spanish exports in 2012 went to European countries.[3] Among the non-European countries, the main destinations are United States, Morocco, China, Algeria, Mexico and Brazil (Myro *et al.*, 2013). With respect to product concentration, Spanish exports are focused on products with medium-high technology content (43.2 % of total exports in 2010) such as *Motor vehicles*, *Machinery*

[2] See Gordo *et al.* (2008) for more details.
[3] More specifically, around 60% of total Spanish exports went to EU-27, whilst around 8% went to other European countries.

and mechanical appliances or *Chemicals products*.[4] Furthermore, exports of products with low technology intensity such as *Food, beverages, and tobacco* or *Textile and clothing* are also significant (30.6% of total exports in 2010). In summary, the industrial pattern of exports could present a bias towards the technologically less advanced activities. Nevertheless, the product specialization of the Spanish exports fits well with the global world demand, which suggests that Spanish exports have good perspectives for expansion.

Moreover, another feature of the internationalization process of the Spanish firms refers to the positive role played by product differentiation –vertical or horizontal– in international competitiveness.[5] In general, this strategy has been commonly used by firms to gain share in domestic or international markets (Moreno-Martín and Rodríguez-Rodríguez, 1998). In this regard, Hidalgo and Hausmann (2009) point out that the Spanish economy is characterized by having a highly diversified supply of products in the basket of exports.[6] Similarly, Easterly *et al.* (2009) also stress the high level of diversification of the Spanish exports.

In conclusion, there is no doubt that in recent decades Spanish firms have intensified the efforts to expand the international projection of their goods and services by setting an ambitious strategy of outward orientation. Accordingly, it is extremely relevant to identify key features of the export behavior of Spanish firms in order to guide the export

[4] The OECD classifies manufacturing industries into four categories based on R&D intensity: high technology, medium-high technology, medium-low technology and low technology. See Hatzichronoglou (1997) and OECD (2003) for more details.

[5] Two products are differentiated vertically if, when the two prices are equal, all the consumers prefer the same product. Accordingly, vertical differentiation is related to product quality differences. Conversely, two products are differentiated horizontally if, when the two prices are equal, some consumers prefer one product and other consumers prefer the other product.

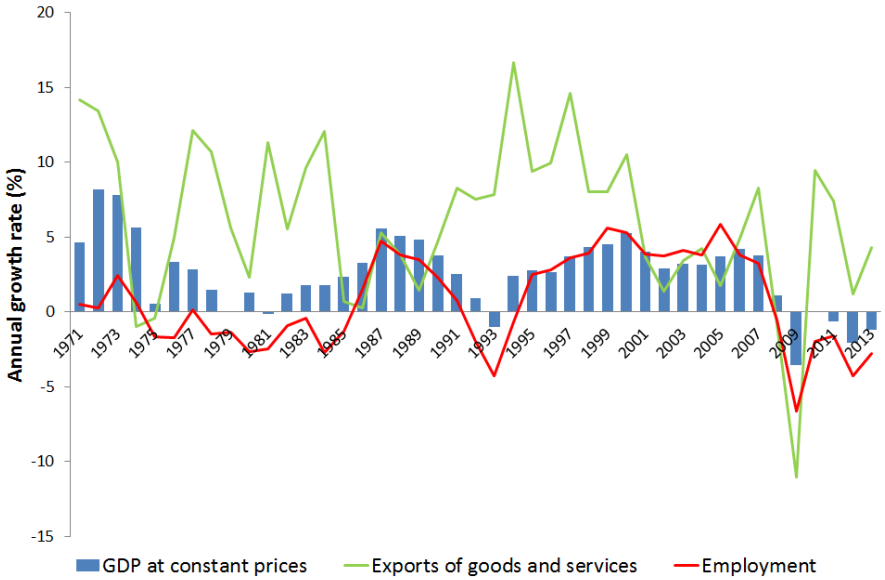
[6] To assess this issue, the authors calculate the index of Revealed Comparative Advantage (RCA) for each product and country (expressed as the relative weight of the percentage of total export of product *p* in a country over the percentage of world exports in that product), and then compare it with some threshold value.

promotion policies. This is precisely the objective of this Dissertation, which investigates the main determinants and externalities derived from export decisions at the firm-level.

1.2 Relevance of the research

The relevance of this research is driven by the importance and the substantial benefits that international trade brings to the economy as a whole. In this regard, important international organizations such as the World Bank, the IMF, and the OECD regularly promulgate advice on the belief that trade openness has predictable and positive consequences for economic and productivity growth and innovation. For instance, as can be seen in Figure 1.3 with Spanish data, there is strong evidence that trade boosts economic growth, and that economic growth means more jobs.

Figure 1.3: Relation between trade and growth for Spain. Annual growth rate (%)



Source: Author's elaboration from the OECD and The World Bank database.

Besides the effects on economic growth, the increase in global trade flows and the growing trade liberalization process have also generated other relevant benefits. Firstly, international trade liberalization increases worldwide competition on tradable goods and thereby promotes efficiency in production and increases productivity growth. Secondly, it reduces prices for consumers and allows firms to take advantage of economies of scale. In particular, trade increases the scale of production (by lowering average costs) and expands the set of final products (or varieties) and the range of product qualities to choose from. Finally, trade improves access to knowledge and fosters the transfer of technologies across countries by reducing the costs of access to new technologies. In summary, it seems clear that the global trade liberalization process that has taken place in the last decades has generated significant benefits and gains for all agents in the economy.

The literature on International Trade has tried to assess the numerous factors that determine export flows and performance. In general, the explanation of the directions of trade flows has changed over time, going from macro-level to micro-level perspectives. For a long time, classic models of trade pointed out that trade flows could be explained by differences in country or industry characteristics.[7] Specifically, these models were based on Ricardian theory of comparative advantage which assumes that sector-specific technological differences and labour costs between countries (measured by the relative labour productivity) determine trade patterns. More specifically, these models of international trade predict that a country specializes in the production of goods in which it is more efficient and has a lower opportunity cost than other countries.

[7] In 1817, David Ricardo published his book *On the Principles of Political Economy and Taxation* where he investigated the international specialization and the benefits from international trade by developing the theory of comparative advantage.

The classical Ricardian theory of comparative advantage based on cross-country differences in productivity and labour costs was complemented by the neoclassical theories in the twentieth century, which focused on factor endowments (Heckscher, 1919; Ohlin, 1933). According to Heckscher-Ohlin model, in free trade, each country tends to specialize in those goods relatively intensive on the productive factor in which the country is relatively more abundant.

Later, in the seventies and eighties, new trade models emerged to address the shortcomings of standard trade theory. Specifically, these models tried to deal with the realities of trade in a more complex way by incorporating a full range of new factors within neoclassical economics. In general, one of the starting point of the so-called *New Trade Theory* is the work by Krugman (1979, 1980), who develops monopolistic competition models of trade with homogeneous firms that incorporates economies of scale, product differentiation and imperfect competition. Therefore, these new trade models began to take into account market imperfections, informational asymmetries, adjustment costs and the strategic behaviour of all agents (firms as well as governments) to explain the patterns of international trade (Ethier, 1982; Krugman, 1984, 1986; Eaton and Grossman, 1986; Grossman and Helpman, 1991).

More recently, the explanation of the characteristics of the significant increase in global trade flows has promoted the emergence of a large economic literature that treats firms as the main unit of analysis and that has introduced producer heterogeneity into trade models. Additionally, new general equilibrium models have allowed us to be more consistent with various dimensions of both the aggregate and the firm-level data. This firm-level perspective, unlike the previous approaches that relied on country/industry dimension, has been favored by two important facts. On the one hand, this change was reflected by the abandonment of the basic assumption of homogeneous firms à la

Krugman that predominated in the International Trade literature until the nineties. On the other hand, this change was also favored by the greater availability of disaggregated data at the firm- or plant-level. All these facts have led to the emergence of the so-called *New New Trade Theory* (Baldwin and Robert-Nicoud, 2008). This Thesis is framed within this line of research.

The recent international trade literature based on heterogeneous firms has also emphasized the importance of firms' intensive and extensive margins for understanding new patterns of trade (Bernard *et al.*, 2003; Chaney, 2008; Eaton *et al.*, 2008; Bernard *et al.*, 2009; Bernard *et al.*, 2010, 2011; Eaton *et al.*, 2011).[8] In this regard, a central insight of this literature points out that the extensive margins of trade can account for a large share of the variation in exports (and imports) across countries. Additionally, new empirical evidence stresses the relevance of multi-product and multi-market characteristics in export strategies. For this reason, the third chapter of the Dissertation takes into consideration these multi-product and multi-market features in explaining entry decisions in new export destinations.

The wealth of evidence from microdata has encouraged the development of new firm-level models of international trade. In particular, these models have increasingly focused on export decisions of heterogeneous firms. In this regard, for instance, an important body of this literature, beginning with Bernard and Jensen (1995), has addressed the relationship between firm's characteristics and exporting decisions that firm takes. In general, empirical evidence points out that exporters are larger, more productive, more capital-intensive, more technology-intensive and pay higher wages than non-exporters (Bernard and Jensen, 1999; Bernard *et al*, 2007). The explanation of

[8] The intensive margin is defined by the average value of exports per firm per product and per country, whereas the extensive margin refer to the number of exporting firms, the number of products that firms trade and the number of countries they trade with.

this exporter *premia* has generated a vast literature which has proposed two alternative, but not mutually exclusive, hypotheses.

The first hypothesis suggests the existence of a *self-selection* process in the export decision. In particular, this hypothesis points out that only the more productive firms are able to overcome the higher sunk costs of entering export markets (Bernard and Wagner, 1997 for German firms; Clerides *et al.*, 1998 for Colombia, Mexico and Morocco; Bernard and Jensen, 1999 for U.S. firms; Aw *et al.*, 2000 for Taiwanese and Korean firms; Girma *et al.*, 2004 for U.K. firms). Accordingly, these models consider the existence of a productivity threshold that determines the potential entry into export markets. In this regard, the paper by Melitz (2003) represents the cornerstone of this type of approach.

The second hypothesis assumes that firms become more productive after becoming exporters (*learning-by-exporting* process). In other words, exporters acquire knowledge from foreign competition which helps them to improve the post-entry performance related to the manufacturing process, the product design or the quality of the goods (Grossman and Helpman, 1991; Kraay, 1999 for Chinese firms; Castellani, 2002 for Italian firms; Baldwin and Gu, 2003 for Canadian firms; Van Biesebroeck, 2003 for sub-Saharan African firms).

As was previously mentioned, this Dissertation is framed within this literature on heterogeneous firms and international trade. Motivated by other empirical findings using micro-level data, this PhD Thesis emphasizes heterogeneity in productivity, size and other firm characteristics to assess the main determinants and externalities derived from export decisions for Spanish manufacturing firms. This research, therefore, rationalizes a number of features of disaggregated trade data (e.g. performance differences between exporters and non-exporters), investigates the potential process of

sequential entry in export markets (focusing on geographical and industrial spillovers), and analyzes the effects of physical capacity constraints on firm's export decisions.

1.3 Objectives and hypotheses

The primary objective of this Thesis is to study the main factors that are relevant in export activity of Spanish manufacturing firms. More specifically, the principal contributions are twofold. Firstly, this Dissertation analyzes potential geographical and industrial spillover effects derived from previous or current participation in export activities. Secondly, this Thesis assesses the main determinants that are relevant in explaining export strategies of firms. With these objectives in mind, new empirical evidence about the behavior of the Spanish manufacturing firms is presented in each chapter of the Dissertation.

Furthermore, the main contributions of the research could be divided in the next three specific objectives. The first one is the analysis and the empirical quantification of spillover effects generated by participation in export activities on both levels and growth rates of domestic sales. The second specific objective focuses on the examination of a potential process of sequential entry in export markets. In particular, we evaluate whether previous experience in close export markets (experienced by the same firm or by other firms in the same industry) facilitates entry into new export destinations. Finally, the third specific objective is to assess the role of capacity constraints in explaining exporting and R&D decisions.

Each of these specific objectives is clearly detailed in the three chapters of the Dissertation. Additionally, in order to summarize these objectives, Table 1.1 presents in a schematic form the main objectives, contributions and hypotheses of the research.

Table 1.1: Research objectives

Main objective	Specific objectives	Contributions	Hypotheses	Methodology
To study the main determinants and externalities derived from export decisions at the firm level	To analyze and quantify the impact of exporter status on domestic sales	**Paper 1.** Empirical quantification of the spillover effects generated by participation in export activities on both levels (volumes) and growth rates of domestic sales	***H1***. Do exporters have higher volumes of domestic sales than non-exporters? ***H2*.** Do non-persistent exporters have higher domestic sales in those years in which they are involved in export activities? ***H3***. Does participation in export activities reduce the growth of domestic sales?	Difference-in-difference methodology. Fixed and random effects model **Data**: Encuesta Sobre Estrategias Empresariales (ESEE)
	To examine sequential entry decisions in new export markets	**Paper 2**. Externalities derived from previous export activity in countries close to those for which a potential entry decision is made and the externalities derived from previous presence of other firms in the same industry	***H1***. Does previous experience in a specific geographical area facilitate entry into new countries of the same area? ***H2*.** Does previous experience of other firms in the same industry facilitate entry into new destinations?	Probit and conditional logit models **Data**: Directory of Spanish Exporting and Importing Firms and The World Bank and the OECD databases
	To evaluate the role of capacity constraints in explaining exporting and R&D decisions	**Paper 3.** Analysis of the effects generated by capacity constraints on export and innovation strategies. New measure to determine if firms face capacity constraints that incorporates industry and time factors	***H1*.** What is the effect of the capacity utilization rate on the joint likelihood of exporting and performing R&D? ***H2*.** Are capacity-constrained firms less prone to engage in exporting and in performing R&D activities?	Bivariate Probit model **Data**: Encuesta Sobre Estrategias Empresariales (ESEE)

Source: Author's elaboration.

1.4 Data source and methodology

To address the main objectives and to test the working hypothesis, this Dissertation has used several statistical datasets. Specifically, it has combined microdata at the firm-level with aggregated information at the country-level.

With respect to the microdata at the firm-level, this Dissertation has used two main databases. On the one hand, the second and the fourth chapter of the Thesis have been done using microdata provided by the *Encuesta Sobre Estrategias Empresariales* (ESEE, Survey on Business Strategies). This survey is carried out yearly by the Spanish Ministry of Industry since 1990 and provides exhaustive information at the firm-level for Spanish manufacturers (number of employees, volume of domestic and export sales, two-digit NACE codes, ownership structure and other important variables related to financial balance sheet). The population of the ESEE covers manufacturing firms with ten or more employees and uses the firm size and the two-digit NACE sector as the main stratification criteria. The original size of the dataset for the considered period 1990-2011 is 40,686 observations which correspond to 5,040 firms. On the other hand, the third chapter of the Thesis has been done using microdata provided by the Directory of Spanish Exporting and Importing Firms. This database is carried out by the Spanish Chambers of Commerce and the Spanish Tax Agency and provides annual information on volume of exports (grouped in three segments), exported products and countries of destinations. This information is freely available through the website of the Spanish Chambers of Commerce, but it does not allow the direct download of the data.[9] For this reason, a complex system of computer programming, based on Visual Basic and Excel Macro, had to be implemented in the data extraction process. The final sample covers from 2000 to 2010 and the panel is composed by 81,181 observations that correspond to 10,124 firms.

[9] See http://directorio.camaras.org/ for more details.

With respect to aggregate country-level information, this Thesis has taken diverse statistic information extracted from different databases such as the World Bank database or the OECD dataset. Specifically, GDP volumes of Spain's trading partners have been obtained from the World Bank database while the OECD dataset has facilitated the information of the country risk indicator which is based on the Arrangement on Officially Supported Export Credits[10]. Moreover, in order to calculate distances between Spain and its trading partners by applying the Great Circle method, we have collected from Google Maps the coordinates of the capitals of Spanish trading partners. Once collected, we have used the Stata command *sphdist* which estimates the distance between two coordinates (latitude and longitude) on Earth.

Additionally, different econometric techniques and methodologies have been used to accomplish the main objectives of the Dissertation. More specifically, this PhD Thesis has applied the methodologies that are described in the following paragraphs.

Firstly, the econometric analysis of the second chapter has been carried out by applying the difference-in-difference approach and the fixed and random effects model for panel data. On the one hand, the diff-in-diff methodology compares pre- and post-export domestic sales for two groups of firms and for two time periods. In particular, this method is based on a simple idea: one of the groups exports in the second time period, but not in the first; while the second group does not export in either period. On the other hand, this chapter also applies fixed and random effects model to estimate the variation in domestic sales associated with participation in export activities by controlling for unobserved heterogeneity.

Secondly, diverse discrete choice models have been used in the third chapter of this Dissertation. In particular, this chapter mainly combines both probit and conditional

[10] See http://www.oecd.org/tad/xcred/crc.htm for more details.

logit models to control for observable and unobservable firm characteristics. These methodologies allow us to take advantage of the panel data structure of the set of new entry decisions made by each firm and to analyze the main determinants in this potential entry process. Additionally, and to test some descriptive results, this chapter has also applied the Poisson regression model for counts of events.

Finally, the fourth chapter of the Dissertation has used a bivariate probit model to estimate the effect of capacity constraints in explaining exporting and R&D decisions. This methodology allows to estimate a joint model for two separate probit equations by taking into consideration that the two binary dependent variables could be interrelated. In this regard, if the estimated correlation between the errors of both equations is significantly different from zero then the model needs to be estimated simultaneously, which indicates that the estimates obtained from a univariate decisions framework would be inefficient.

Additionally, each of the chapters of the PhD Thesis includes a section that details in a more specific way the applied methodology.

1.5 Structure of the Thesis

This Dissertation is composed by five chapters, and this introduction is the first of them. The next chapter –chapter II– contains the first paper of the dissertation, which analyzes and quantifies the impact of exporter status on domestic sales. It is widely assumed that exporters sell more volume in domestic markets than non-exporters. In addition, non-persistent exporting firms have, on average, higher volumes of domestic sales in those years in which they are involved in export activities. This chapter contributes to this literature by using data from a representative sample of Spanish manufacturing firms (*Encuesta Sobre Estrategias Empresariales*) over the period 1990-2011. By applying a

difference-in-difference approach, findings confirm that exporters have, on average, larger domestic sales (volumes and growth rates) than non-exporters. Moreover, a fixed and random effects model is also applied to measure the impact of exporters status on domestic sales, considering only exporting firms. Results suggest that exporter status increases domestic sales volumes, although it significantly reduces growth. We will refer to this deceleration as residual exports. Finally, findings also indicate that the amount of these effects varies depending on firms' persistence in export markets.

The third chapter –chapter III– is devoted the second paper of this Thesis, which addresses sequential entry decisions in export markets. Specifically, this paper focuses on externalities derived from previous export activity in countries close to those for which a potential entry decision is made (*geographical spillovers*) and externalities derived from previous presence of other firms in the same industry (*industrial spillovers*). The empirical analysis uses Spanish microdata for the period 2000-2010 in a firm decision model that also integrates country and industry characteristics. The main findings of the research suggest that these two types of spillovers have a positive and relevant effect in explaining entry decisions in new markets, though both are smaller in magnitude than the effects coming from previous presence in the same specific destination.

The fourth chapter –chapter IV– contains the third paper of the Dissertation that analyzes the role of capacity constraints in the firm's joint decision to export and perform R&D activities. In general, most of the models based on firm heterogeneity assume that production is completely flexible and do not take into account the critical role of capacity constraints on firms' strategic decisions. In this regard, for instance, these models do not consider that capacity-constrained firms cannot freely increase production. By using data drawn from the *Encuesta Sobre Estrategias Empresariales*,

this chapter applies a bivariate probit model in order to estimate the effect of capacity constraints in explaining both strategic decisions. In doing so, this paper provides a new measurement to determine if firms face capacity constraints that incorporates heterogeneity related to industry and time dimensions. Findings confirm that capacity-constrained firms (those with capacity utilization rates above a particular threshold) are less prone to engage in exporting and in performing R&D activities. In addition, results also indicate that a high capacity utilization rate in the preceding year increases the joint probability of exporting and investing in R&D.

Finally, the last chapter of the Thesis –chapter V– summarizes the main findings and conclusions of the research. Furthermore, it also suggests some future research questions.

CHAPTER II

RESIDUAL EXPORTS AND DOMESTIC DEMAND

2.1 Introduction

The increase in the number of exporting firms is a remarkable indicator of the internationalization process in recent decades. As expected, this rise of international trade flows has promoted competition in domestic and export markets. In this regard, the relationship between domestic demand growth and incentives to enter and stay in export markets has been a widely discussed topic for a long time. In general, it is assumed that entry into export markets is affected by two main determinants. On the one hand, it may depend on firm characteristics or firm-specific behavior. In particular, empirical evidence shows that exporters are bigger, more productive, more intensive in R&D and pay higher wages (Mayer and Ottaviano, 2008; Rodríguez, 2008). Additionally, Martín-Machuca *et al.* (2009) also suggest that previous experience in domestic market can have a positive impact on the probability of export entry. This approach is based on a self-selection hypothesis, where only "better firms" are able to face the sunk costs associated with the entry. On the other hand, export entry is also affected by external factors that include characteristics related to the international

economic environment, demand shocks in domestic and export markets, and exchange rate fluctuations. Thus, for example, changes in the domestic cycle may encourage participation in exporting.

