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# SMEs' STRATEGIES TO FACE THE ONSET OF THE GREAT RECESSION

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**Abstract**

*This work analyses how SMEs (as compared to large firms) endured the onset of the recent Great Recession through the engagement in internationalization and innovation strategies. We focus on the SMEs strategies of exporting and undertaking R&D and the impact of these activities on firms' markups (i.e., a measure of performance). This study will allow determining whether performing these strategic activities allowed SMEs to get advantages to sustain markups, not only in an expansive period but also during the hit of the hardest period of the recent financial and economic crisis. The data we use is the Spanish survey on firms' strategies (ESEE), 1993-2009. We obtain two main results: first, for SMEs the strategies of only exporting or performing both activities explain higher markups; and, second, there is confirmation that R&D played an increasing role in protecting firms against a decrease in markups in the onset of the crisis.*

Key words: SMEs, Exports, R&D, markups, the Great Recession

*JEL Classification:* D24, F14, O32, E32

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## 1. Introduction.

Exporting and the performance of R&D activities are key firm strategies that contribute to improve firms' success and survival and also to countries economic development. Studying the profitability of these activities is crucial to convince managers and policy makers acknowledging the importance of carrying them out. Several papers study the impact of exports or innovation on firm productivity, obtaining in overall that both exporting companies and those that perform R&D activities are more efficient than those that do not carry out such activities.[1] These works rely theoretically on models for firm international trade and on models for firm innovation.

Recent global trade theoretical approaches that consider heterogeneous companies (for example, Melitz, 2003) predict the existence of a significant correlation between export status and several characteristics of the companies, such as their productivity and size. This theoretical model can be used to justify the productivity (efficiency) advantages enjoyed by exporting companies as compared to non-exporters. However, one might hypothesize that if the productivity distribution depends on firm's size, then the productivity trading threshold identified by Melitz (2003), entailing self-selection into exports, could be binding for Small and Medium Enterprises (SMEs) but not for bigger companies, given that larger firms have higher productivity overall.

[1] See Griliches (1979, 1995, 1998), Beneito (2001), Huergo and Jaumandreu (2004), Máñez *et al.* (2005), Hall *et al.* (2010), Rochina-Barrachina *et al.* (2010), Doraszelski and Jaumandreu (2013), and Máñez *et al.* (2013), among others, for the effects of innovation on productivity; see Delgado *et al.* (2002), Baldwin and Gu (2003), Van Biesebroeck (2005), Wagner (2007, 2012), De Loecker (2007, 2013), Martins and Yang (2009), Singh (2010), Silva *et al.* (2010), Merino (2012) and Manjón *et al.* (2013), among others, for the impact of foreing trade on productivity; and see Aw *et al.* (2007, 2008, 2011), Damijan *et al.* (2010), Máñez *et al.* (2009), Lileeva and Trefler (2010), Cassiman *et al.* (2010), Bustos (2011) and Máñez *et al.* (2014), for the effects of jointly undertaking R&D activities and exporting on productivity.

One step further in this literature is to analyse if the differences encountered in terms of productivity translate into major benefits for businesses, measured, for example, through markups. Some recent works explain differences in markups on the basis of the exporting activity of companies. In particular, the theoretical models of Bernard *et al.* (2003) and Melitz and Ottaviano (2008), obtain predictions regarding the markups of companies and their exporting status. Thus, Bernard *et al.* (2003) present a model for foreign trade assuming imperfect competition that links enterprise level efficiency, markups and the exporter status. Consequently, in markets with imperfect competition, enterprises set a price above marginal cost. According to this model, the most efficient producers establish higher margins and are more likely to be exporters. Further, Melitz and Ottaviano (2008) propose a model of monopolistic competition with heterogeneous firms (in terms of productivity) and endogenous distinctions in the intensity of competition in foreign markets, reflected by the number of firms and the firm productivity average of those competing in each market. Thus, they find different predictions about the distribution of business markups based on product differentiation and competition in the market. These markups might also be different for SMEs as the competition they face in international markets might be different as compared to large firms.

Moreno and Rodríguez (2004, 2010) study the association between serving international markets and firms' markups using a panel of Spanish firms. The first work analyses markups for exporting companies during the period 1990-1997. The second one studies the differences in markups between firms exporting and firms that do not export, during the period 1990-1999. These works reach to the conclusion that exporters show higher markups (as compared to non-exporters). De Loecker and Warzynski (2012) is very likely the most influential work on markups in the last decade. They propose a novel

approach to calculate firms' markups. Using this methodology, they find that Slovenian exporters set (on average) higher markups than non-traders, for the period 1994-2000,

The study of the performance of R&D investment is a topic of considerable interest given that investment in innovation is costly and, therefore, companies need to be sure that the returns of this activity are positive. This is especially relevant for SMEs since they can be more liquidity constrained than large firms. Hall *et al*. (2010) provide a survey of the literature that analyses the performance of R&D activities. R&D expenditures undertaken by enterprises vary in type, but its ultimate goal is increasing the stock of knowledge to discover new applications and innovations. This allows firms to increase the quality and number of products or to obtain reductions in the costs of production of existing goods. These improvements, which can affect both the demand and the productivity of enterprises, might mean increases in firms' benefits *via* cost reductions (not completely translated into reductions in prices) or even allow for positive variations of prices. In addition, it is fundamental stressing that R&D revenues are the result of a complex interaction between the strategies of companies, the strategies of competitors and the macroeconomic environment, being some of these factors often non-predictable by firms when they take R&D decisions.

As regards the empirical papers studying the nexus between innovation and company's benefits, we can highlight Geroski *et al.* (1993) and Cassiman and Vanormelingen (2013). Geroski *et al.* (1993) explore the link between innovation and the firm accounting net profit for a sample of British companies. Cassiman and Vanormelingen (2013) discuss how Spanish companies benefit from their innovative activities through its effect on firms' markups. They