The strategy of considering exports as a way to place "residual" sales has been present in some specific sectors like the steel industry. In this regard, Blonigen and Wilson (2010) analyze the U.S. steel industry for the period 1979-2002, concluding that excess capacity (produced by foreign government subsidies and high protective trade barriers) leads foreign producers to sell at high prices in their domestic markets and dump the excess on the U.S. This strategy has also happened historically with some agricultural products, where foreign markets were the solution for domestic production surpluses. The recent economic crisis that started in 2008 offers a recent example for revisiting this topic (Tiana, 2012; Lee *et al.*, 2009). In general, it is assumed that recessions significantly reduce domestic demand, which tends to promote participation in export markets. Therefore, it seems clear that access to export markets is often a necessary strategy for a firm's long-term survival, especially in crisis periods. This assumption is also applied to Spanish firms in the recent recession, during which firms have made an effort to improve foreign sales, in spite of the severe decline of international trade flows in 2009, as a mechanism for balancing shrinking domestic sales. The result of this important effort was highly satisfying. Specifically, Spanish manufacturing exports (in nominal terms) increased 8.5% from 2007 to 2012, while exports from Germany, France and Italy increased 10.5%, 6.5% and 4%, respectively.

The primary goal of this chapter is to analyze the impact of exporter status on domestic sales. More specifically, the main contribution of this paper is to empirically quantify the spillover effects of being an exporter on both levels (volumes) and growth rates of domestic sales. In particular, this paper addresses two main questions: (1) what is the

variation in domestic sales between exporters and non-exporters; and, (2) for the universe of firms that export in some years (but not in all of them), what happens with domestic sales when these firms engage in exporting?

The empirical analysis is carried out using firm-level data drawn from a Business Strategy Survey (*Encuesta Sobre Estrategias Empresariales*; ESEE) on a representative sample of Spanish manufacturing firms over the period 1990-2011. Firstly, the econometric analysis applies the difference-in-difference approach. This technique analyzes pre- and post-treatment results of firms exposed and not exposed to treatment. In this study, treatment is defined as participation in export activities. Therefore, we compare domestic sales of exporters before and after exporting (treatment group), with a control group defined by non-exporters. Additionally, we distinguish among different types of firms according to their persistence in export activities. As expected, results suggest that exporters have larger domestic sales (volumes and growth) than firms that never export. Secondly, a fixed and random effects model is applied to analyze the impact of export status on domestic sales for firms that export in some periods. Results confirm that domestic sales are greater when firms are exporting. However, results also indicate that growth is reduced as a consequence of participation in export activity, suggesting a substitutability relationship between domestic and export sales. We will refer to this fall in domestic sales growth as residual exports.

The remaining chapter will be organized as follow. Section 2 reviews the recent literature related to the relationship between domestic and export sales. In Section 3, data and some descriptive results are presented. The econometric analysis and the main results using different estimation techniques are contained in Section 4. Finally, Section 5 discusses the main findings from the research.

2.2 Theoretical framework

The literature on International Trade has tried to analyze why exporting occurs, what the directions of the trade flows are or what the main determinants in export performance are. The answers to the previous questions have changed over the decades, going from macro-level (comparative advantage, factor endowments or gains from trade) to micro-level perspectives. The latter approach analyzes firms' characteristics to obtain the determinants related to entry and behavior in export markets. However, there are not many papers that analyze the interrelationship between export and domestic sales.

An exception is Salomon and Shaver (2005), who analyze this interrelationship and its main determinants for Spanish manufacturing firms between the years 1990 and 1997. That study has three main conclusions. Firstly, they obtain that export and domestic sales are simultaneously determined by firms. Secondly, the authors suggest that this interdependent relationship varies according to the ownership structure of firms. On the one hand, they find that domestic and export sales are complements for Spanish-owned firms. On the other hand, both types of sales are substitutive for foreign-owned firms. Finally, that paper analyzes the effects of different variables on domestic and international sales. For example, as is expected, foreign economic growth makes easier exports, while domestic growth increases domestic sales. However, the evidence is not clear about the effects of R&D investment and exchange rate fluctuations on both markets.

This line of research is also followed by Liu (2012), who focuses on the dynamics of domestic and export sales. In particular, the author suggests that exporters face trade-off between domestic and export sales in the short run in response to external demand shocks. She develops a dynamic model of firms' sales dynamics with capacity constraint and endogenous investment. The results also suggest the substitution between

domestic and export sales. More specifically, she points out that expansion into export markets is caused by positive foreign demand shocks, which generates a rise in output price and investment, and induces welfare losses for domestic consumers. This result underlines the importance of the fixed capital adjustment cost (capacity constraint) when firms have to adjust their investment levels because of external shocks that generate demand shifts (domestic and foreign).

An additional issue in recent studies is related to the role of marginal costs and capacity constraint. In that vein, Blum *et al.* (2013) argue that export is a response to stochastic demand shocks and the existence of increasing marginal cost. The underlying intuition indicates that when a firm is affected by a negative domestic demand shock, it is able to use more fixed capital to sell in foreign markets. Similarly, they suggest that firms leave aside foreign sales (or reduce the number of destinations) and they focus on the national market when domestic demand is relatively high. Therefore, they emphasize the importance of fixed capital investment as a mechanism for explaining the participation in both markets. The authors develop a heterogeneous firm model, based on Melitz (2003), where each firm knows its productivity parameter before entering an export market. This parameter indicates the profitability (or non-profitability) of export activity, because it determines whether a firm may face sunk costs or fixed capital investment associated with entry. Thus, the model distinguishes two kinds of exporters depending on the level of fixed capital investment: occasional and perennial. On the one hand, occasional exporters are usually small and not highly efficient firms and they base their export decisions on the state of demand. These firms sell to foreign markets when domestic demand is relatively low and fixed capital is "under-utilized". On the other hand, perennial exporters are usually large and highly efficient firms which invest enough capital to sell in domestic and foreign markets, regardless of demand. As in

previous papers, the main conclusion of this paper confirms the substitution relationship between domestic and foreign sales.

Following the same line of analysis, Ahn and McQuoid (2012) also analyze that interrelationship with Indonesian and Chilean data, focusing on the existence of increasing marginal costs. They suggest that this assumption is key for analyzing the trade-off between domestic and foreign sales. In this regard, the authors point out that those firms with constant marginal costs may not reduce their domestic sales in response to positive external shocks since increasing production has no effect on the level of marginal costs. However, the same positive foreign shocks, under the assumption of increasing marginal costs, would increase export sales and would reduce domestic sales because the increase in the production level also raises the level of marginal costs. Therefore, they suggest that the existence of financial and physical constraints leads to increasing marginal costs. Their results also indicate a strong negative correlation between domestic and foreign sales related to financial and physical capacity constraints. In particular, firms with capacity constraints present a higher substitution relationship between domestic and export sales than those that are not constrained.

As was previously mentioned, the recent economic turmoil has stimulated researches into the effects of changes in the economic cycle on domestic and foreign markets. This issue is addressed, for instance, in Lee *et al.* (2009), who analyze export intensity of Korean firms to changes derived from the Asian economic crisis in 1997. The authors observe a huge drop in domestic demand in the crisis period, distinguishing two different types of firms according to their adaptation to that external economic change and their domestic market position. On the one hand, they denote those firms with investment in flexible capabilities which may reorient their production to export

markets. On the other hand, the authors identify those firms that are locked in with inflexible resources and tend to fail (exit the domestic market). The main finding of the paper indicates that domestic leaders have a greater incentive to increase their export sales, because they lost an important part of their domestic sales as a result of the national demand shrinking. Moreover, they also obtain that this positive relationship between domestic position and export intensity is stronger in the post-crisis than in the pre-crisis period.

A descriptive analysis about this issue is carried out by Tiana (2012), who analyzes the main factors that explain the behavior of Spanish manufacturing industries during the recent recession. He indicates that national demand has reduced because of the impact of the crisis on the construction industry, which caused direct and indirect spillovers.[11] In this regard, he points out the significant decline of private consumption and equipment investment as a consequence of the weakness of the Spanish economy (compared with the other EU countries). Moreover, the author also indicates that exports have helped to absorb the impact of the crisis on industrial production and domestic demand. The progressive opening of Spanish firms has reoriented production to external markets, triggering improvements in price competitiveness. Specifically, the paper shows that the Real Effective Exchange Rate based on total unit labour costs improved by 12% during the crisis period from 2007 to 2012, while manufacturing exports, as stated above, grew 8.5% in the same period. Additionally, this improvement in the competitiveness index has been also observed with the most current data from the statistics of the Bank of Spain, which confirms the results presented above.

An alternative way to assess the "residual" effects is by incorporating domestic demand growth in a classical demand function of exports. Under this approach, Moreno (1997)

[11] Direct spillovers are related to all goods required in the construction industry. By contrast, indirect spillovers have an impact on the rest of the goods.

estimates export demand functions for a set of Spanish manufacturing firms, including a variable that approaches the domestic pressure of demand. The main result of the research points out that that domestic demand did not have any impact on the evolution of Spanish exports to the EU in the period 1978-1989. This result is similar to the one obtained in Buisán and Gordo (1994), who also suggest that domestic pressure of demand does not influence Spanish exports.[12]

In summary, the literature on international trade has not taken into consideration potential residual effects associated with participation in export activities. However, it is also necessary to consider what occurs with domestic sales when firms engage in international trade. In this regard, we want to evaluate the variation in levels and growth rates of domestic sales generated by export-related activities. More specifically, the main hypothesis to be tested is whether exporting has a residual effect on domestic sales by reducing their growth rates.

2.3 Data and descriptive results

This study exploits firm-level data that comes from the *Encuesta Sobre Estrategias Empresariales* (ESEE). This database is based on an annual survey of Spanish manufacturing firms. The survey is sponsored by the Ministry of Industry and has been carried out since 1990. The ESEE uses firm size and industry sector to two-digit NACE as the main stratification criteria. The sample period covers the years 1990-2011 and an unbalanced panel from the available data is used. The initial sample has 5,040 firms.

This database provides information related to firms' characteristics: domestic and export sales volumes, number of employees, two-digit NACE codes, ownership structure

[12] However, it is necessary to remark that previous work by Fernández and Sebastian (1989) did find a significant negative effect of domestic demand on Spanish exports.

(foreign- or nationally-owned) and other important variables related to financial balance sheets. Additionally, it also facilitates information about participation in export activities over the period. In this regard, four different types of firms can be identified according to persistence in exporting: (i) those firms that never export (non-exporters), (ii) those that always export (always-exporter), (iii) those that leave export markets and never re-enter (stoppers), and (iv) those new exporters that enter export markets only one (persistent entrants) or multiple times (switchers) throughout the period.[13] Additionally, the database also provides information about R&D investment and participation in process and product innovation activities. To avoid the presence of outliers, we exclude the two tails of the distribution of domestic sales growth defined by the percentiles 1 and 99. Table 2.1 shows some descriptive results related to domestic sales and R&D expenditure, according to firms' persistence in export markets.

Table 2.1: Descriptive results of the data according to exporting participation

	# Employees		Domestic sales (volumes)[1]		Domestic sales (growth)		R&D investment	# Firms	%
	Mean	Median	Mean	Median	Mean	Median	Mean		
Non-exporters	38.07	19	3.32	0.87	1.10%	-0.16%	9,061	1,744	34.6
Switchers	195.4	35	18.00	2.53	4.26%	1.31%	782,936	669	13.3
Non-exporting	*91.8*	*24*	*12.98*	*1.67*	*5.53%*	*1.88%*	*63,980*		
Exporting	*275.3*	*55*	*22.67*	*4.28*	*3.14%*	*0.70%*	*1,436,504*		
Persistent entrants	181.3	40	24.38	3.20	5.57%	2.96%	977,137	265	5.3
Before entry	*124.9*	*28*	*13.92*	*1.95*	*7.01%*	*4.43%*	*200,644*		
After entry	*207.7*	*50*	*29.42*	*4.12*	*5.51%*	*2.59%*	*1,346,713*		
Stoppers	136.2	26	15.67	1.46	2.25%	-1.25%	275,100	167	3.3
Always-exporters	429.6	202	34.08	11.23	3.41%	0.88%	1,363,310	2,195	43.5
Total firms	252.8	48	21.53	3.29	3.16%	0.78 %	832,785	5,040	100

Note: [1] in 2011 millions of euros.

Source: Author's elaboration from ESEE database.

[13] In this regard, we have to remark that persistent entrants denote those firms that start to export in a particular year and continue to export until the last year of the sample consecutively.

As expected**,** firms that participate in export activities in any year of the period have more employees and present greater domestic sales than those that never export. Additionally, differences between the diverse types of exporting firms are observed. First, always-exporters are the biggest, the most innovative and those which have the highest domestic sales. Second, firms that leave export markets have lower numbers of employees, domestic sales (in median value) and R&D expenditure than those firms that continue exporting. Moreover, the average growth rate of domestic sales for stoppers is negative and the lowest. Finally, results between switchers and persistent entrants are very similar, although the latter usually present more employees (in median), more domestic sales, a higher growth rate for domestic sales and more R&D expenditure than switchers. Therefore, it seems clear that export generates spillovers that have a positive effect on firms. Particularly, the more persistent the firm is in export markets, the larger the effect is.

Another interesting result is related to the variation of the latter variables for switchers and persistent entrants for those years in which they are involved in export activities. In this regard, Table 2.1 shows that both types of firms have more employees, greater domestic sales and more R&D expenditures when they are engaged in exporting. Particularly significant is the increase in R&D investment as a result of entry into exporting. Specifically, R&D expenditure is multiplied, on average, by 22 and 7 for switchers and persistent entrants, respectively. However, both groups of firms tend to reduce domestic sales growth when they are exporting. It may indicate that firms decide to focus on and strengthen their foreign position, leaving aside domestic markets, when they incorporate foreign destinations in their portfolio. Therefore, it seems clear that exporting generates important increases in domestic sales, though the growth (measured by growth rates) is reduced in those years in which the firm is involved in export activities.

A primary goal of this paper is to investigate the variation of domestic sales when firms decide to participate in export activities. To address this question, Table 2.2 provides evidence on the single-difference of domestic sales growth before, during and after the first entry into export markets. Thus, we may obtain preliminary results about the existence of a complementary or substitutability relationship between domestic and export sales. Since we wish to compare variations in domestic sales as a result of entry into exporting, only persistent entrants and switchers are considered in this analysis. As was previously explained, the former are defined as those firms that enter export markets and continue exporting in consecutive years from that moment, while the latter imply those firms that enter and exit from exporting multiple times over the period.[14]

Table 2.2: Average growth rate for domestic sales in real terms (%)

	Switchers		Persistent entrants	
	Mean	Median	Mean	Median
Before the entry (*t-1*)	7.60	4.63	6.51	4.74
In the entry period (*t*)	3.53	0.70	5.72	3.92
After the entry (*t+1*)	7.29	3.21	6.15	2.44
# Total of firms	265		140	

Source: Author's elaboration from ESEE database

As can be seen in Table 2.2, switchers and persistent entrants decrease domestic sales growth as a result of entry into export markets. In particular, switchers halved domestic sales growth compared with the pre-entry period, going from 7.60% to 3.53%. This fall is also observed in persistent entrants, although it is not as great as it is in switchers. Therefore, it seems clear that, as expected, entry into export market responds to a substitution between domestic and foreign sales in the short run. Firms that decide to

[14] Related to the results of Table 2.2, we must remark that we only consider those firms with non-missing values in domestic sales before and after entry in exporting.

enter foreign markets focus on these sales, reducing or neglecting the domestic market.[15]

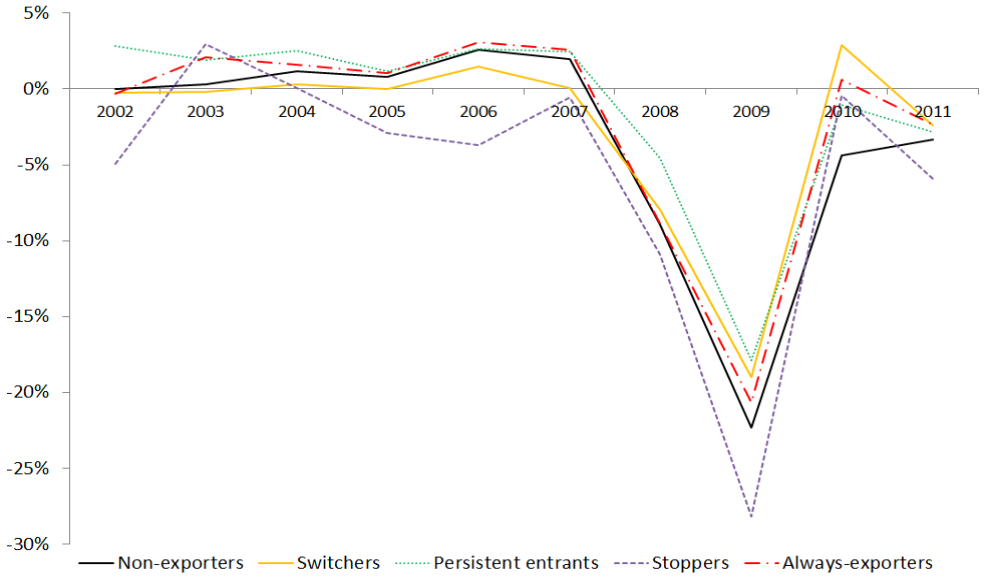
Results for both types of firms are similar when the post-entry period is analyzed. On the one hand, switchers increased their domestic sales growth rates after entry, suggesting that exporting is a transient situation. Therefore, switchers may use foreign markets as a mechanism for selling surpluses and recover, after entry, the normal growth of domestic sales. On the other hand, persistent entrants also increased their national sales growth rates in the post-entry period, although we observed an important fall in median value. It may suggest that once they decide to enter exporting, they prefer to strengthen their position in foreign markets rather than to focus on national markets.[16] Additionally, these growths (before, during and after entry) are manifestly higher than those obtained by non-exporters and always-exporters. In particular, the average growth rate of domestic sales for firms that never export is 1.10%, while the rate for those firms that export throughout the period is 3.41%. It may suggest that exporting also promotes sales in domestic markets.

Regarding the effects of the global economic crisis that started in 2008 on national demand, Figure 2.1 shows the evolution of the average growth rates of domestic sales for the different types of firms according to exporting persistence in the period 2002-2011. As can be seen, firms presented positive growth rates in the years previous to the beginning of the crisis (with the exception of the stoppers). In general, always-exporter and persistent entrants have greater domestic sales than the other types of firms.

[15] Results remain unchanged when the whole set of sample firms is considered.

[16] The trend of the results also remains when we analyze growth rates of domestic sales two periods after the entry. In *t+2*, the growth rates continued diminishing for switchers to 5.58%, while the rates for persistent entrants increased slightly to 7.68 %.

Figure 2.1: Average domestic sales growth (2002-2011)



Source: Author's elaboration from ESEE database.

The main change in the trend begins in 2008, with a significant decrease in domestic demand (the growth rates for all types of firms are clearly negative). This important shrinking continues and accentuates in 2009, even to negative rates of over 20%. Therefore, this result would be in accordance with the severe collapse in world trade in late 2008 and 2009. In particular, international trade flows decreased by around 12% in 2009 (WTO, 2010), which represented the sharpest and deepest slump in trade in more than 70 years. According to exporting participation, Figure 2.1 also shows that non-exporters and stoppers were the firms with a greater reduction in their domestic sales. Therefore, it seems clear that firms involved in export activities suffer lower shrinking in their domestic sales than those not involved or those stopping exporting. In subsequent years, growth rates slightly improved to reach positive rates in the last year of the period.

2.4 Econometric approach

Results of the previous Section may suggest the existence of export spillovers in domestic sales. Thus, for instance, the decrease in domestic sales growth is apparently correlated with the first entry into exporting. We are now interested in analyzing the effect of being an exporter on domestic sales over the entire sample period. Accordingly, this Section sets up the econometric strategy to analyze (i) differences in domestic sales between different groups of firms according to their presence in export markets (i.e., exporters and non-exporters) and (ii) variations in domestic sales as a result of entry into exporting, considering only exporters.

To tackle these issues, we use three different approaches. First, the difference-in-difference methodology is applied to compare domestic sales for two different groups of firms (control and treatment group), which are defined according to involvement in exporting. Second, a fixed-effects model is estimated to capture the impact of exporter status on domestic sales, considering only non-persistent exporting firms. By using this methodology, we are able to estimate the variation in domestic sales associated with participation in export activities by controlling unobservable heterogeneity. In particular, this methodology supposes that firm effects are constant over time and independent for each firm. Finally, in order to also estimate the impact on domestic sales caused by export-related activities, a random effects model is applied. The underlying idea of this methodology is based on the assumption that firm effects are a random variable.

2.4.1 Exporters vs. non-exporters: difference-in-difference approach

As mentioned above, this study firstly applies the difference-in-difference methodology. This technique has become very widespread in the last few decades since the work of Ashenfelter and Card (1985). The underlying idea of this methodology compares pre-

and post-treatment results for two groups of individuals and for two time periods and it is based on a simple idea: one of the groups is exposed to the treatment in the second time period, but not in the first; while the second group is not exposed to the treatment in either period. To remove biases in second period comparisons between both groups, the average gain in the second group (control) is subtracted from the average gain in the first group (treatment). For instance, the paper by Ashenfelter and Card (1985) analyzes the effect of training programs on unemployment earnings and low-income workers. Using this methodology, they can measure, evaluate and quantify the effectiveness of these programs on wages.[17] Though initially developed in the field of public policy, the use of this technique has been extended to many other economic fields.

The next step is to apply the difference-in-difference approach in our study. As was previously mentioned, we want to analyze the effect of exporter status on domestic sales. First, we must identify treatment and control group. In this regard, treatment refers to participation in export activities. It indicates that a firm "suffers" the treatment when it sells in foreign markets in period 2, but not in period 1. By contrast, the control group includes all firms that do not export over the two periods. Using this methodology, we may compare and measure the change in domestic sales (volumes and growth) for the treatment group (exporters) and the control group (non-exporters) under the assumption that the difference is due to exporting. This latter expression can be written as follows:

$$DID = [(Dom_{t+1} \mid X = 1) - (Dom_t \mid X = 1)] - [(Dom_{t+1} \mid X = 0) - (Dom_t \mid X = 0)] \quad (1)$$

[17] This research measured the impact of the 1976 "*Comprehensive Employment and Training Act"* (CETA) programs, implemented by the U.S. congress. In particular, they estimate that the effect of these programs on unemployed workers ranged from $200 to $2000, concluding that trials are needed to evaluate the accuracy of these programs.

where *Dom* indicates domestic sales before and after the exporting (*t* and *t+1*, respectively), and *X* is a dummy variable which captures the effect of participation in export activities for the two groups of firms. In particular, this variable takes the value one in those years in which firms are involved in export activities, and zero otherwise.

The basic formulation of this methodology is one with pre- and post-treatment observations (export or not export) on a group, where domestic sales by firm is the outcome variable.

$$Dom_{it} = \alpha + \beta T_t + \delta X_i + \gamma T_t \times X_i + C_{it}^{'}\phi + \varepsilon_{it}, \quad t = 1,2 \tag{2}$$

In the latter expression, *i* indexes the two different groups of firms (*i*=1 for treatment group, exporters, and *i*=0 for control groups, non-exporters), T_t is a dummy variable which takes value zero in the pre-treatment period (*t*=1) and one after the treatment (*t*=2), and X_i is another dummy that is equal to one in those periods in which the firm exports and zero otherwise. Finally, C_{it} is a set of control variables and ε_{it} denotes random shocks. The variation in domestic sales, before and after the treatment, for those exporting firms is:

$$E(Dom_{i2} \mid X_i = 1) - E(Dom_{i1} \mid X_i = 1) = (\alpha + \beta + \delta + \gamma) - (\alpha + \delta) = \beta + \gamma \tag{3}$$

Similarly, the change for non-exporting firms is:

$$E(Dom_{i2} \mid X_i = 0) - E(Dom_{i1} \mid X_i = 0) = (\alpha + \beta) - \alpha = \beta \tag{4}$$

Therefore, the difference in difference is obtained by subtracting expressions (3) and (4). Specifically,

$$[E(Dom_{i2} \mid X_i = 1) - E(Dom_{i1} \mid X_i = 1)] - [E(Dom_{i2} \mid X_i = 0) - E(Dom_{i1} \mid X_i = 0)] = \gamma \quad (5)$$

The methodology described above requires a restriction of the initial sample. On the one hand, always-exporters are not considered in this analysis. These firms are being "treated" in the first year of the sample period and continue being "treated" over the entire period. Therefore, they cannot be exposed again to the treatment. On the other hand, those firms that leave export markets (stoppers) are also excluded. These firms are suffering the treatment and they leave it, not being exposed to the treatment in any subsequent period (those firms that re-undergo the treatment are included in switchers). Under these assumptions, the total number of firms is reduced to 2,678. Additionally, in order to capture firm characteristics *ex-ante* that could lead to differential domestic sales, we also control for a set of variables related to the firm size, the engagement in R&D activities and firm's ownership structure (national or foreign). The inclusion of this set of control variables allows us to estimate the average treatment effect on the treated by matching firms in the treatment group to similar firms in the control group.

Table 2.3 summarizes estimated export effects, considering switchers and persistent entrants as the treatment group and non-exporters as the control group. These estimates are based on equation (2). As expected, exporters have, on average, higher volumes of domestic sales than non-exporters. In particular, the export impact on domestic sales for exporters is, on average, 9.60 million euros greater than for non-exporters. Therefore, it seems clear that exporting firms have higher domestic sales than those firms that never participate in export activities. With respect to domestic sales growth, Table 2.3 also suggests that it is, on average, 1.2 percentage points (pp hereafter) greater when firms are exporters. Results remain unchanged when fixed time effects are included, though the impact magnitude is smaller.

Table 2.3: Summary of estimated exporting effects applying the diff-in-diff methodology

	Domestic sales (2011 million euros)		Domestic sales growth (%)	
Exporting effect	9.60***	8.92***	0.012***	0.010**
	(0.93)	(1.16)	(0.003)	(0.004)
Time effects	No	Yes	No	Yes
No. of firms	2,678	2,678	2,678	2,678
No. observations	21,527	21,527	19,167	19,167

Note: Standard errors in parenthesis. ***, ** and * indicate significant at 1%, 5% and 10%, respectively.

A final check of this impact is presented in Table 2.4, which shows the same analysis as the previous table but distinguishing export effects for persistent entrants and switchers vs. non-exporters. Therefore, the effect of participating in export activities for persistent entrants (or switchers) is compared with those firms that never export.

Table 2.4: Summary of estimated exporting effects for switchers and persistent entrants

	Domestic sales (2011 million euros)				Domestic sales growth (%)			
	Persistent entrants		Switchers		Persistent entrants		Switchers	
Exporting effect	25.27***	25.98***	20.48***	20.07***	0.035***	0.028***	0.008	0.005*
	(2.12)	(1.98)	(2.26)	(1.76)	(0.005)	(0.005)	(0.008)	(0.003)
Time effects	No	Yes	No	Yes	No	Yes	No	Yes
No. firms	2,009	2,009	2,413	2,413	2,009	2,009	2,413	2,413
No. observations	13,572	13,572	18,455	18,455	11,500	11,500	16,188	16,188

Note: Standard errors in parenthesis. ***, ** and * indicate significant at 1%, 5% and 10%, respectively.

As expected, persistent and non-persistent engagement in export activities significantly increases domestic sales. Firstly, persistent entrants have, on average, 25.27 million

more euros of domestic sales than non-exporters. If the analysis is carried out in growth rates, results suggest that participation in export activities increases domestic sales growth for persistent entrants 3.5 pp more than for non-exporters. Secondly, switchers also sell more in domestic markets compared with non-exporters. In particular, the average increase of domestic sales for switchers is equal to 20.48 million euros. However, as can be observed, this increase is lower for switchers than for persistent entrants. It may suggest that entry and exit dynamics experienced by switchers reduce the effect of being an exporter on domestic sales. Therefore, it seems clear that exporting generates spillovers that stimulate domestic sales, confirming and quantifying the results of other research. Finally, the results also suggest that switchers do not vary the percentage change of their domestic sales as a consequence of exporting (compared with non-exporters).

As was previously mentioned, the comparisons made in this Section are across different group of firms. Nevertheless, the fact that we observe firms with both export status (export in some years and do not export in other) supports the idea of assessing within-firm variations. This is precisely the aim of the next Section.

2.4.2 Only exporters: fixed and random effects model

As was previously mentioned, we also want to analyze the effect of export status on domestic sales (levels and growth) in those years in which firms are involved in export activities. In doing so, a fixed and random effects model is used in this Section. Since we want to analyze the effect of exporter status, only those firms that enter export markets one or multiple times over the sample period are considered. In other words, only persistent entrants and switchers are taken into account in this Section.

The empirical specification of the effects on domestic sales (volumes) is therefore mainly explained by the following equation:

$$Dom_{it} = \beta_0 + \beta_1 Export_{it} + \beta_2 R\&D_{it} + \beta_3 Small_{it} + \beta_4 Large_{it} + \beta_5 Foreign_{it} + \beta_6 d_{it}^{H} + \varepsilon_{it},$$

where $Export$ and $R\&D$ are two dummy variables that take the value one in those years in which firms export or perform R&D activities, respectively. To control for firm size, we also include dummy variables related to firm size: *Small*, *Medium* and *Large*. Specifically, small firms employ less than 50 employees, medium size employ between 51 and 200 employees, and large firms employ more than 200 employees. [18] *Foreign* is another dummy variable related to firm's ownership structure which takes the value one when firms are mainly controlled by foreign capital and zero when firms are owned by national capital. Finally, d^{H} is a firm-specified indicator which identifies the behavior of domestic market demand during a certain year with respect to the previous year according to three different categories: recession, stability and expansion (value 1, 2, and 3, respectively). This individual indicator is provided by the ESEE in each of the five principal industries in which firms operate. It is constructed by weighting these values over all domestic markets defined by each firm. The weights are the proportion of sales in each industry with respect to total domestic sales.

Table 2.5 shows the results of the fixed and random effects models on domestic sales, considering both persistent entrants and switchers. As can be observed, participation in export activities increases domestic sales. This result is obtained by using both fixed and random effects models. Firstly, the fixed effects model predicts that exporter status increases domestic sales, on average, by 3.67 million euros. It suggests that export participation may generate spillovers that exceed the effect on foreign sales, also

[18] To avoid the presence of multicollinearity, we only consider small and large firms in the estimation (medium size is the reference).

impacting domestic market. In addition, this result remains when other variables are included in the analysis. In particular, exporter status increases domestic sales by 2.33 million euros on average. Column (ii) also suggests that innovative firms have higher domestic sales than non-innovative firms. Moreover, it also points out the positive effect of firm size. In particular, results indicate that large (small) firms present higher (lower) domestic sales than medium size firms. With respect to ownership structure, results suggest that firms controlled by foreign capital have lower domestic sales than those firms managed by national hands. Finally, the business cycle indicator also has a positive and significant impact on domestic sales, indicating that domestic sales present a procyclical behavior. Therefore, an increase in the market dynamism indicator (demand *proxy*) generates positive domestic sales variations.

Table 2.5: Fixed and random effects models on domestic sales (2011 million euros)

	Fixed Effects		Random Effects	
	(i)	(ii)	(iii)	(iv)
β_0	17.75***	15.58***	18.05***	15.87***
	(0.35)	(1.19)	(1.58)	(1.67)
Export	3.67***	2.33***	3.92***	2.15***
	(0.52)	(0.54)	(0.52)	(0.54)
R&D		4.73***		5.41***
		(0.76)		(0.75)
Small		-6.65***		-10.45***
		(1.22)		(1.13)
Large		17.49***		24.07***
		(1.29)		(1.23)
Foreign		-2.87**		1.07
		(1.44)		(1.37)
d^H		1.15***		1.19***
		(0.37)		(0.37)
# Observations	11,285	10,619	11,285	10,619
R2	0.014	0.337	0.014	0.350
Hausman Test	(i) vs. (iii)			30.48*** [1]
	(ii) vs. (iv)			286.48*** [6]

Note: ***, ** and * indicate significant at 1%, 5% and 10%, respectively. Standard errors in parentheses, and degrees of freedom between square brackets.

Secondly, the random effects model also predicts increments in domestic sales as a result of exporter status. In particular, national sales are increased because of export spillovers by 3.92 million euros when random effects are considered. Moreover, this effect is equal to 2.15 million euros when other variables are included in the regression. Again, as expected, participation in R&D activities, the firm size and the business cycle indicator have a positive and significant impact on domestic sales volumes. In contrast to the fixed effects model, the parameter related to ownership structure is non-significant, which indicates that this variable does not affect domestic sales. Finally, to test the adequacy of both models, a Hausman test is implemented. As can be observed this result suggests that the fixed effects model is a more adequate specification.[19]

The latter results related to *premia* on domestic sales for the group of firms that participate in export activities in some years, are complemented with the following analysis which distinguishes between the two possible export statuses: persistent entrants and switchers. Again, it is necessary to take into account that persistent entrants refer to those firms that start to export in a specific year and continue exporting since then. Conversely, switchers refer to those firms that enter and exit into export markets multiple times. The results of these estimates are presented in Table 2.6.

As can be observed, the impacts for persistent entrants are similar to previous results when both groups of firms are jointly considered. Firstly, results indicate that persistent entrants have, on average, higher volumes of domestic sales when they are engaged in export and R&D activities. Secondly, the Hausman test result also points out that the fixed effects model is more consistent than the random effects model. Additionally,

[19] As is well known, the Hausman test checks a more efficient model (random effects) against a less efficient but consistent model (fixed effects) to make sure that the more efficient model also gives consistent results.

Table 2.6 also suggests that innovative and large persistent entrants have greater domestic sales.

Table 2.6: Fixed and random effects on domestic sales for persistent entrants and switchers

	Persistent entrants		Switchers	
	FE	RE	FE	RE
β_0	11.71***	10.65***	15.83***	16.80***
	(2.64)	(3.61)	(1.30)	(1.86)
Export	9.39***	8.67***	0.027	-0.027
	(1.23)	(1.23)	(0.57)	(0.58)
R&D	3.57**	4.56***	5.00***	5.56***
	(1.62)	(1.61)	(0.84)	(0.83)
Small	-4.23*	-8.44***	-7.06***	-10.73***
	(2.41)	(2.28)	(1.39)	(1.29)
Large	13.73***	22.58***	18.67***	24.32***
	(2.76)	(2.62)	(1.42)	(1.36)
Foreign	6.82*	10.95***	-4.97***	-1.44
	(3.76)	(3.40)	(1.50)	(1.44)
d^H	1.59*	1.83**	1.02**	1.00**
	(0.82)	(0.82)	(0.40)	(0.41)
# Observations	3,009	3,009	7,610	7,610
R2	0.315	0.343	0.339	0.355
Hausman Test	(i) vs. (ii)			108.91*** [6]
	(iii) vs. (iv)			191.33*** [6]

Note: ***, ** and * indicate significant at 1%, 5% and 10%, respectively. Standard errors in parentheses, and degrees of freedom between square brackets. All figures are in 2011 million euros.

However, the results change substantially when only switchers are considered. Although the Hausman test result also indicates that fixed effects is a better specification than random effects, Table 2.6 shows that export status does not affect domestic sales. It may suggest that entry and exit dynamics in export markets are the main determinants which explain the exporting behavior of this group of firms. In other words, switchers do not vary their domestic sales, regardless of exporter status, and they

use exporting as a mechanism to sell possible domestic surpluses. Therefore, it seems clear that export persistence and the duration of these spells (transients or permanents) significantly impact on domestic sales volumes. With respect to R&D participation, results also suggest that switchers that perform R&D have greater domestic sales than those switchers that do not perform innovative activities. Moreover, as expected, firm size also has a positive effect on domestic sales. Finally, the effect of ownership structure is clearly different for both groups of firms. Specifically, foreign-capital switchers have lower domestic sales than those switchers in national hands.

Once the impact of exporter status on domestic sales volumes has been analyzed, we also want to estimate how domestic sales growth varies when firms are involved in export activities. As was suggested in the descriptive results, firms reduce growth in the export entry period. However, we also want to analyze whether this trend lasts over the whole export period. In particular, the equation to be estimated is:

$$\Delta Dom_{it} = \beta_0 + \beta_1 Export_{it} + \beta_2 R\&D_{it} + \beta_3 Small_{it} + \beta_4 Large_{it} + \beta_5 Foreign_{it} + \beta_4 \Delta d_{it}^{H} + \xi_{it},$$

where Δdom is the annual growth rate of domestic sales; *Export*, *R&D*, *Small*, *Large* and *Foreign* are dummy variables previously defined and related to export participation, R&D investment, firm size and ownership structure, respectively; and Δd^{H} is demand variation in domestic markets according to the difference in the individual indicator of the business cycle. Table 2.7 shows the results on domestic sales growth for the whole set of persistent entrants and switchers when the fixed and random effects models are considered.

Table 2.7: Fixed and random effects models on domestic sales growth

	Fixed Effects		Random Effects	
	(i)	(ii)	(iii)	(iv)
β_0	0.068***	0.070***	0.062***	0.059***
	(0.005)	(0.013)	(0.005)	(0.009)
Export	-0.037***	-0.031***	-0.027***	-0.025***
	(0.007)	(0.008)	(0.006)	(0.007)
R&D		-0.013		0.006
		(0.0011)		(0.008)
Small		-0.015		-0.008
		(0.017)		(0.009)
Large		0.033*		0.010
		(0.019)		(0.011)
Foreign		0.005		0.020*
		(0.021)		(0.011)
Δd^H		0.060***		0.061***
		(0.005)		(0.005)
# Observations	10,170	9,539	10,170	9,539
R2	0.001	0.019	0.001	0.021
Hausman Test	(i) vs. (iii)			6.60** [1]
	(ii) vs. (iv)			14.56** [6]

Note: ***, ** and * indicate significant at 1%, 5% and 10%, respectively. Standard errors in parentheses, and degrees of freedom between square brackets.

As can be observed, the results show that firms reduce the growth rate of domestic sales in those periods in which they are engaged in export activities. More specifically,the average reduction in domestic sales growth is equal to 3.7 pp. In addition, the slowing down of domestic sales growth would be consistent with the descriptive results obtained when only pre- and post-entry periods are considered. Therefore, these results may suggest that firms focus on foreign markets when they engage in exporting, leaving aside domestic markets. [20] We will refer to the fall in domestic sales growth as residual exports. Moreover, the result of the Hausman test indicates that the fixed effects model is more consistent than the random effects specification.

[20] It is necessary to remark that participation in export activities continues to increase domestic sales, although at lower growth rates.

The inclusion of other variables in the analysis (R&D participation, firm size and ownership structure) does not change the negative impact of residual exports. In other words, firms also slow down the growth rate of domestic sales in those years in which they export when other control variables are considered. However, all of these control variables are clearly non-significant, which indicates that they do not affect domestic sales growth once the other variables are considered. Finally, with respect to the indicator of domestic market dynamism, the results suggest that, as expected, domestic sales growth presents a procyclical behavior.

Finally, Table 2.8 shows the results about variations in domestic sales growth, distinguishing between persistent entrants and switchers. As can be observed, results are similar when only persistent entrants are considered. On the one hand, the effect of residual exports is also negative and significant, which confirms the reduction in the growth rates of domestic sales in those years in which firm exports. Specifically, firms reduce on average 3.5 pp the growth rate of domestic sales in those years in which they also sell in foreign markets. This result is also observed for switchers, which also slow down domestic sales growth when they are engaged in exporting (although to a lesser extent). On the other hand, the results of the Hausman test for both groups of firms (persistent entrants and switchers) also points out that the fixed effects model is more appropriate that the random effects model. Moreover, the results also emphasize the positive effect of firm size on domestic sales. In particular, they point out that large switchers increase on average the growth rate of domestic sales 5.8 pp more than medium size firms. Conversely, the results also indicate that small switchers present lower growth rates of domestic sales than medium size switchers. Finally, Table 2.8 also suggests the procyclical behavior of the domestic sales growth for both persistent entrants and switchers.

Table 2.8: Fixed and random effects on domestic sales growth for persistent and switchers

	Persistent entrants		Switchers	
	FE	RE	FE	RE
β_0	0.058**	0.064***	0.083***	0.060***
	(0.025)	(0.016)	(0.016)	(0.012)
Export	-0.035**	-0.024*	-0.028***	-0.027***
	(0.016)	(0.013)	(0.009)	(0.008)
R&D	-0.021	0.026**	-0.008	0.001
	(0.019)	(0.012)	(0.013)	(0.010)
Small	0.066**	-0.004	-0.060***	-0.014
	(0.029)	(0.014)	(0.022)	(0.012)
Large	-0.018	0.003	0.058**	0.014
	(0.033)	(0.017)	(0.023)	(0.014)
Foreign	-0.001	0.028*	0.007	0.014
	(0.046)	(0.016)	(0.023)	(0.014)
Δd^H	0.050***	0.053***	0.064***	0.064***
	(0.009)	(0.009)	(0.006)	(0.005)
# Observations	2,730	2,730	6,809	6,809
R2	0.001	0.019	0.015	0.023
Hausman Test	(i) vs. (ii)			26.99*** [6]
	(iii) vs. (iv)			13.63** [6]

Note: ***, ** and * indicate significant at 1%, 5% and 10%, respectively. Standard errors in parentheses, and degrees of freedom between square brackets.

In summary, the results of this Section suggest that firms have higher volumes of domestic sales in those years in which they are involved in export activities. However, the results also point out that the growth rates of domestic sales are reduced as a result of exporting. In other words, export spillovers tend to induce a slowdown in domestic sales growth. We define this reduction in growth rates as residual exports. Therefore, it seems clear that being an exporter has a residual impact on domestic sales. Additionally, the latter results may also suggest a substitutability relation between national and foreign sales.

2.5 Discussion of the results

Participation in export activities generates spillovers that lead firms to be bigger, more productive, more innovative, more technology-intensive and pay higher wages than those firms that do not export. In addition, empirical evidence also assumes an increase in domestic sales volumes as a result of engagement in exporting. In this paper, we evaluate and quantify the impact of exporter status on domestic sales by using different methodologies.

Firstly, the difference-in-difference methodology is applied to compare domestic sales pre- and post-export entry between two different groups of firms, which are defined according to participation in export activities. The empirical results indicate that exporters have, on average, higher domestic sales (volumes and growth) than non-exporters. The results also indicate that this effect varies substantially depending on firm's persistence in export markets. In particular, this impact is greater for persistent entrants than for switchers. It may suggest that entry and exit dynamics from exporting could reduce the spillover effects on the domestic market.

Secondly, and by considering only the universe of firms that participate in export activities in some years (but not in all of them), we apply a fixed and random effects model in order to evaluate the impact of exporter status on domestic sales. As expected, the results indicate that firms have higher volumes of domestic sales in those years in which they are engaged in exporting. Again, this result differs depending on firm's persistence in export markets. Specifically, persistent entrants increase their domestic sales because of participation in export activities, whilst switchers do not vary their domestic sales volumes. Additionally, the results also suggest that firms significantly reduce the growth rates of domestic sales in those periods in which they are involved in export activities. As before, the extent of this reduction depends on export persistence.

The slowdown in terms of growth rates is defined as residual exports and it may suggest a substitutability relation between domestic and export sales.

The latter results suggest that export promotion policies focused on persistent entries would have benefits that go beyond the fact of starting exporting, insofar as it would also significantly increase national sales, although at lower growth rates than those of the pre-entry period.

CHAPTER III

GEOGRAPHICAL AND INDUSTRIAL SPILLOVERS IN ENTRY DECISIONS ACROSS EXPORT MARKETS

3.1 Introduction

The literature on International Trade has extensively analyzed firms' decisions to enter foreign markets. On this matter, different papers have studied the persistent nature of export decisions, which are likely related to sunk costs that firms face when they decide to enter. It is usually assumed that current choice of entry in export markets depends on previous decisions (e.g., Roberts and Tybout, 1997; Esteve-Pérez and Rodríguez, 2013, with Spanish data). A complementary literature addresses the whole pattern of export activity by analyzing the duration of export activity spells (Besedes and Prusa, 2006a, b; Esteve-Pérez *et al.*, 2013).

The analysis of export decisions, or even the duration of the export activity, does not usually consider multi-market characteristics of export strategies. However, this sharply contrasts with the empirical evidence, which points out that multi-market (and multi-product) exporters represent an important share of total exports in developed countries. Specifically, empirical evidence on the importance of multi-market and multi-product exporters on total export value is provided by Bernard *et al*. (2007) for the U.S., Mayer

and Ottaviano (2008) for France and Bastos and Silva (2010) for Portugal, among others. Firstly, Bernard *et al.* (2007) point out that those firms which export to five or more destinations account for 92.9% of the total export value. In addition, firms which export five or more products account for 98% of export value. Secondly, Mayer and Ottaviano (2008) also obtain this result by using French data. In particular, they show that firms which export to five or more markets account for 93% of total export value, whereas firms which export five or more products represent approximately the 91% of total exports. Finally, Bastos and Silva (2010) also discuss this issue by using Portuguese firm-level data. Specifically, the percentage of total exports traded by firms which export to five or more markets (products) is approximately the 80% (79.5%).

The primary goal of this chapter is to consider these multi-market and multi-product characteristics and to analyze whether previous experience in export markets facilitates entry in new export destinations. More specifically, the main contribution of this chapter is to empirically address the existence of geographical and industrial spillovers, taking explicitly into account previous decisions made by the same firm or by other firms of the same industry. In this regard, the spillover effects considered in this chapter are twofold. First, there are those effects coming from previous entry decisions in countries with similar economic, social or cultural characteristics. We assume that these characteristics depend on the proximity between markets, so we refer to them as *geographical spillovers*. Secondly, the entry decision in a specific market could also depend on previous choices made by other firms that manufacture similar products. This previous entry by other firms located in the same home country generates an information externality that may influence firms that decide *ex novo* to enter this new market. We refer to it as an *industrial spillover*. This information externality is usually considered a main argument to justify export promotion policies (Volpe and Carballo, 2010).

Consequently, this chapter assumes a sequential pattern of entry into foreign markets in which firms' export decisions are made in two stages. In the first stage, the firm decides to enter export activity by selling in one or multiple destinations. In the second stage, the firm could decide to expand to new export markets. In doing so, previous decisions in geographically close markets would have a positive impact on these new potential entry decisions. This does not neglect the presence of sunk entry costs in the second stage, but merely that such costs would be lower if firms previously had a strong position in this geographical area. Additionally, this two-stage assumption does not exclude the emergence of firms that adopt an international or even global approach from the moment they are founded or very shortly thereafter (the so-called "born-global" companies). Specifically, as was previously mentioned, our analysis does not reject the fact that the first entry into foreign markets covers several countries.

An important limitation of the data is that most of the existing Spanish databases do not provide crossed information between volumes and export destinations, in contrast to some other countries which provide firm-level data which breaks down firm exports by destination. These limitations lead us to use the data provided by the network of Spanish Chambers of Commerce (Cámaras de Comercio), which are complemented with some basic information provided by SABI (Bureau van Dijk Electronic Publishing). The period analyzed covers the years 2000-2010. These microdata are combined with country information in the context of a gravity function approach. However, in contrast to the traditional gravity function which uses trade flows, the variable to be explained is a binary variable that describes the firm's entry decision in each market and year. Therefore, the analysis focuses on the extensive margin of trade; the lack of data about trade volumes does not allow us to analyze the intensive margin. The empirical strategy combines probit and fixed effects logistic regressions. It allows us to control for observable and unobservable firm characteristics, taking advantage of the panel data

structure of the set of decisions made by each firm. The results confirm that both types of spillovers (geographical and industrial) have a positive impact on entry decisions in new destinations.

The remaining chapter will be organized as follow. The next Section reviews the recent literature related to sequential entry into export markets and the impact of spillover effects in entry decisions. The third Section contains the data description and presents some descriptive results, and the fourth Section is devoted to the empirical analysis. Finally, the last Section discusses the main findings and implications from the analysis.

3.2 Previous research

The recent literature about sequential exporting has increased in the last few years. A common starting point is the influential work by Melitz (2003), who introduces asymmetries across firms in productivity and emphasizes the relevance of fixed costs of exporting. These fixed costs should be faced for every country the firm decides to export. As a consequence, the total fixed export costs are larger the more foreign countries the firm chooses to serve. A characteristic of Melitz's model is that it assumes that fixed export costs are homogenous between different export markets, in contrast to variable trading costs. However, it could be expected that fixed costs were specific for each market. The differences between fixed export costs would arise from differences in uncertainty levels, due to imperfect information about the market size, the requirements for product adaptation in the new market, or the performance of the distribution channel, among other things. If that is the case, there are at least two possible ways to reduce uncertainty and, therefore, entry costs. Firms may adopt a sequential entry process, in which previous steps could help current decisions. Thus, for example, the similarity in economic, social or cultural characteristics between previous destinations and new potential markets (cultural distance) may facilitate entry process in these new

destinations. Alternatively, new exporters may benefit from strategies followed by other firms in that new destination.

Eaton *et al.* (2008) provide a good example of the increasing literature that addresses sequential entry in export markets. The main result of this paper points out the potential existence of a two-stage entry process: in the first stage, the firm exports to one specific export market and, if that action is successful, it gradually expands in the second stage to a greater number of destinations. Therefore, the sequential entry of firms, along with the survival probability as exporter, depends crucially on the firm's success in the choice of the first destination. Sequential exporting has also been addressed more recently in Albornoz *et al.* (2012), who study this process by considering the sunk costs and the uncertainty that firms face. Their results point out that uncertainty about entry success into export markets is key for understanding export patterns, since that uncertainty is strongly correlated with time and markets. They develop a model to analyze these implications in which (i) the firm finds out its profitability level as a consequence of its entry into the export market, (ii) the firm can make new decisions about entry into new markets and (iii) once the firm decides to enter new markets and overcome sunk costs, the correlation between export profitability across markets generates incentives to enter new destinations sequentially. Accordingly, the model suggests that exporting firms benefit from information spillovers that promote entry into new markets, through the reduction of sunk entry costs. Additionally, this paper also emphasizes the role of trade spillovers as a mechanism of policy coordination between markets.

In dealing with entry into foreign markets, Segura-Cayuela and Villarrubia (2008) also emphasize the role of uncertainty and information spillovers. They combine a framework of monopolistic competition with heterogeneous firms in productivity levels

and entry decisions in foreign markets under uncertainty. The main result points out that the uncertainty about market size and traded products substantially affects a firm's entry mechanism for foreign markets: exporting, horizontal FDI, vertical FDI, etc. In addition, empirical evidence also suggests that firms are more prone to re-enter foreign markets in which they have been previously exporting. Blum *et al.* (2013) also address this issue by observing the existence of multiple exporting spells to specific export destinations. Specifically, the paper analyzes the different ways of entry and exit in export markets for perennial and occasional exporters. The results indicate that perennial exporters are highly efficient and invest more capital to serve in domestic and foreign markets, regardless of the state of demand. By contrast, occasional exporters are less efficient, smaller and vary their export decisions according to the demand level. Therefore, that paper also suggests that the uncertainty about demand level may determine entry and exit decisions into export markets.

The previous studies are examples of a growing literature that emphasize the main role of the uncertainty in explaining entry decisions. In this regard, the uncertainty about sunk entry costs is also addressed by another strand of the international business literature. Specifically, this literature focuses on the concept of cultural distance, which is based on the difference between foreign and home country cultures. More specifically, it points out that uncertainty about sunk entry costs is reduced substantially as a consequence of the similarity in economic, social, educational or cultural characteristics between domestic and foreign markets (Hofstede, 2001; Shenkar, 2001). For instance, Tadesse and White (2010) use a modified gravity specification to analyze whether such cultural differences affect the volume of trade flows. Their main result suggests that greater cultural differences between the domestic market and the trading partner reduce exports to that country. The similarity between the characteristics of destination countries is also addressed in Morales *et al.* (2011). Specifically, this paper

analyzes the entry and exit dynamics in foreign markets by focusing on (i) the similarity between home and destinations markets, and (ii) the similarity between previous and new entry destinations. In addition, they also analyze how costly the adaption process in new markets is. The main result indicates that firms are more likely to enter those countries that are similar to those where firms had previously exported to. This framework based on the cultural distance between domestic and foreign markets is partially related to our concept of *geographical spillovers*, but applied to geographical areas. In other words, we classify firms' destinations in nine geographical areas which share similar economic, social or cultural characteristics. In addition, our study also expands this line of research by considering whether previous presence in those geographical areas makes it easier to enter new countries of the same area.

The previous approach suggests, therefore, that sunk entry costs are reduced substantially as a consequence of prior experience in similar markets. Recently, a number of firm-level studies have established that exporting is also affected by previous exporting history and spillover effects. In this regard, Sheard (2012) proposes a model for the timing of entry to new export markets that takes into account previous experience in the process of entry. The main result suggests that the fixed cost of entry is reduced by the experience gained from having entered other markets. In addition, this paper also predicts the process of entry in new destinations by considering differences in firms' productivity levels. The study of Maurseth and Medin (2013) also investigate how market-specific sunk and fixed export costs are affected by prior experience and spillovers. Specifically, they point out that knowledge acquired by other exporters may spill over to potential exporters and reduce market-specific export costs. Sinani and Hobdari (2010) also model current exporting decisions as a function of a firm's last two years of exporting history. Their main result indicates that sunk costs, firm characteristics and spillovers from nearby exporters are the main determinants in

explaining export decisions. Additionally, they also find that a firm's exporting history significantly affects the likelihood of remaining in this specific market.

The uncertainty about sunk entry costs could also be reduced as a result of following strategies taken by other similar firms. Specifically, this part of the literature is based on the concepts of first-mover and late-entrants (Lieberman and Montgomery, 1988; Kerin *et al.*, 1992). In general, it is assumed that first-mover or market pioneering has potential disadvantages related to the lack of information about market size or uncertainties about product adaptation to local preferences and entry costs. Accordingly, late-entrants may benefit from previous experience of first-mover and reduce uncertainty about market characteristics and entry costs.

More recently, Koenig (2009) and Koenig *et al.* (2010) point out that fixed costs of exporting, which are sector and destination-specific, decrease in the number of exporters. In addition, they also suggest that the number of exporters to a specific destination determines the strength of the spillover and the probability of starting exporting. Our research expands this approach by considering previous decisions made by other firms of the same specific industry in the new potential destination. Additionally, to measure the strength of this spillover effect, we also consider the total number of similar firms that export to that specific destination.

3.3 Data and descriptive analysis

This study combines microdata with industry and country information. As usual, the main problem lies on access to firm-level data on export activity, given that Spanish Customs does not provide access to that information.[21] Therefore, the database used

[21] Many studies of internationalization for Spanish firms use the Encuesta Sobre Estrategias Empresariales (ESEE). However, that database only provides quadrennial information on export destinations aggregated in four broad geographical areas.

here is the Directory of Spanish Exporting and Importing Firms, completed by the Spanish Chambers of Commerce and the Spanish Tax Agency.[22] This is the only publicly available source with Spanish firm-level data that comprises annual information on volume of exports, exported products (defined according to the Combined Nomenclature at 2 digits) and countries of destination.[23] However, like most of the databases from other countries, this dataset does not provide firm level information on exports (or products) broken down by countries of destination. Specifically, it only provides the range of export products and the full list of country destinations. The data covers the period 2000-2010. This database has also been also used in other empirical studies in recent years; particularly Castillo-Giménez *et al.* (2011) and Esteve-Pérez *et al.* (2013).[24]

That database has been matched with accounting information contained in the SABI database, elaborated by Bureau van Dijk Electronic Publishing. The matching procedure has led to a final sample of 7,756 firms. However, many of those firms (38% of the total) are trading firms (NACE Rev.1: divisions 51 and 52). We exclude them from the analysis because the nature of fixed entry costs for trading firms may be different from those producers that export their own products. In particular, it is more likely that entry and exit decisions could be the result of shipments upon requests and not based on strategic decisions made by firms. The final number of manufacturing firms is 3,859 and an average firm is in the panel in 7.5 years. Though it is not a completely balanced panel, approximately half of all sample firms (45.30% of total firms) engage in exporting in consecutive years during the whole sample period 2000-2010.

[22] Further information about the database can be found at http://directorio.camaras.org/.
[23] The overall volume of firm exports is grouped in three segments: less than one hundred thousand euros, between that amount and one million euros, and more than one million euros.
[24] Castillo-Giménez *et al.* (2011) analyze the determinants of a firm's export decision by focusing on the influence of proximity to other exporters. Moreover, Esteve-Pérez *et al.* (2013) investigate the duration of Spanish firms' trade relationships by applying a survival analysis.

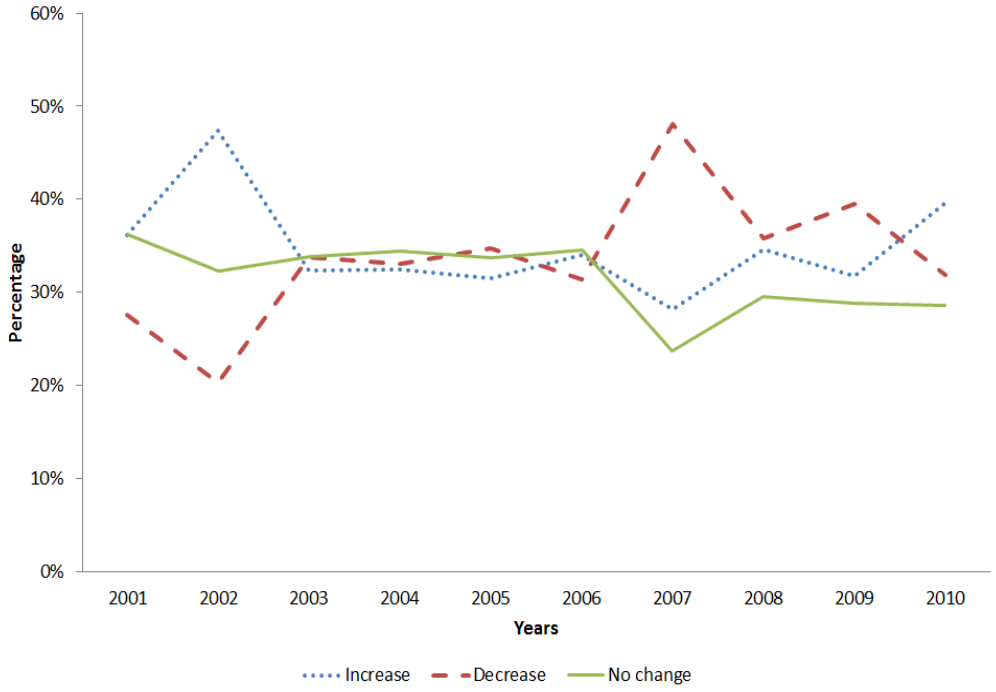
Table 3.1: Distribution of firms according to No. of export markets

	2000	2005	2010
1 country	29.5	25.0	21.4
2-5 countries	34.7	36.5	32.1
6-10 countries	13.0	13.3	15.0
11-25 countries	15.5	16.5	19.6
26-50 countries	5.9	6.9	8.8
> 50 countries	1.4	1.8	3.1
Average No. of countries (per firm)	7.7	8.7	10.6
Median No. of countries (per firm)	3.0	3.0	5.0
Total No. of firms	3,220	3,352	2,314

Source: Author's elaboration from Directory of Spanish Exporting and Importing Firms.

Table 3.1 shows the distribution of firms according to the number of export markets in 2000, 2005 and 2010. As can be seen, almost one fourth of all exporters sell in only one country. As expected, the distribution is highly asymmetric, with a large share of firms exporting to very few countries: more than half of them exported to less than six countries. Anyway, this concentration is smaller than what was obtained by Mayer and Ottaviano (2008). They concluded that 42.6% of French firms exported to one country, while 15.5% of them exported to more than ten countries. Apart from differences between countries, the sample used here may have some biases towards medium and large-sized firms, for which more presence in export markets is expected. Additionally, the average number of destination countries for Spanish exporters increases throughout the analyzed period from 7.7 to 10.6. This growth is compatible with great turmoil in firm-level behavior. As can be seen in Figure 3.1, the percentage of firms that do not change their total number of exporting countries in two consecutive years was pretty stable around 35% before the crisis. After 2007, that percentage decreased to 28% and it was compensated with remarkable growth in the number of firms that reduced their number of foreign markets.

Figure 3.1: Distribution of firms (%) according to changes in the number of foreign markets



Source: Author's elaboration from Directory of Spanish Exporting and Importing Firms.

Regarding export destinations, Table 3.2 shows the most frequent export markets of the Spanish exporters. As expected, Spanish firms mainly trade with other firms located in EU countries. In particular, Portugal and France were the two main destinations in all years of the considered period. Geographical distance is, obviously, a main explanatory factor: ten of the fifteen most frequent export markets are integrated in the EU. Only the United States, Switzerland, Mexico, Morocco and China are non-EU countries in that short list. This geographical distribution is in accordance with the aggregated data of the Balance of Payments which point out that 70% of Spanish exports were to EU countries.

Table 3.2: Most frequent export markets (% of firms)

	2000	2005	2010
Portugal	35.7	35.8	46.2
France	35.5	36.3	45.4
Italy	25.9	28.2	36.2
Germany	26.9	27.7	35.1
UK	25.1	25.6	30.4
Andorra	20.7	25.7	28.9
USA	23.5	24.9	28.2
Belgium	20.6	21.1	26.7
Netherlands	18.9	20.4	25.7
Morocco	14.2	16.3	23.6
Switzerland	15.5	19.2	23.3
Mexico	15.0	18.0	21.2
Poland	10.0	11.9	19.7
Greece	13.3	15.3	18.6
China	4.6	10.1	16.1

Source: Author's elaboration from Directory of Spanish Exporting and Importing Firms.

Finally, Table 3.3 shows the distribution of exported products according to the Combined Nomenclature (CN), which distinguishes 98 chapters.[25] As can be seen, approximately one third of exporters only trade one product. That percentage rises to more than 50% when firms that export two products are also considered. Again, this result is similar to Mayer and Ottaviano (2008), who obtain that the percentage of French exporters that trade only one product is 35%, and only 19% of them export more than ten products.[26] The average number of exported products by firm is about four. However, it has increased throughout the period: firms exported three products on

[25] As was previously mentioned, the database used provides information on goods exported by each firm, which are classified in 98 chapters of products according to the Combined Nomenclature (CN) at two digits. We recognize that this could be a limitation because it might be too aggregated, but the database used does not provide more disaggregated information. However, the NACE classification at three digits identifies 103 manufacturing chapters. Therefore, the CN classification at two digits could approximately represent the NACE classification at three digits. Accordingly, we might consider that this study uses, approximately, a three digits classification.

[26] We should remember that the product classification followed by the dataset is highly aggregated, so this comparison should be taken with caution.

average in 2000, while it reached 3.7 in 2010. The most frequently exported products correspond to *Machinery and mechanical appliances* and *Plastic and articles thereof*, which are exported by about 30.2% and 20.2% of firms in the sample, respectively. Only 7.9% of all exported products could be considered high-tech products, according to the usual OECD classification. By contrast, almost 60% of exported products are characterized by low or medium-low technological intensity.

Table 3.3: Distribution of firms according to No. of exported products

	2000	2005	2010
1 product	39.2	29.2	34.3
2 products	22.3	18.3	21.3
3 products	13.0	13.1	12.8
4 products	7.2	9.2	8.1
5 products	4.8	6.9	5.1
6-10 products	10.3	15.4	11.9
11-25 products	2.9	7.2	5.8
> 25 products	0.3	0.7	0.7
Average No. of products (per firm)	3.0	4.2	3.7
Total	3,220	3,352	2,314

Source: Author's elaboration from Directory of Spanish Exporting and Importing Firms.

In summary, the descriptive analysis confirms three basic features of Spanish exporters. First, firms typically export only a few products in a few markets. Second, the main destination countries are those integrated in the EU area (in particular, those which share a border with Spain). Third, only a reduced percentage of exported products have high-tech intensity. This exploratory analysis is complemented in the next Section once we explain how the variable related to entry decision is constructed.

3.4 Econometric approach and results

The previous descriptive analysis suggests that, as expected, distance plays a main role in explaining entry decisions in export markets. A standard way to deal with this issue is by using a gravity function, with distance and economic size of the importing country as explanatory variables on total trade flows. However, this study does not try to explain the cross-country pattern of Spanish exports, but to address the regional and industrial spillover effects associated with previous decisions made by each firm or by other firms in the same industry. Given that the study is focused on entry decisions in new markets (discrete choice model), those strategies related to current presence in a country (that is, decisions related to continuing in or exiting from current export markets) are excluded from the empirical analysis. In other words, we are interested in each entry decision (e_{ijct}) in a country *c* in time *t* made by firm *i*, which belongs to industry *j*, conditioned to that firm was not exporting to that specific country *c* in *t-1*. More specifically, the decision to analyze corresponds to the conditional probability:

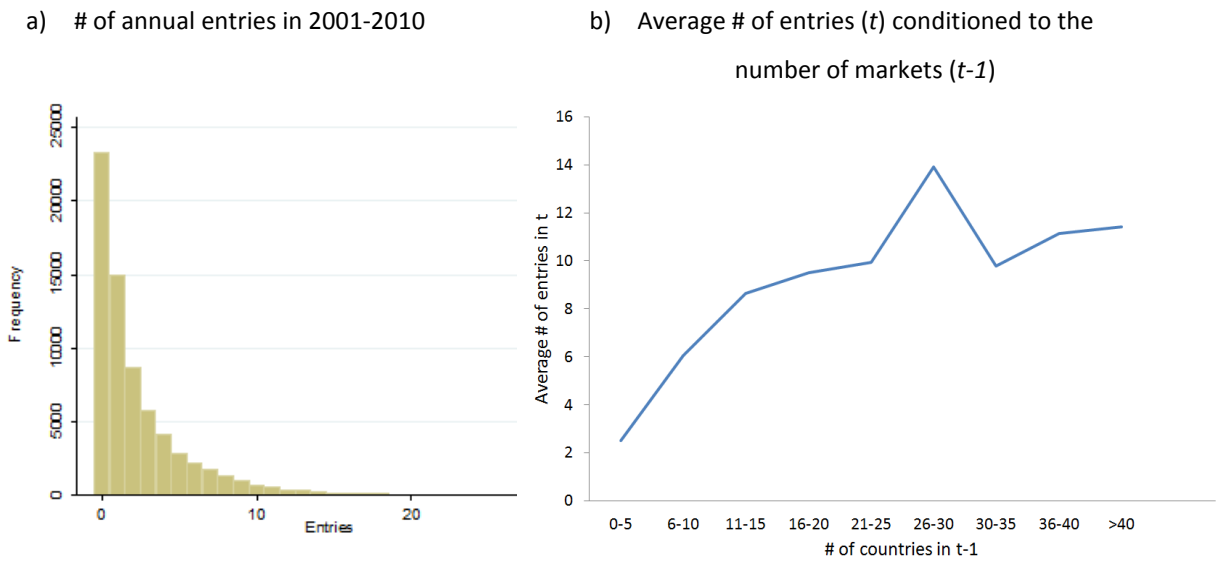
$$P(e_{ijct} / e_{ijct-1} = 0) \qquad i = 1,...,\text{N firms},\ j = 1,...,\text{S industries},\ c = 1,...,\text{M countries}$$

This definition implies a reduction in the initial set of potential decisions, insofar as a firm in *m* countries at *t-1* takes *M-m* entry decisions at *t*. In constructing the set of countries M, we have dropped those markets in which the number of occurrences (that is, firms exporting to that country in a specific year) is lower than 20. It implies that the initial number of countries/destinations, which was equal to 242, is reduced to 201.

The total number of observations with complete data for all the variables is close to 3 million, which refer to 3,221 firms. Only 1.47% of them (i.e., 41,455 observations) correspond to entries. This low rate of occurrence for value 1 (entries) is the consequence of considering all potential decisions by each firm/year for all countries in

which it is not operating in the previous period. This seems to imply some kind of zero inflated models. However, this is not a count model, insofar as the dependent variable is binary (entry or no entry), and it does not count events. Regarding descriptive analysis of entries, Figure 3.2(a) shows the distribution of entries for the whole period 2001-2010. As may be expected, the number of entries is normally very small. On average, a typical firm enters 1.98 markets (countries) per year. Additionally, Figure 3.2(b) shows the average number of entries in *t* conditioned on the number of countries that the firm exported to in *t-1*. As can be seen, the average number of entries increases with the total number of export markets in the previous year, though the positive relationship seems to be less intense once firms export to more than 20 countries.

Figure 3.2: Distribution of entries by year (all years)



Source: Author's elaboration from Directory of Spanish Exporting and Importing Firms.

The positive relationship suggested by the Figure 3.2(b) can be tested by using a Poisson regression model. This econometric approach counts the total number of positive entries (or events) for each firm/year, taking values from 1 to 60 (maximum

number of entries by firm/year). This is a significant difference with the discrete choice model that will be used afterward. Table 3.4 shows the results of the Poisson model when previous number of foreign markets, firm size (measured by the number of employees) and distance are considered. In this regard, the variable related to distance measures the average number of kilometers to new export markets.[27] As can be seen, the number of countries in period *t-1* affects positively on the total number of entries. Moreover, firm size also has, as expected, a positive effect on the number of entries. The positive effect of distance could seem an unexpected result, insofar as it would expect a negative impact as obtained in the classical gravity functions. Nevertheless, as stated above, the dependent variable is a measure of the total number of positive entries by firm/year, and, therefore, it is expected that greater simultaneous entries are correlated with an increase in average distance. The following example may clarify this result: a firm *i* which enters *c* new countries in a specific year *t* will cover less average distance than another firm *i+1* which enters in *c+m* countries (*m*>0) in the same specific year.

Table 3.4: Total number of entries: Poisson regression model

# countries t-1	0.0833***	(0.0064)
Average_dist_entry	0.0042*	(0.0022)
Size 50-100	0.0075	(0.0289)
Size >100	0.0397*	(0.0213)
Constant	0.9006***	(0.0262)
No. observations	12,485	
Pseudo R^2	0.1086	

Note: ***, **, * indicates significant at 1%, 5% and 10% respectively. Robust standard errors are in parentheses.

[27] To avoid the influence of "zero" kilometers when the number of entries is equal to zero, only positive events (i.e., one or more entries by a firm/year) are considered in the Poisson regression model.

As was previously explained, the main objective of this chapter is to analyze the main determinants of entry decisions in each foreign market. With that aim, a discrete choice model based on firm decisions (entry or no entry) is followed. In particular, the empirical equation to estimate is:

$$P(e_{ijct} / e_{ijct-1} = 0) = \beta_0 + \beta_1 GDP_{ct} + \beta_2 Dist_c + \beta_3 Risk_{ct} + \beta_4 Size_{it} + \beta_5 TFP_{it} + \beta_6 Products_{it} + \beta_7 Presen_{ijct-2} + \beta_8 Spill\_R_{ict-1} + \beta_9 Spill\_I_{ijct-1} + \varepsilon_{ijct} \quad (1)$$

The explanatory variables can be classified into three groups according to the combination of the four dimensions considered. The first group is a set of variables with geographical dimension: economic size (*GDP*), distance (*Dist*) and commercial risk (*Risk*) of the destination country. The GDP volume of the importing country has been extracted from the World Bank database, while bilateral distances between Spain and importing countries have been calculated by using the Great Circle method. Additionally, country risk classification captures minimum premium rates linked to transfer and convertibility risk and cases of force majeure. It is based on the Arrangement on Officially Supported Export Credits, elaborated by the OECD. This variable takes values in the range [0, 7], where higher values indicate higher non-payment risk by the debtor country. As usual, the expected signs for distance and risk are negative, while economic size is expected to have a positive effect on the probability of entry.

The second group of variables includes those with a firm dimension and it measures firms' size and performance. Firm size (*Size*) is measured by the number of employees and, as usual, it is expected to have a positive effect on entry in export markets. Firm's performance is approximated with a productivity indicator (*TFP*), which has been

calculated using the approach of Levinsohn and Petrin (2003).[28] Following the theoretical framework revised in Section 2, it is expected that productivity will have a positive effect on entry in new foreign markets. Additionally, the *Products* variable indicates the total number of exported products, defined according to the Combined Nomenclature at 2 digits, and it is expected that it also will have a positive effect. The assumption that underlies this expectation is that product-diversified firms have more incentives or abilities to enter new foreign markets. However, this is not an uncontroversial issue, insofar as it is not evident that economies of scope arising from diversified production can be successfully used to facilitate entries into new markets.[29]

Finally, equation (1) has three variables with a geographical and firm dimension. Firstly, the growing literature on persistence in export activity emphasizes the importance of previous decisions made by a firm. As was previously explained, the sample used is restricted to those decisions about entry into new countries: i.e., markets in which the firm was not exporting at *t-1*. However, it does not exclude that the firm exported at previous periods (before *t-1*). The hypothesis is that entry barriers should be lower in the case of re-entry. Accordingly, *Presen* takes the value 1 when the firm exported to a specific destination in previous periods (*t-2* or before) and 0 otherwise.

The other two variables in this group capture the externalities related to previous presence in the same region *(geographical spillover*) or previous decisions about the same country of other firms that belong to the same industry (*industrial spillover*). The variable related to geographical spillovers (*Spill_R*) takes the value 1 for country *c* in period *t* when the firm was exporting to another country that belongs to the same

[28] Levinsohn and Petrin (2003) propose a semiparametric model that uses intermediate inputs (e.g., materials and energy) as proxies for unobserved productivity. Using this approach, gross revenue, capital stock, number of employees and materials (for each firm/year) are used to estimate and construct this TFP measure.

[29] Of course, product diversification is a strategy closely related to firm size. However, note that the effect of firm size is already controlled for in the empirical analysis.

geographical area as *c* in *t-1*, and 0 otherwise. The geographical areas follow a continental classification which distinguishes nine large regions: North America, Central America, South America, Europe, other European countries, Africa, the Middle East, the Far East and Oceania (see Table in the Appendix A2 for more details).[30] The variable related to the industrial spillover (*Spill_I*) measures the number of exporting firms in industry *j* that exports to a country *c* in year *t-1*. The idea behind this spillover is that better knowledge about foreign markets, previously experienced by other firms in the same industry, could have a positive impact on new entry decisions.[31] The effects for both geographical and industrial spillover are expected to be positive.

Finally, when we consider the influence of regional spillovers, we should redefine the measurement of distance. If the firm was exporting to the region at *t-1* (i.e., *Spill_R*=1), it does not seem appropriate to consider the distance between Spain and the new foreign market, insofar as many of the underlying entry costs in distance (e.g., cultural distance) are reduced once the firm is present in the region. For that reason, in those cases we define *Dist_ave* as the average number of kilometers between country *c* and the set of countries in the same region to which the firm was exporting in *t-1*. If the firm was not present in the area, then the usual measurement for *Dist* applies.

A short example clarifies this issue. Suppose a firm that was not exporting to South America in *t-1* and decides to export to Argentina in period *t*. In this case, distance refers to the number of kilometers between Argentina and Spain. By contrast, suppose that it was already exporting to Uruguay and Brazil in *t-1*. In this case, the relevant distance for entry decision in Argentina is the average number of kilometers between

[30] We do not consider the existence of Free Trade Agreements (FTAs) in our country classification. The following example clarifies this issue. Only one of the three NAFTA countries (Mexico) is currently a signatory to a regional trade agreement with the EU. Thus, a Spanish firm that was exporting to Mexico in *t-1* does not have any incentive to enter another country that also belongs to NAFTA in period *t*, once non-FTA variables are controlled for.
[31] See the Appendix A1 for more details on the elaboration of both variables.

Argentina-Uruguay and Argentina-Brazil. In that sense, distance could be interpreted as a measure of the average number of "new kilometers" within the region where a firm was previously exporting.

Table 3.5: Entry decision: Probit regressions

	(i)	(ii)	(iii)	Country fixed effects
GDP	0.0017***	0.0017***	0.0002***	0.0001**
	(0.0001)	(0.0001)	(0.0000)	(0.0000)
Dist	-0.0005***	-0.0005***		
	(0.0001)	(0.0001)		
Dist_ave			-0.0006***	-0.0001***
			(0.0000)	(0.0000)
Risk1	-0.0039***	-0.0039***		
	(0.0004)	(0.0004)		
Risk2	-0.0030***	-0.0030***		
	(0.0002)	(0.0002)		
Risk3	-0.0049***	-0.0049***		
	(0.0001)	(0.0001)		
Risk4	-0.0051***	-0.0051***		
	(0.0001)	(0.0001)		
Risk5	-0.0073***	-0.0074***		
	(0.0001)	(0.0001)		
Risk6	-0.0097***	-0.0097***		
	(0.0001)	(0.0001)		
Risk7	-0.0191***	-0.0191***		
	(0.0002)	(0.0002)		
Size50-100		0.0005***		0.0000
		(0.0002)		(0.0000)
Size>100		0.0008***		0.0001***
		(0.0002)		(0.0000)
TFP		0.0005***	0.0001**	0.0000
		(0.0001)	(0.0000)	(0.000)
Products			0.0001***	0.0001***
			(0.0000)	(0.0000)
Presen			0.0061***	
			(0.0003)	
Spill_R			0.0006***	0.0001***
			(0.0000)	(0.0000)
Spill_I			0.0002***	0.0001***
			(0.0000)	(0.0000)
No. observations	2,805,865	2,805,865	2,805,860	2,805,860
Pseudo R^2	0,0619	0,0620	0.3053	0.3740

Note: *** and ** indicate significant at 1% and 5%, respectively. Marginal effects are reported with robust standard errors in parentheses.

Table 3.5 shows the marginal effects for probit regressions of equation (1). The first column collects the results when the classical gravity variables are considered in our analysis, which indicates the relationship between the entry decision and economic size, distance and country risk. As expected, distance has a negative effect on the probability of entry, while GDP shows a positive sign. Note that the latter coefficient may not be interpreted in the same way as usual gravity functions, in which GDP elasticity of the importer country is close to 1. In this sense, a growth of a billion dollars in the economic size of the foreign market increases the likelihood of entry by 0.17%, that is, 11.6% of the observed probability of entry. The Risk variable also shows the expected sign, pointing out that the higher the risk of non-payment, the lower the probability of entry is. The second column includes the variables with firm (but not country) dimension. As expected, firm size also shows a positive relationship with entry decisions.[32] That relationship is compatible with a significant effect of firm productivity, measured with TFP, even though firm size and TFP are positively correlated variables. It must be emphasized that small marginal effects should be considered in relationship to an observed entry probability equal to 1.46%.

The third column includes the variable related to the total number of products that a firm exports and all those variables that combine firm and country/industry characteristics. We do not include in this column the set of variables related to country risk. As we previously mentioned, our measure of geographical spillovers classifies countries according to similar economic, cultural or social characteristics. Therefore, it is expected that countries belonging to the same geographical areas show similar country-risk values. For this reason, we exclude the set of country-risk variables when the variables related to spillover effects are included in the analysis. As can be seen,

[32] In complementary regressions, size was measured with the three segments of overall volume of exports and results remain unchanged.

variables related to GDP and productivity levels (TFP) do not change their sign.[33] In this column the measurement of *Distance* changes in accordance to previous explanation, but its effect remains negative and significant. The results indicate that firms with a higher total number of exported products are more likely to enter new foreign markets. As expected, previous presence in the country has a very relevant influence on current decisions. The likelihood of re-entry increases by 0.6%, that is, 45% when it is considered in relationship to the observed probability of entry. Additionally, previous export experience in the same region (*Spill_R*) makes current entries in other countries of the same geographical area easier.[34] It is important to remark that this effect is obtained even after controlling for previous presence in the same country. The positive and significant sign for *Spill_I* suggests that firms deciding to enter a new foreign market also take into account the previous presence of other firms in their industry.

The last column (iv) in Table 3.5 shows the results of the Probit regression when country fixed effects are considered. As can be seen, GDP, distance, firm size, total number of exported products and geographical and industrial spillovers have the expected sign and all of them are significant. However, the effects for each variable are smaller than obtained in the other columns. In this case, the likelihood of entry into a new destination when the firm was previously exporting to that specific region increases by 0.01%. This effect is more reduced if we compare the results obtained without country fixed effects, where probability of entry increases by 0.06%.

[33] The correlation between the variables related to TFP and firm size is quite high, which might suggest the lack of significance in the TFP when both variables are considered simultaneously. However, coefficients of these variables are clearly significant when they are included separately. For this reason, column (iii) of Table 3.5 only includes the variable related to TFP.

[34] To check the robustness of the results, we have also considered the classification of countries suggested by The World Bank. This classification distinguishes between seven large aggregate areas: East Asia and Pacific, Europe and Central Asia, North America, Latin America and the Caribbean, the Middle East and North Africa, South Asia, and Sub-Saharan Africa. The results also confirm the positive effect of the geographical spillovers on entry decisions.

The previous estimations do not take into account panel characteristics of the dataset. In fact, there are two bi-dimensional features of firms' decisions that are potentially interesting: firms *x* years (for every country) and firms *x* country (for every year). Given the objective of this study, which emphasizes differences in decisions across countries adopted by each firm, the second of them is definitively the most relevant. If we concentrate our attention in a specific year, we can take advantage of multiple decisions made by each firm to control for fixed-firm effects, that is, firm characteristics that are independent of the specific entry decision adopted by each firm in each market. This is the case for *Size* and other firm-level variables, but not for *Spill_R* or any other variable that also has a country dimension.

A well-known technique for estimating panel data in a logistic specification with fixed effects was proposed by Chamberlain (1980). It conditions the observed events (entry or no entry into a specific country) on a sufficient statistic which cancels out the fixed elements in the conditioned likelihood function. This purpose is achieved by conditioning the observed pattern of entry decisions for a given firm in a set of M_i countries ($e_{i,c=1}, e_{i,c=2}, ..., e_{i,c=M_i}$) to the sum of its dependent variables, this is, the amount of 'ones' for the M_i different decisions faced by the firm ($\sum_{c \in M_i} e_{ic}$). The inclusion of firms that decide not to enter any market or to enter all countries (an event never observed) is irrelevant in this specification. Therefore, the conditional logit excludes those firms from the sample to work with, without any other consequence. Additionally, to test the adequacy of the conditional logit against the pooled probit estimation we implement a Hausman test. The pooled probit will be consistent and efficient under the null hypothesis even with the presence of observable or unobservable fixed firm effects, but inefficient under the alternative. The conditional logit, being consistent under both hypotheses, will be inefficient under the null. For this test, the conditional logit was

compared with the pooled probit estimation of the same specification. In particular, we compare the results of column (iii) in Table 3.5 and the estimations presented in Table 3.6.

Table 3.6: Entry decision: Conditional logit regression

GDP	0.0015*** (0.0000)
Dist_ave	-0.0065*** (0.0002)
Products	0.0002*** (0.0000)
Presen	0.0224*** (0.0009)
Spill_R	0.0031*** (0.0002)
Spill_I	0.0017*** (0.0000)
No. observations	2,420,543
Pseudo R^2	0.3240
Hausman test Conditional Logit *vs.* Pooled probit	4,409.9 [6] (p-value=0.00)

Note: *** indicates significant at 1%. Robust standard errors in parentheses and degrees of freedom between square brackets.

Table 3.6 shows the marginal effects of the fixed effect logistic regression for the set of decisions that correspond to all years of the sample. As can be seen, estimators related to GDP, distance, number of exported products, previous presence and geographical and industrial spillovers have the expected effect and all of them are significant with predicted signs. The result of the Hausman test suggests that conditional logit is an adequate specification for dealing with (observable and unobservable) firm-fixed effects.[35]

[35] As was previously mentioned, this analysis excludes those countries in which the number of occurrences (firms exporting to that country in a specific year) is lower than 20. To check the robustness of the results, we have repeated the analysis excluding those countries in which the number of occurrences is lower than 200. By considering this threshold, the number of countries is reduced to 151 and the significance of the considered variables remains unchanged.

3.5 Discussion of the results

An emerging literature addresses sequential entry as a mechanism for reducing sunk costs that firms face when they decide to enter foreign markets. In this context, this chapter analyzes entry decisions in new foreign markets made by Spanish exporters in the period 2000-2010. The main objective is to address those effects related to previous presence in other markets in the same region (*geographical spillovers*) and, also, those related to export activity in each market taken by other firms in the industry (*industrial spillovers*). The effect of these variables is evaluated by controlling for the influence of a firm's previous presence in a specific foreign market, which facilitates re-entry. By implementing a discrete choice model based on firm decisions, other variables concerning industry and country characteristics are also considered.

The descriptive analysis does not only confirm some basic features of export activity for Spanish exporters, such as a more frequent exporting presence in closer countries or a reduced number of exported products and destinations, but also the influence of diversification in foreign markets and firm size to explain the amount of entries.

This chapter focuses on explaining individual entry decisions: i.e., entry decisions made by each firm for each market in each specific year. Accordingly, exit decisions are not introduced in the empirical analysis. It could be argued that a different explanatory model underlies exit decisions. Additionally, in our empirical specification, each firm makes a complete set of decisions with respect to all countries where it was not exporting in the previous year. That empirical framework would not be suitable for exits, where the set of decisions would be confined to the specific set of countries where it was previously exporting.

The results point out that distance and risk of export credits have a negative effect on entry decisions. Conversely, economic size of new markets, firm size and total number of products exported by the firm have a positive effect on entry decisions. The results also indicate a positive influence of previous presence in a specific market on re-entry probability. As expected, this effect is large, suggesting that previous experience in a country significantly reduces sunk re-entry costs. Once those variables are controlled for, the results point out the relevance of information spillovers both in relationship to previous export activity in the same region and with respect to experience of other firms in the same industry. In particular, the former shows that firms use a sequential exporting strategy, where entry into a country is profitably used to enlarge the range of countries in the same geographical area. The main conclusion of the chapter suggests, therefore, that export promotion policies focused on entry into a specific country in a new region (e.g., Singapore) would have benefits that spill over the country borders, insofar as it would be facilitating additional entries into neighboring countries (East Asia).

In addition, this chapter could also contribute to other future research questions related to the analysis of entry duration and the persistence of export activity. This research only analyzes entry decisions in new export markets and does not take into account the exact nature of that entry (transient or persistent) or the duration of the export activity spells. However, it might be interesting in the future to explore the impact of both types of spillovers (geographical and industrial) on export persistence. More specifically, it might be interesting to analyze whether having a better knowledge about foreign markets, previously experienced by the same firm or by other firms in the same industry, increases the duration of the export spell.

CHAPTER IV

THE ROLE OF CAPACITY CONSTRAINTS IN EXPLAINING EXPORTING AND R&D DECISIONS

4.1 Introduction

The analysis of firms' strategic decisions based on heterogeneous firm models, starting from Melitz (2003), has extensively examined the main factors that influence export and innovation strategies. In general, it is concluded that firm characteristics− including, among others, size, productivity, age and wages− significantly influence the probability of exporting or performing R&D activities (Bernard *et al*., 2003; Helpman *et al.*, 2004; Costantini and Melitz, 2008; Melitz and Ottaviano, 2008; Lileeva and Trefler, 2010). However, these studies omit a potentially important element that may change firms' behavior. In particular, standard heterogeneous firm models of trade assume that production decisions are completely flexible and do not consider the critical role of capacity constraints in firm's strategic decisions. In this regard, capacity utilization (and demand expectations) could be one important determinant of exporting and investing in R&D.

The studies that address this topic typically assume that capacity constraints change the structure of firms' marginal costs. In general, these studies put forward that firms with capacity constraints face increasing marginal costs (among others Ahn and McQuoid, 2012 and Blum *et al.*, 2013). Therefore, it seems clear that new structure of marginal costs might substantially change participation in exporting or innovation activities. With respect to export participation, capacity-constrained firms cannot freely expand their production to supply foreign markets. In other words, these firms produce at full capacity and they are not able to increase production to access new markets.[36] Accordingly, the adjustment process between demand and inflexible inputs (mainly capital) depends on the firm's capacity utilization.

Moreover, and related to R&D investment, firms innovate in order to reduce production costs (process innovation) or to increase demand (product innovation). Additionally, innovation may also generate indirect benefits related to a higher quality perception by consumers, and a greater flexibility and adaptation to cost and demand shocks. However, capacity-constrained firms are restricted and may not face these shocks (i.e., these firms are not able to increase production), which might negatively affect the future innovation performance of firms. With these facts in mind, the main contribution of this chapter is to consider the potential existence of capacity constraints in explaining export and innovation strategies.

The empirical analysis is carried out using firm-level data from a Business Strategy Survey (*Encuesta Sobre Estrategias Empresariales*; ESEE) over the period 1990-2011. The econometric analysis applies a discrete choice model of the joint decision to export

[36] In this regard, this PhD Thesis (Chapter 2) and other different studies have suggested the existence of a substitutability relationship between domestic and export sales. Accordingly, it may imply that firms that are facing capacity constraints have to reduce domestic sales in order to enter foreign markets. See Ahn and McQuoid (2012) and Chapter 2 of this Dissertation for more details.

and engage in R&D activities. More specifically, we estimate a bivariate probit model to control for the potential simultaneity of the two firms' decisions. To measure the existence of capacity constraints, we use three different thresholds in the firm's capacity utilization rate. Particularly, we consider a firm to be capacity-constrained when this rate is higher than 95%, equal to 100%, or higher than a specific threshold which is calculated for each industry and year. In addition, other control variables related to firm size or firms' demand conditions are also considered in the analysis.

The empirical findings confirm that firms' capacity utilization rates and the measure of capacity constraints have significant influence on decisions about exporting and performing R&D. On the one hand, the results suggest that a high capacity utilization rate in the preceding year increases, up to a particular threshold, the probability of exporting and investing in R&D. On the other hand, the results also reveal that capacity constraints have significant influence on firms' export and R&D decisions. In particular, capacity-constrained firms are less prone to participate in these firms' strategic decisions. It may suggest that firms with slow adjustment of capacities with respect to demand find it harder to increase their production in order to participate in export activities. Furthermore, these capacity-constrained firms seem to focus on this adjustment, leaving aside innovation activities. The results also suggest that relevance of capacity constraints is maintained when we distinguish between SMEs and large firms and between product and process innovations.

The remainder of the chapter is organized as follows. The next Section briefly reviews the recent related literature. Section 3 describes the dataset and shows some descriptive results. The econometric analysis by estimating a bivariate probit model is presented in Section 4. Finally, Section 5 summarizes the main conclusions of the chapter.

4.2 A review of the related literature

The literature that has addressed the effect of capacity constraints on firms' decisions has increased significantly in the last decade. In general, all of these studies assume that inputs (mainly those related to capital) adjust gradually to their long-term equilibrium, emphasizing the role of capacity constraints in firms' optimal strategies. Accordingly, capacity constraints may be explained as a slow adjustment of inputs with respect to demand. In addition, these studies also suggest that capacity constraints change the structure of firms' marginal costs.

More recently, there has emerged a new body of literature that addresses the relationship between capacity constraints and export dynamics. In this regard, Ahn and McQuoid (2012) develop a structural model that incorporates the presence of physical (and financial) capacity constraints to quantify aggregate implications about export participation. An important contribution of this paper suggests that these constraints are the main source of increasing marginal costs, which might change the response of constrained firms to external demand shocks. In particular, the main result of the paper points out that the presence of constrained firms significantly reduces aggregate output responses to external demand shocks, which substantially increases aggregate price level.

The latter result is also obtained by Blum *et al.* (2013), who emphasize the role of capacity constraints and stochastic demand shocks as the main determinants in firms' export decisions. Consequently, and depending on the level of fixed capital investment which is used as a proxy for capacity constraints, the model predicts the way to engage in export activities: occasional or perennial. More specifically, the authors assume that perennial exporters invest in enough fixed capital to serve both domestic and foreign markets. Conversely, they suggest that occasional exporters decide whether to engage in

exporting depending on the state of domestic demand and the level of fixed capital utilization.

Other related papers which focus on trade dynamics by considering firm heterogeneity in capacity utilization rates and productivity levels include Soderbery (2014) and Crespo (2014). On the one hand, Soderbery (2014) develops a model of international trade where firms are heterogeneous across capacity and productivity that assesses the impact of firms' capacity constraints on export dynamics. Particularly, the author suggests that capacity utilization is determined by export status and sales volume. Additionally, he also points out that capacity constraints induce firms to raise prices in order to take advantage of access to foreign markets, given that this strategy is the only tool to adjust their margin.[37]

On the other hand, Crespo (2014) also develops a model of international trade with capacity-constrained firms. The main result of this paper indicates that capacity constraints generate two types of effects on trade: a substitution effect and a composition effect. The substitution effect is related to the trade-off between domestic and export sales. In particular, capacity-constrained firms are constrained in their capacity utilization and they cannot increase production to access foreign markets. Therefore, these firms have to reduce domestic sales in order to enter exporting. Moreover, since firms producing at full capacity are unable to expand production in order to benefit from advantages of entering larger markets, they raise prices even in the presence of strong levels of competition. Accordingly, the existence of firms facing capacity constraints may lead to a softening of competition as markets grow (composition effect).

[37] Firms facing capacity constraints are unable to freely increase their production to access new markets and, therefore, their only margin of adjustment would come through raising prices or making costly investments.

With respect to innovation strategy, a basic premise suggests that firms perform R&D in order to reduce costs (production process innovations) or to increase demand (product innovations). As regards process innovations, firms innovate to develop better production techniques and gain more from scale economies. Moreover, product innovations are performed to develop better products and differentiate from competitors. Therefore, variables related to firm size, capacity utilization, market structure or firms' demand conditions may condition innovation behavior. In this regard, Smolny (2003) uses a model based on a framework of monopolistic competition, demand uncertainty and delayed adjustment of capacities to analyze the main determinants of innovation strategies of West German manufacturing firms. In particular, this paper focuses on demand expectations and capacity constraints. The main result of the paper suggests that medium-run demand expectations and capacity utilization (*proxy* variables of firms' demand situation) affect the implementation of innovations. In addition, it also reveals that capacity constraints reduce the probability of performing innovations.

The factors that constrain innovation activity are also analysed in Hewitt-Dundas (2006). Particularly, the author identifies three main firm-specific resources that restrict innovation: financial, human and organisational constraints. The main result of the paper indicates that these constraints (especially those related to plant-specific characteristics) have a significant effect on the explanation for whether or not firms perform R&D and the level of innovation success. The identification of the main constraints and firm characteristics that hinder innovation is also addressed in Oum *et al.* (2014). These authors conclude that limited access to information (related to markets and/or competitors), an insufficient quantity of unskilled workers and a shortage of capital to finance new business plans tend to limit participation in R&D activities.

4.3 Data and descriptive results

This paper uses firm-level information about Spanish manufacturing firms for the period 1990-2011. The data used are provided by the *Encuesta Sobre Estrategias Empresariales* (ESEE, Survey on Business Strategies), which has been carried out yearly by the Spanish Ministry of Industry since 1990. This database uses the firm size and the two-digit NACE sector as the main stratification scheme. Specifically, the population of the ESEE covers manufacturing firms with ten or more employees. On the one hand, firms that employ between 10 to 200 workers were randomly selected by using sampling schemes based on the NACE industry classification. On the other hand, all firms with more than 200 employees were requested to participate in the survey, which resulted in a participation rate of around 70%. The initial sample for the period 1990-2011 is 5,040 firms.

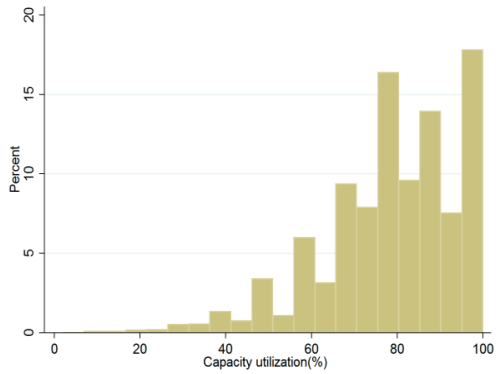
By using these data, and to avoid too short time periods for each firm, we only take into account those firms that report information for at least three consecutive years. In addition, we also drop the observations corresponding to the initial year (1990) because of the lack of some relevant variables in that year. Accordingly, the final sample has 36,700 observations that correspond to 4,291 firms.

The ESEE provides information related to firms' characteristics: number of employees, two-digit NACE codes, domestic and export sales, ownership structure and financial variables, among others. It also facilitates information about whether a firm exports and/or performs R&D activities, distinguishing between product and process innovations. In this regard, the database indicates that, throughout the whole period, 35.05% of firms neither export nor perform R&D, 29.41% only export, 4.47% only participate in R&D activities and, finally, 31.06% of firms carried out both activities.

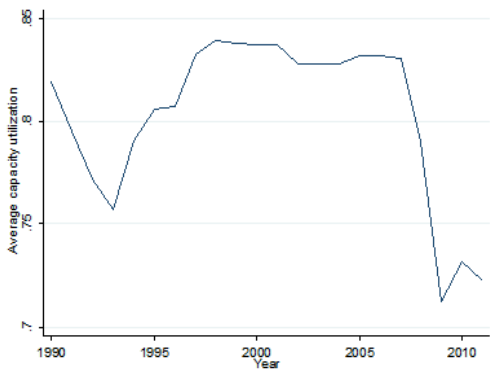
The database also contains information on the firm's demand conditions. On the one hand, this database provides information about the behavior of firms' demand during a particular year with respect to the previous year. In particular, the ESEE measures the current state of the demand according to three different categories: recession, stability and expansion (value 1, 2, and 3 in the sample, respectively).[38] In the empirical analysis, two dummy variables are calculated to determine if firms face a recessive or expanding market. A stable market is the reference case for both dummy variables. On the other hand, the database provides the degree of the standard capacity utilization (*U*). This variable takes values in the range [0-100], where values close to 100 may suggest the existence of firms' capacity constraints. In this regard, the average capacity utilization in the sample for the whole period is about 80 percent and the standard deviation is about 16 percent.

Figure 4.1: Firm's capacity utilization.

a) Histogram of firm's capacity utilization



b) Evolution of the average capacity utilization



Source: Author's elaboration from ESEE database.

Figure 4.1(a) depicts the distribution of capacity utilization for Spanish manufacturing firms. As can be seen, about 50% of firms have a capacity utilization rate higher than

[38] This variable is provided by the ESEE in each of the five principal industries in which a firm operates. It is constructed by weighting these values over all markets defined by each firm. The weights are the proportion of sales in each industry with respect to total domestic sales.

80%. This percentage drops to 25% when the threshold is 90% of capacity utilization. Additionally, the percentage of firms with capacity utilization equal to 100% is about 17%, which suggests that the production capacity of these firms is fully exploited and they are not able to increase it further. In addition, Figure 4.1(b) shows the evolution of average capacity utilization in the period 1990-2011. As can be seen, capacity utilization presents a clear procyclical behavior. The short crisis of the early nineties (1992-1993), and the recent recession have caused an important decrease in this variable. This decline has been especially significant in the last four years, where the average capacity utilization have gone from 83.1% in 2007 to 72.1% in 2011.[39]

To assess the correlation between capacity utilization rate and participation in exporting and innovation activities, Table 4.1 shows the percentage of firms that perform these activities by distinguishing between five different groups of firms depending on their capacity utilization rate. As can be seen, it seems clear that capacity utilization is positively correlated with exporting and R&D decisions. First, by comparing export status, it is observed that a high rate of capacity utilization increases the probability of exporting. More specifically, the data suggest that exporting is more likely than non-exporting for those firms with capacity utilization rates above 41% (i.e., 55.45 vs. 44.55 for the range 41-60; or 65.25 vs. 34.75 for the range 81-100). Second, the results also point out that firms are less prone to perform innovations. However, having a high rate of capacity utilization increases the probability of engaging in R&D activities. In particular, while only 17.29% of firms with capacity utilization rates in the range 0-20 perform R&D activities, that percentage raises to 38.45% for those firms with rates above 81%.

[39] The Spanish Ministry of Industry also calculates the degree of standard capacity utilization. The evolution of this indicator is very similar to the evolution presented in Figure 4.1 (b). Specifically, it also emphasizes the huge decrease in the period 2007-2011.

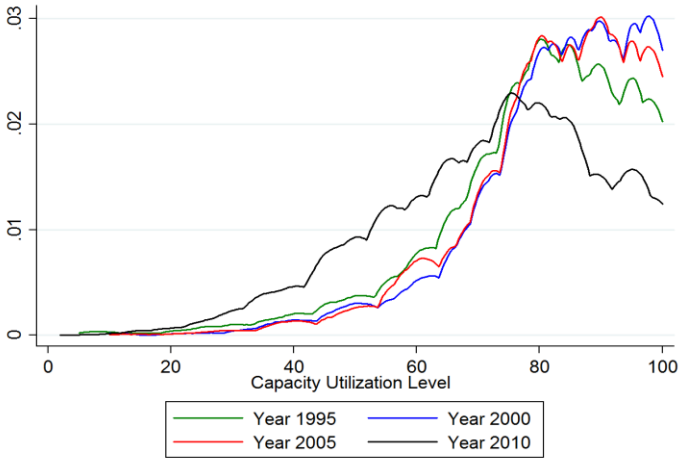
Table 4.1: Capacity utilization rate on exporting and R&D decisions (% of firms)

Capacity utilization	Export		R&D		% of firms
	No	Yes	No	Yes	
0-20	56.30	43.70	82.71	17.29	0.37
21-40	56.95	43.05	79.92	20.08	2.65
41-60	44.55	55.45	70.64	29.36	11.31
61-80	38.41	61.59	64.68	35.32	36.78
81-100	34.75	65.25	61.55	38.45	48.89

Source: Author's elaboration from ESEE database.

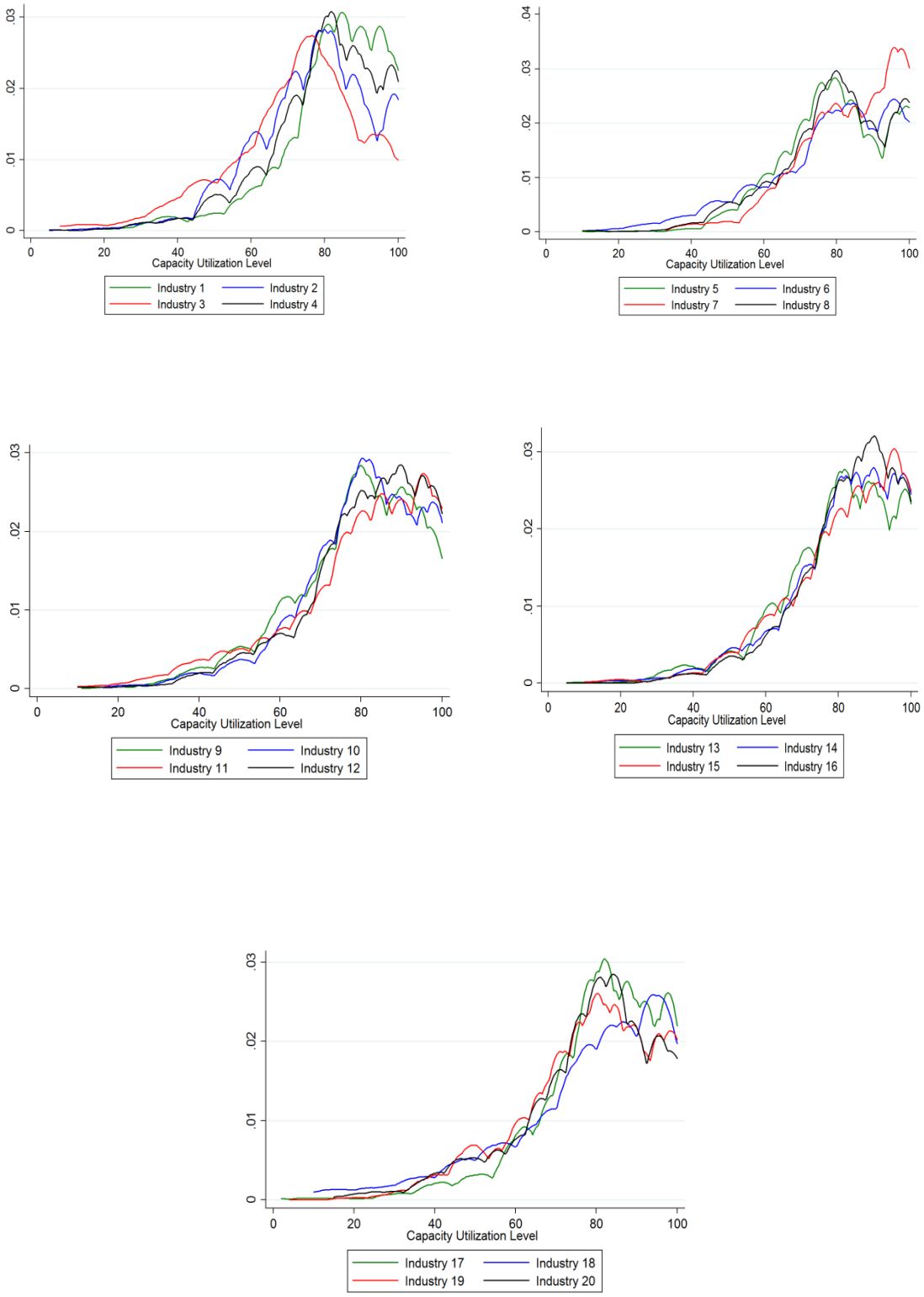
Following Smolny (2003) and Ahn and McQuoid (2012), we use different thresholds of capacity utilization to estimate the impact of capacity constraints on exporting and R&D decisions.[40] On the one hand, we consider that firms face capacity constraints when the capacity utilization rate during the year preceding the participation in exporting and R&D strategies is higher than 95% (*U>95*), or equal to 100% (*U=100*). On the other hand, we expect that this threshold might be different among industries and over time, as Figures 4.2 and 4.3 depict.[41]

Figure 4.2: Distribution of capacity utilization (kernel density)



[40] Smolny (2003) considers a firm to have capacity constraints when its capacity utilization rate is higher than 95%, whilst Ahn and McQuoid (2012) assume that this threshold should be equal to 100%.
[41] See also Table A.4 in Appendix.

Figure 4.3: Distribution of capacity utilization by industries (kernel density)



Source: Author's elaboration from ESEE database.

Firstly, Figure 4.2 shows the significant drop in the capacity utilization rate after the beginning of the recent economic crisis. Second, Figure 4.3 shows the heterogeneity in the capacity utilization according to industry sector. Therefore, the results shown in these two figures suggest that the capacity threshold may vary among industries and over time.

Based on previous results, we calculate a specific threshold for each industry *j* and year *t*. Specifically, the new threshold ($U > U_{jt}^{*}$) is defined as the sum of the average capacity utilization for each industry in any specific year and the standard deviation of the capacity utilization in the same industry and year. The addition of the standard deviation allows us to control for the average dispersion of the industry and year.

In the empirical strategy, a dummy variable related to the existence of capacity constraints is calculated, taking the value one if the firm's capacity utilization is higher than the different thresholds, and zero otherwise. By using these dummy variables, Table 4.2 shows the share of firms that engage in exporting or perform R&D activities according to the three different capacity thresholds (*U>95*, *U=100* and $U > U_{jt}^{*}$).

Table 4.2: Capacity constraints on exporting and R&D decisions (% of firms)

	Export		R&D		Export and R&D		% of firms
	No	Yes	No	Yes	No	Yes	
U>95 (constrained)	7.09	10.22	11.87	5.45	12.46	4.84	17.33
U≤95 (non-constrained)	30.78	51.91	52.42	30.25	56.01	26.69	82.67
U=100 (constrained)	6.63	7.88	10.60	3.92	11.13	3.38	14.52
U<100 (non-constrained)	31.24	54.24	53.70	31.78	57.35	28.14	85.48
$U > U_{jt}^{*}$ (constrained)	7.30	10.22	12.09	5.44	12.70	4.80	17.54
$U \leq U_{jt}^{*}$ (non-constrained)	30.57	51.91	52.21	30.26	55.77	26.72	82.46

Source: Author's elaboration from ESEE database.

As can be seen, it seems clear that capacity constraints are correlated with exporting and R&D decisions. Firstly, the results indicate (last column) that about 17.33% of firms face capacity constraints when a 95% threshold is considered. This percentage is very similar to the threshold that takes into account industry and time heterogeneity[42], though it is bigger than 100% threshold.

Secondly, by comparing export status between constrained and non-constrained firms, it is observed that the probability of exporting is higher for the last group of firms. More specifically, the data suggest that while exporting is about 44% more likely than non-exporting for constrained firms (i.e., 10.22 vs. 7.09 in the U>95 threshold), such probability increases to 69% in the case of unconstrained firms (i.e., 51.91 vs. 30.78). The results also point out that firms are less prone to engage in R&D activities. However, again, being an unconstrained firm has a positive influence on performing R&D. In particular, while only 31.4% of constrained firms perform R&D, that percentage raises to 36.6% for non-constrained firms.[43] In summary, these results reveal that unconstrained firms can adjust their capacity utilization in order to increase production and begin to supply foreign markets or perform R&D activities.

4.4 Econometric approach

The previous descriptive analysis suggests that, as expected, capacity constraints play a relevant role in explaining exporting and R&D strategies. A standard way to deal with this topic is by using a bivariate probit regression model, which examines the

[42] In this regard, considering the existence of both thresholds (U>95 and $U > U_{jt}^{*}$), the data suggest that 15.5% (80.6%) of firms are constrained (unconstrained) in their capacity. Moreover, 1.8% of firms face capacity constraints by considering the 95% threshold, but they are unconstrained firms if we consider the existence of specific thresholds for each industry and year. Similarly, 2.1% of firms face capacity constraints by taking into account thresholds that incorporate heterogeneity across industries and over time, but they are unconstrained firms when the 95% threshold is considered.

[43] For the U>95, 17.33% of firms are capacity constrained. For these firms, 31.4% of them (=5.45/17.33) are engaged in R&D activities.

relationship between both decisions and a set of independent variables. In particular, the estimated bivariate probit model is:

$$X_{it} = \begin{cases} 1, & if \quad \beta^X C_{it\text{-}1} + \gamma^X W_{it-1} + \eta^X y_t + \lambda^X s_i + \varepsilon_{it}^X > 0 \\ 0, & otherwise \end{cases} \tag{1}$$

$$R\&D_{it} = \begin{cases} 1, & if \quad \beta^{R\&D} C_{it\text{-}1} + \gamma^{R\&D} W_{it-1} + \eta^{R\&D} y_t + \lambda^{R\&D} s_i + \varepsilon_{it}^{R\&D} > 0 \\ 0, & otherwise \end{cases} \tag{2}$$

Export decision (*X*) of firm *i* in year *t* depends on capacity constraints variables *C* in year *t-1* and another set of lagged variables *W*. Similarly, participation in R&D projects (*R&D*) of firm *i* in year *t* also depends on constraint variables *C* in year *t-1* and the set of lagged variables *W*. To control for time and industry effects, a series of year (*y*) and industry (*s*) dummy variables defined at the level of two-digit NACE codes are also included in the analysis. The model is estimated by maximum likelihood methods assuming that the errors in Eqs. (1) and (2) have a joint probability distribution that is bivariate normal.

The variables included in the vector C_{it-1} are the following. First, we include the firm's capacity utilization (*U*), which, up to a certain threshold, is expected to increase the probability of engaging in export and R&D activities. Second, we also consider the dummy variables related to the existence of capacity constraints. As was previously defined, these dummy variables take the value 1 when firm's capacity utilization is higher than a threshold, and zero otherwise. We consider three different cut-off levels as a *proxy* variable of the capacity constraints: *U*>95, *U*=100 and $U > U_{jt}^{*}$. It is expected that variables related to capacity constraints have a negative impact on export and R&D likelihood.

Additionally, control variables included in the vector W_{it-1} are the following. First, this vector includes three dummy variables related to firm size: *Small, Medium* and *Large.* Specifically, small firms employ less than 50 employees, medium size firms employ between 51 and 200 employees, and large firms employ more than 200 employees. Second, we estimate a measure of Total Factor Productivity (*PTF*), which has been calculated by using the approach of Levinsohn and Petrin (2003). These authors propose a semiparametric model that uses intermediate inputs (e.g. materials or energy) as proxies for unobserved productivity. By using this approach, gross revenue, capital sock (constructed with the perpetual inventory method), total number of actual hours worked per year, and material have been used to estimate this TFP measure. Third, the vector W_{it-1} includes a dummy variable related to ownership structure (*Ownership*). In particular, this variable takes the value 1 if the firm's capital is participated by a foreign firm and 0 otherwise. Finally, the behavior of domestic market demand is also included in this vector. As was previously mentioned, we consider two dummy variables which compare the current state of demand with respect to the previous year according to two different categories (recession or expansion). Specifically, these dummy variables (*Recessive* and *Expansive*) take the value 1 if the state of the demand is recessive/expansive and 0 otherwise, respectively.

The results of the bivariate probit regressions on exporting and R&D decisions are reported in Table 4.3. As can be seen, the rho-parameter (the estimated correlation between the errors of both equations) is positive and significantly different from zero. This indicates that the model needs to be estimated simultaneously and confirms that the estimates obtained from a univariate decisions framework would be inefficient.[44] The

[44] See Greene (2011) for more details.

sign and significance of estimated parameters in both exporting and R&D strategies are examined below.

Table 4.3: Bivariate probit results on exporting and R&D decisions

	Capacity constraints U>95		*Capacity constraints U=100*		*Capacity constraints* $U > U^*_{jt}$	
	Export	*R&D*	*Export*	*R&D*	*Export*	*R&D*
U	0.135**	0.144**	0.219***	0.199***	0.188***	0.162**
	(0.068)	(0.071)	(0.066)	(0.069)	(0.068)	(0.071)
U>95	-0.080***	-0.145***	–	–	–	–
	(0.027)	(0.027)				
U=100	–	–	-0.156***	-0.218***	–	–
			(0.028)	(0.029)		
$U > U^*_{jt}$	–	–	–	–	-0.114***	-0.154***
					(0.027)	(0.027)
Small	-0.607***	-0.597***	-0.604***	-0.593***	-0.606***	-0.596***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Large	0.395***	0.587***	0.392***	0.585***	0.393***	0.586***
	(0.029)	(0.025)	(0.029)	(0.025)	(0.029)	(0.025)
TFP	0.673***	0.531***	0.669***	0.527***	0.672***	0.531***
	(0.027)	(0.026)	(0.027)	(0.026)	(0.027)	(0.026)
Ownership	0.398***	-0.041*	0.399***	-0.041*	0.399***	-0.041*
	(0.031)	(0.024)	(0.031)	(0.024)	(0.031)	(0.024)
Recessive	0.152***	0.123***	0.152***	0.123***	0.152***	0.123***
	(0.021)	(0.022)	(0.021)	(0.022)	(0.021)	(0.022)
Expansive	0.174***	0.249***	0.173***	0.248***	0.173***	0.249***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Observations	*30639*		*30639*		*30639*	
Log-Likelihood	*-28379.64*		*-28357.95*		*-28374.46*	
Estimated ρ	*0.352 (0.013)*		*0.350 (0.013)*		*0.352 (0.013)*	
LR test ρ=0	χ^2*(1)=724.65, p-val.=0.0*		χ^2*(1)=717.68, p-val.=0.0*		χ^2*(1)=723.32, p-val.=0.0*	

Note: ***, **, * indicate significant at 1%, 5% and 10%, respectively. Robust standard errors between brackets. Time- and industry-dummy variables are included in the analysis. All the explanatory variables refer to the preceding year.

With respect to the export decision, and by using the three different thresholds, it is interesting to remark that all variables included in vector C_{it-1} have significant influence on this strategy. On the one hand, the results point out that a higher rate of capacity utilization in the preceding year increases the probability of engaging in exporting. On the other hand, the results also reveal that capacity constraints (measured by capacity

utilization rate above the threshold) reduce the likelihood of exporting. Therefore, it seems clear that firms with capacity constraints find it difficult to adjust the production to the demand level and face sunk costs associated with export activity. In other words, capacity constraints modify the structure of firms' marginal costs, which may change the response of constrained firms to demand shocks. Additionally, the control variables have the expected sign in the export probability. In particular, larger and more productive firms are more prone to engage in exporting. Furthermore, facing an expansive or recessive demand also increases export probability.

With respect to the R&D decision, the results also reveal that those firms with a high capacity utilization rate in the previous year are more prone to perform R&D activities. In this regard, the capacity utilization rate may be used as a proxy measure of the demand situation, which suggests that firms are more prone to innovate if their capacity utilization (and demand) is large enough to access new markets. The results also confirm that firms facing capacity constraints are less prone to perform R&D activities. It may imply that firms with slow adjustment of capacities with respect to demand (capacity-constrained firms) focus on the adjustment to demand shocks, which do not allow them to perform R&D projects. Finally, the other control variables have the expected significant effect. On the one hand, firm-level variables indicate that size and productivity have a positive impact on the R&D decision. Furthermore, the results also suggest that foreign-capital firms are less prone to invest in R&D. On the other hand, the two dummy variables related to the state of demand also reveal that firms facing an expansive or recessive demand increase the likelihood of performing R&D.

4.4.1 The role of firm size

The latter results confirm that capacity constraints are key in explaining a firm's decisions to export and to invest in R&D. However, it may be expected that the impact

of these constraints could be different according to the size of the Spanish manufacturing firms. Thus, for instance, Hewitt-Dundas (2006) uses Irish data to examine the resources and capabilities that restrict innovation projects, and whether these constraints differ for small and larger firms.[45] Her main result suggests that small firms are more prone to face resource shortages and capacity constraints, and, therefore, they are significantly less likely to innovate than larger firms. Reynolds and Wilson (2000) also indicate that firm size is important in determining the capacity utilization rate. They suggest that small firms have no incentive to expand their capacity because capacity expansion would reduce their expected revenue in the event that demand was lower than expected. In this line, Besanko and Doraszelski (2004) also suggest that capacity decisions might adjust the firm size for many years beyond the point at which they are actually made.

To tackle the issue of firm size and the effect of capacity constraints on export and R&D decisions, we perform a separate analysis for the small- and medium-size firms (SMEs) and large firms, considering all other explanatory variables. In this regard, we classify the sample firms based on their number of employees. On the one hand, those firms with 200 or less employees are defined as SMEs. On the other hand, we consider those with more than 200 workers to be large firms.[46] Table 4.4 shows the effect of these constraints for SMEs and large firms on the decision to export and perform R&D.[47]

As can be observed, capacity constraints play a relevant role for SMEs in explaining export and R&D decisions. Firstly, the results suggest that a high capacity utilization rate in the preceding year increases the probability of exporting. However, this positive

[45] This paper only considers the decision to perform innovation activities.

[46] The ESEE classification is used to define both SMEs and larger firms.

[47] This table only presents the results for the threshold that includes heterogeneity across industries and over time ($U > U^{*}_{jt}$). The results of the estimates by taking into account the other two thresholds ($U>95$ and $U=100$) are quite similar.

relationship is not observed with respect to perform R&D. Secondly, the results also indicate that capacity constraints have a negative influence on both decisions. This is shown in the negative and significant effect of the capacity threshold variable, which indicates that those capacity-constrained firms with 200 or less workers are less prone to export and to perform R&D. On the one hand, it may suggest that these firms produce at full capacity and they are not able to increase their production to supply foreign markets (and face sunk costs). On the other hand, the slow adjustment of capacities with respect to demand may also hinder R&D investment. Thus, for example, SMEs with capacity constraints focus on this adjustment process, leaving aside innovation activities. Finally, all the control variables considered in the analysis have the expected sign when we distinguish by firm size.

Table 4.4: Bivariate probit results on exporting and R&D decisions: SMEs and large firms

	SMEs		*Large firms*	
	Export	*R&D*	*Export*	*R&D*
U	0.171**	0.079	0.145	0.458***
	(0.074)	(0.082)	(0.192)	(0.139)
$U > U^*_{jt}$	-0.127***	-0.191***	-0.066	-0.090*
	(0.029)	(0.034)	(0.069)	(0.049)
Small	-0.546***	-0.557***	-	-
	(0.026)	(0.026)		
TFP	0.782***	0.611***	0.235***	0.345***
	(0.031)	(0.031)	(0.059)	(0.046)
Ownership	0.492***	-0.026	0.302***	-0.042
	(0.042)	(0.037)	(0.048)	(0.032)
Recessive	0.148***	0.150***	0.187***	0.076*
	(0.023)	(0.027)	(0.056)	(0.040)
Expansive	0.198***	0.277***	0.060	0.194***
	(0.023)	(0.026)	(0.050)	(0.035)
Observations	*21943*		*8696*	
Log-Likelihood	*-21360.26*		*-6694.62*	
Estimated ρ	*0.350 (0.015)*		*0.314 (0.029)*	
LR test ρ=0	$\chi^2(1)$=559.43, p-val.=0.0		$\chi^2(1)$=119.88, p-val.=0.0	

Note: ***, **, * indicate significant at 1%, 5% and 10%, respectively. Robust standard errors between brackets. Time- and industry-dummy variables are included in the analysis. The explanatory variables refer to the preceding year.

Regarding large firms, Table 4.4 also indicates that large firms facing capacity constraints are less likely to perform R&D activities. Firstly, unlike SMEs, the results indicate that the capacity utilization rate does not affect export probability. Related to performing R&D, Table 4.4 indicates that the capacity utilization rate has a positive influence on R&D decisions. This result is the opposite of the one obtained for SMEs, which confirms the influence of firm size on these strategies. Secondly, those firms that produce at full capacity (firms with capacity constraints) reduce the probability of participating in exporting and R&D strategies. Additionally, the control variables also have the expected sign when only large firms are considered.

4.4.2 Product and process innovations

As was previously explained, the dummy variable that measures participation in R&D activities indicates whether the firm has dedicated resources to any innovation activity in a specific year. However, this variable does not consider whether these resources have been used to implement product or production process innovations. To tackle this issue, this Section analyzes the effect of capacity constraints on the joint decision to export and perform product or production process innovations.

With respect to the two types of innovation methods, the ESEE also provides information about firms' participation in these two innovation strategies. On the one hand, this database contains a dummy variable which takes the value 1 if the firm performs product innovations, and zero otherwise. In this regard, product innovations refer to the implementation or commercialization of products with improved performance characteristics to deliver new or improved services to the consumer. On the other hand, the ESEE also takes into account the existence of production process

innovations by using a dummy variable that takes the value 1 when the firm performs such innovations, and zero otherwise. In this regard, production process innovations refer to implementation or adoption of new or significantly improved production methods.

Table 4.5: Bivariate probit results on exporting and product or process innovation

	Product innovation		*Process innovation*	
	Export	*Product_In*	*Export*	*Process_In*
U	0.120***	0.034	0.189***	0.358***
	(0.041)	(0.043)	(0.068)	(0.065)
$U > U^*_{jt}$	-0.110***	-0.121***	-0.117***	-0.179***
	(0.025)	(0.025)	(0.027)	(0.025)
Small	-0.603***	-0.314***	-0.601***	-0.200***
	(0.025)	(0.025)	(0.025)	(0.024)
Large	0.388***	0.274***	0.391***	0.260***
	(0.029)	(0.025)	(0.030)	(0.024)
TFP	0.677***	0.180***	0.678***	0.271***
	(0.028)	(0.024)	(0.028)	(0.023)
Ownership	0.403***	-0.058**	0.411***	-0.035
	(0.031)	(0.023)	(0.031)	(0.022)
Recessive	0.154***	0.103***	0.154***	0.018
	(0.021)	(0.022)	(0.021)	(0.020)
Expansive	0.171***	0.250***	0.170***	0.299***
	(0.021)	(0.020)	(0.021)	(0.019)
Observations	*30774*		*30774*	
Log-Likelihood	*-29463.40*		*-29455.95*	
Estimated ρ	*0.278 (0.013)*		*0.278 (0.013)*	
LR test ρ=0	*χ^2(1)=446.52, p-val.=0.0*		*χ^2(1)=444.98, p-val.=0.0*	

Note: ***, **, * indicate significant at 1%, 5% and 10%, respectively. Robust standard errors between brackets. Time- and industry-dummy variables are included in the analysis. The explanatory variables refer to the preceding year.

Table 4.5 shows the results of the joint decision to export and innovate, but distinguishing between product and process innovations, respectively, as variables related to innovation activity. Firstly, both tables indicate that the rho-parameter is positive and significantly different from zero, which suggests that equations need to be estimated simultaneously. Secondly, as expected, capacity constraints reduce

participation in export and innovation decisions. In other words and related to innovation investment, capacity-constrained firms are less prone to engage in product or process innovations. Thirdly, there is an interesting result with respect to the capacity utilization rate. On the one hand, the capacity utilization rate does not have any impact on the probability of implementing product innovations. The explanation for this lies in the fact that capacity utilization rates do not change as a consequence of product innovations; it only improves product characteristics to deliver new or improved services to the consumer. On the other hand, the capacity utilization rate tends to positively affect the implementation of process innovations. This type of innovation is related to improvement of production processes and, therefore, may change the capacity utilization rate. Thus, it is expected that the higher the capacity utilization, the more likely the implementation of process innovation is. Finally, the other variables considered in the analysis have the expected sign. Particularly, firm size, productivity and firms' demand expectations increase the probability of implementing product and process innovations.

4.5 Discussion of the results

The recent economic crisis has emphasized the role played by constraints (physical and financial) in firm-level decisions related to international trade. In this context, this chapter evaluates the main factors that influence on the joint decision to export and invest in R&D activities, focusing on firm-level characteristics related to capacity utilization rates and physical capacity constraints. Using a large sample of Spanish manufacturing firms over the period 1990-2011, we estimate a bivariate probit model to assess the role of capacity constraints and other firm-level variables (such as capacity utilization rate, size, productivity, ownership structure or demand expectations) in determining the participation in exporting and innovation activities. In this regard, we

provide a new measure to determine if firms face capacity constraints, which incorporates heterogeneity across industries and over time. The main hypothesis to be tested is whether capacity-constrained firms are less likely to engage in both activities.

The empirical results point out that, as expected, firm size and productivity have a positive effect on exporting and innovation decisions. Moreover, the results also reveal that firms' capacity utilization rate and capacity constraints are relevant in explaining the joint decision to export and in perform R&D. First, they suggest that the existence of a high rate of capacity utilization in the preceding year increases, up to a particular threshold, the joint probability of participating in these strategic decisions. Secondly, the findings also confirm that capacity-constrained firms (those firms producing at capacity or above a particular threshold) are less prone to engage in both activities. In summary, it seems clear that capacity constraints modify the structure of firms' marginal costs, which could lead to change the strategic behavior of constrained firms to demand shocks.

Finally, in order to check the robustness of the results, we repeat the same analysis by taking into account only SMEs and large firms, and by distinguishing between the main types of innovation activities: product and production process innovations. On the one hand, we find that capacity constraints do not change their relevant role in explaining participation in exporting and R&D decisions when only SMEs or large firms are considered. On the other hand, results remain unchanged when we distinguish as innovation activities between product and process innovations.

The main conclusion of the chapter suggests, therefore, that firms will be more likely to export and perform R&D investment if they can freely expand their production. In this regard, for instance, a country heavily impacted by the existence of capacity-constrained firms will face severe limitations when trying to enter and compete on international

markets. Accordingly, policies focused on the improvement of the capacity utilization rate would provide some significant positive benefits to firms. Specifically, these policies would lead firms to increase their participation in export markets and also raise their innovation capacity, with consequent effects on welfare and economic growth of the economy.

CHAPTER V

CONCLUSIONS, LIMITATIONS AND IMPLICATIONS

Recent research in international trade increasingly takes into account firm-level decisions in understanding the causes and consequences of the increase in global trade relations. Motivated by an increasing availability of micro level data on plants and firms, this literature emphasizes the role of firm heterogeneity as a key driver in explaining stylized facts of international trade flows. Specifically, differences across firms in basic characteristics, such as size and productivity, are strongly related to export participation. Additionally, firms' characteristics may determine different patterns of entry into export markets. Issues such as the degree of persistence in export activity, the relationship between export and import activity at the firm level, or outsourcing strategies and its impact on firm efficiency are some of the many questions that recent empirical trade literature has laid on the table, and whose answer may help to design better public policies in supporting economic growth and welfare.

Since the seminal contribution by Melitz (2003), research on heterogeneous firms has advanced significantly because of the greater availability of mico-level data. The underlying idea of these models is that heterogeneity across firms is crucial to understand some important features of international trade. In particular, this literature rationalizes a number of stylized facts about the export behavior of firms. Firstly, it

documents that exporting firms are few and, among them, only a handful of firms account for the bulk of aggregate exports. Secondly, this literature also suggests that exporters perform better than non-exporters. More specifically, it indicates that exporters are generally bigger, more productive, more capital intensive, more profitable and pay higher wages than non-exporters. Finally, this literature also points out the gains derived from trade liberalization. In general, these studies establish that trade liberalization leads to a reallocation of resources within industries, which raises average industry productivity and increases the number of varieties available to consumers.

This PhD Thesis is framed within the line of research on heterogeneous firms and international trade. The analysis here presented has been carried out using disaggregated information at the firm-level. In particular, this Dissertation has basically used three databases (the Directory of Spanish Exporting and Importing Firms, SABI and the *Encuesta Sobre Estrategias Empresariales*) which provide detailed microdata on Spanish firms. In order to pursue the aims of the research, this Thesis has considered heterogeneity in productivity, size and other firm characteristics. With these features in mind, this Dissertation contributes to this strand of the literature by assessing some factors that are relevant in firms' decisions on whether to sell. It has implied to assess the interactions between domestic and foreign sales, but also the interactions among entry decisions across different foreign markets. Finally, though entry decisions are certainly the result of many firm characteristics, this Thesis has focused on those related to capacity constraints.

The first specific objective of the research is related to the analysis and the empirical quantification of the spillover effects generated by participation in export activities on both volumes and growth rates of domestic sales. By assuming that exporters are different from non-exporters in terms of their characteristics (bigger, more productive,

more intensive in R&D, pay higher wages, etc.), the first research paper of the Dissertation tries to evaluate empirically the effect of export status on domestic sales. More specifically, this paper addresses two main questions: (i) what is the variation in domestic sales between exporters and non-exporters; and (ii) for the universe of firms that export in some year, what happens with domestic sales when these firms engage in exporting? According to these questions, the main hypothesis to be tested is whether exporting has a residual effect on domestic sales by reducing their growth rates. In this regard, and to check this hypothesis, we apply three different econometric approaches: the difference-in-difference methodology, the fixed-effects model and the random-effects model.

The empirical results obtained are twofold. On the one hand, and by applying the diff-in-diff methodology, the findings confirm the hypothesis that exporters have, on average, higher domestic sales (volumes and growth rates) than non-exporters. On the other hand, the results suggested by the fixed and random effects models reveal that firms present higher volumes of domestic sales in those years in which they are engaged in exporting. Notwithstanding, they also point out that firms significantly reduce growth rates when they are involved in export activities, which may suggest the presence of residual effects associated with participation in export markets. This result adds new evidence in support of the potential existence of a substitutability relationship between domestic and export sales.

A limitation of the first paper of the research is related to the lack of a wider time period after the 2009 crisis. A longer post crisis period would allow us to assess more accurately the impact of the economic turmoil on domestic sales. Our number of observations is considerably reduced when we only consider the crisis period (2009-

2011), which prevents a more detailed analysis of the effect of the global recession on the domestic demand.

The second specific objective of the research is to examine the potential existence of a sequential pattern of entry into new foreign markets. More specifically, this analysis is based on the framework of a two-stage sequential pattern of entry. In the first stage, the firm decides to enter export activity by selling in one or multiple destinations. In the second stage, the firm could decide to expand to new foreign markets. In this way, previous export decisions could condition current entry strategies. With this framework, the second research paper of this Thesis focuses on externalities derived from previous export decisions made by the firm or by other firms in the same industry. In this context, the externalities considered are twofold. First, those external effects coming from previous entry decisions in countries with similar economic, social or cultural characteristics to those for which a potential entry decision is made (*geographical spillovers*). Second, those effects associated with previous export decisions made by others firms that manufacture similar products (*industrial spillovers*).

The empirical findings reveal that distance and risk of nonpayment of export credits have a negative effect on new entry decisions. Conversely, economic size of the potential markets, firm size and total number of exported products have a positive impact on entry decisions. Regarding spillover effects, the results confirm that both types of externalities (geographical and industrial) play a positive role in explaining entry decisions in new export markets. They also point out that previous presence in a specific foreign country facilitates re-entry into that specific destination. Accordingly, these last results provide new evidence on the assumption that sunk entry costs could be reduced substantially as a result of prior experience in export markets.

Empirical analysis in chapter 3 also introduces some limitations. Two are the most relevant. Firstly, the database used does not contain firm-level information on export volumes broken down by countries of destinations and exported products. In other words, it only provides the range of exported products and the full list of country destinations. It may imply, therefore, that our findings cannot be generalized as a pattern for all firms, given that we do not know what type of product is specifically exported to each country. Secondly, chapter 3 only focuses on entry decisions in new export markets and does not take into account whether entry is transient or persistent, nor the duration of the export activity spells. The large amount of decisions taken by each firm each year makes difficult to integrate a long-term perspective, though it is certainly a line of research to follow in the next future.

Finally, the last specific objective of this PhD Thesis is to examine the critical role that capacity constraints play in the firm's joint decisions to export and perform R&D activities. This research, therefore, contributes to the growing literature that emphasizes the relevance of constraints (physical and financial) in firm-level decisions related to international trade. Based on the assumption that capacity-constrained firms cannot freely expand their production, the third research paper of the Dissertation estimates a bivariate probit model to evaluate the potential influence of these constraints (and other variables related to plant characteristics and the state of demand) in explaining export and innovation decisions of firms. In this regard, we have used a new measure to determine if firms face physical constraints based on the capacity utilization rate of the firm, which incorporates heterogeneity across industries and years. The main hypothesis to be tested is whether capacity-constrained firms (those companies that produce at full capacity or above a certain capacity threshold) are less prone to engage in exporting and R&D.

The empirical findings suggest that firms' capacity utilization rate and capacity constraints play an essential role in participation in these strategic decisions. On the one hand, results reveal that a high capacity utilization rate in the preceding year increases the joint likelihood of exporting and performing R&D. On the other hand, they also point out that the existence of capacity constraints significantly reduces the probability of carrying out these activities. In addition, the other variables related to firm heterogeneity (size, productivity or ownership structure) and the state of demand have the expected sign.

Regarding limitations, this research paper only focuses on physical capacity constraints and does not consider the other main source that may restrict production. In other words, it does not take into account the effects of financial constraints, which might be also relevant in determining the participation in firms' strategic decisions. As is expected, participation in export and/or R&D activities is associated with the overcoming of additional sunk costs, which may be covered by using own funds or by borrowing. Accordingly, firm's financial situation may also play a relevant role in explaining the engagement in both strategies. Therefore, future research could extend these empirical findings taking into account the presence of financial constraints.

Furthermore, this Dissertation has also highlighted some policy implications and recommendations for governments. Firstly, Chapter 2 promotes the development of export promotion policies focused on persistent entries into export markets in order to reduce residual effects from exporting. Secondly, and by considering the positive influence of geographical and industrial spillovers, Chapter 3 suggests the implementation of policies and strategies of internationalization that support entry into countries belonging to new geographical regions in which firm had not previously exported. In this regard, the initial entry could facilitate additional entries into

neighboring countries. Finally, Chapter 4 recommends the development of policies that lead firms to improve their capacity utilization rate in order to achieve a better adjustment between production and potential demand levels.

In summary, the three research papers that integrate this Thesis have successfully accomplished the main objective of the research, adding new empirical evidence related to the main determinants and externalities derived from export decisions at the firm level. In addition, this Dissertation has also reached the three specific objectives we set in the introduction chapter. Finally, this Thesis has also faced some limitations that would motivate other future researches, and presents some policy implications and practical recommendations.

Additionally, all these findings have motivated the development of other future research questions within the line of research on heterogeneous firms in international trade. In this regard, I am working now on expanding the Chapter 2 and 4 of the Dissertation. Specifically, I am trying to develop a theoretical framework consistent with the empirical facts, which allows to evaluate the interconnections between domestic and export sales by considering the existence of financial and physical capacity constraints. The preliminary results suggest that firms that are facing capacity and financial constraints substitute sales across locations, which could confirm the substitution relationship between domestic and export sales under the existence of capacity constraints.

Finally, this Dissertation has also contributed to the publication of articles in different scientific journals, which are listed below:

Muñoz-Sepúlveda, J.A. and Rodríguez, D. (2015). Geographical and industrial spillovers in entry decisions across export markets. *Applied Economics*, 47 (39), p. 4168-4183. http://dx.doi.org/10.1080/00036846.2015.1026582

Muñoz, J.A. and Rodríguez, D. (2012). El comportamiento exportador de las empresas industriales y el papel de la calidad. *Economistas*, 130, p. 76-82. ISSN 0212-4386

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APPENDIX

Appendix A1: Construction of variables

Geographical spillover

Firm *i* decides to export (1) or not (0) to country *c* at time *t*, conditional to not exporting at *t-1* (e_{ict} /e_{ict-1} = 0). That country *c* belongs to a region R_c according to the classification showed in Table A2. Then, the geographical spillover for firm *i* in country *c* at time *t* considers whether or not the firm was exporting to other country in the same region R_c at time *t-1*. Due to the sample is conditional to entry in *c*, that country is not accounted in the set of countries in R_c at time *t-1*.

Industrial spillover

The database provides information on goods exported by each firm, classified in 98 groups of products according to the Combined Nomenclature. That information corresponds to firm's exports as a whole, and it is not crossed for each export destination. Therefore, we assume that each firm exports the same bunch of products to all export destinations. The industrial spillover for a firm *i* exporting to country *c* at time *t* computes the number of firms that were exporting similar products to the country *c* at time *t-1*. Therefore, the procedure is as follows. Firstly, for each firm *i* that belongs to the subsample of firms exporting to a country *c* at time *t*, we calculate the number of firms in that subsample that export any of the products exported by the firm at time *t-1* (column b). Secondly, the industrial spillover is computed as the difference between that number and the total number of goods produced by the firm (column a). Next table shows an example for five firms and six exported products in a specific country and year.

	Products				# of firms in each product							*Spill_I*
Firms in country *c*	P1	P2	P3	Total # of products (a)	ds1	ds2	ds3	ds4	ds5	ds6	Total # of firms (b)	(b-a)
Firm 1	2	3	5	3	0	2	2	0	3	0	7	4
Firm 2	3	5	6	3	0	0	2	0	3	1	6	3
Firm 3	1	2	.	2	1	2	0	0	0	0	3	1
Firm 4	4	.	.	1	0	0	0	2	0	0	2	1
Firm 5	4	5	.	2	0	0	0	2	3	0	5	3

When the firm is not exporting to country *c*, the industrial spillover is defined as b (not as b-a) and it captures the number of firms exporting at least one of the products to the same country/year.

Appendix A2: Country classification by geographical areas

Country	Region	Country	Region
Afghanistan	Middle East	Kyrgyz Republic	Middle East
Albania	Other European countries	Laos	Far East
Algeria	Africa	Latvia	Europe
Andorra	Europe	Lebanon	Middle East
Angola	Africa	Liberia	Africa
Anguilla	Central America	Libya	Africa
Antigua and Barbuda	Central America	Liechtenstein	Europe
Argentina	South America	Lithuania	Europe
Armenia	Middle East	Luxembourg	Europe
Aruba	Central America	Macau	Far East
Australia	Oceania	Madagascar	Africa
Austria	Europe	Malawi	Africa
Azerbaijan	Middle East	Malaysia	Far East
Bahamas	Central America	Maldives	Far East
Bahrain	Middle East	Mali	Africa
Bangladesh	Far East	Malta	Europe
Barbados	Central America	Marshall Islands	Oceania
Belarus	Other European countries	Mauritania	Africa
Belgium	Europe	Mauritius	Africa
Belize	Central America	Mayotte	Africa
Benin	Africa	Mexico	North America
Bermuda	Central America	Moldova	Other European countries
Bolivia	South America	Mongolia	Far East
Bosnia and Herzegovina	Other European countries	Montenegro	Other European countries
Botswana	Africa	Morocco	Africa
Brazil	South America	Mozambique	Africa
British Virgin Islands	Central America	Myanmar	Far East
Brunei Darussalam	Far East	Namibia	Africa
Bulgaria	Europe	Nepal	Far East
Burkina Faso	Africa	Netherlands	Europe
Burundi	Africa	Netherlands Antilles	Central America
Cambodia	Far East	New Caledonia	Oceania
Cameroon	Africa	New Zealand	Oceania
Canada	North America	Nicaragua	Central America
Cape Verde	Africa	Niger	Africa
Cayman Islands	Central America	Nigeria	Africa
Central African Republic	Africa	North Korea (DPRK)	Far East
Chad	Africa	Norway	Europe
Chile	South America	Oman	Middle East
China	Far East	Pakistan	Middle East
Colombia	South America	Palestine	Middle East
Comoros	Africa	Panama	Central America
Congo, Dem Rep.	Africa	Papua New Guinea	Far East
Congo, Rep.	Africa	Paraguay	South America
Costa Rica	Central America	Peru	South America
Croatia	Other European countries	Philippines	Far East
Cuba	Central America	Poland	Europe
Cyprus	Other European countries	Portugal	Europe
Czech Republic	Europe	Qatar	Middle East
Denmark	Europe	Romania	Europe

(continued)

Country	Region	Country	Region
Djibouti	Africa	Russia Federation	Other European countries
Dominica	Central America	Rwanda	Africa
Dominican Republic	Central America	Samoa	Oceania
Ecuador	South America	San Marino	Europe
Egypt	Africa	São Tomé and Príncipe	Africa
El Salvador	Central America	Saudi Arabia	Middle East
Equatorial Guinea	Africa	Senegal	Africa
Eritrea	Africa	Serbia	Other European countries
Estonia	Europe	Serbia and Montenegro	Other European countries
Ethiopia	Africa	Seychelles	Africa
Falkland Islands	South America	Sierra Leone	Africa
Faroe Islands	Europe	Singapore	Far East
Fiji	Oceania	Slovak Republic	Europe
Finland	Europe	Slovenia	Europe
Former Yugoslav Republic of Macedonia (FYROM)	Other European countries	South Africa	Africa
France	Europe	South Korea	Far East
French Polynesia	Oceania	Sri Lanka	Far East
Gabon	Africa	St. Kitts-Nevis	Central America
Gambia	Africa	St. Lucia	Central America
Georgia	Other European countries	St. Vincent and Grenadines	Central America
Germany	Europe	Sudan	Africa
Ghana	Africa	Suriname	South America
Gibraltar	Europe	Sweden	Europe
Greece	Europe	Switzerland	Europe
Greenland	North America	Syria	Middle East
Grenada	Central America	Taiwan	Far East
Guam	Oceania	Tajikistan	Middle East
Guatemala	Central America	Tanzania	Africa
Guinea	Africa	Thailand	Far East
Guinea-Bissau	Africa	Togo	Africa
Guyana	South America	Tonga	Oceania
Haiti	Central America	Trinidad and Tobago	Central America
Honduras	Central America	Tunisia	Africa
Hong Kong, China	Far East	Turkey	Other European countries
Hungary	Europe	Turkmenistan	Middle East
Iceland	Europe	Turks and Caicos Islands	Central America
India	Far East	Uganda	Africa
Indonesia	Far East	Ukraine	Other European countries
Iran	Middle East	United Arab Emirates	Middle East
Iraq	Middle East	United Kingdom	Europe
Ireland	Europe	United States	North America
Israel	Middle East	United States Virgin	Central America
Italy	Europe	Uruguay	South America
Ivory Coast	Africa	Uzbekistan	Middle East
Jamaica	Central America	Vanuatu	Oceania
Japan	Far East	Venezuela	South America
Jordan	Middle East	Vietnam	Far East
Kazakhstan	Middle East	Yemen	Middle East
Kenya	Africa	Zambia	Africa
Kosovo	Other European countries	Zimbabwe	Africa
Kuwait	Middle East		

Appendix A3: Descriptive statistics of the explanatory variables

Variable	Name	Mean	Std. Deviation	Min	Max
GDP (Billions $, in PPP)	*PIB*	0.2743	1.02	0.0001	13.14
Distance (km.)	*Dist*	6,158.71	3,823.6	502.7	19,839.6
Country Risk	*Risk*	4.71	2.50	0	7
Number of employees	*Size*	89.49	379.48	1	14,470
Total Factor Productivity (in log)	*TFP*	3.71	0.48	-2.52	6.51
Previous presence in the country	*Presen*	0.20	0.14	0	1
Regional spillover	*Spill_R*	0.31	0.47	0	1
Industrial spillover	*Spill_I*	210.98	445.46	0	14,477

Appendix A4: Average capacity utilization by industries (following ESEE classification)

Manufacturing industry	Average Capacity Utilization (%)
1- Meat products	82.80 (14.68)
2- Food products (excluding meat) and tobacco	77.46 (16.06)
3- Beverages	73.06 (18.22)
4- Textiles and wearing apparel	80.49 (15.42)
5- Leather and related products	80.61 (14.69)
6- Wood and cork products (excluding furniture)	78.98 (18.32)
7- Paper products	84.16 (13.78)
8- Printing and reproduction of recorded media	80.64 (15.40)
9- Chemicals and pharmaceutical products	78.78 (15.74)
10- Rubber and plastic products	80.57 (15.09)
11- Non-metallic mineral products	79.91 (18.15)
12- Basic iron and non-ferrous metals	81.62 (15.52)
13- Fabricated metal products	80.48 (15.89)
14- Agricultural and industrial machinery and equipment	81.82 (15.40)
15- Computer, electronic and optical products	82.10 (16.17)
16- Electrical equipment and materials	83.18 (14.15)
17- Motor vehicles	81.17 (15.37)
18- Other transport equipment	79.01 (19.51)
19- Furniture	78.62 (16.79)
20- Other manufacturing	78.57 (16.82)

Note: Standard deviation of the capacity utilization for each industry between brackets.

Source: Author's elaboration from ESEE database.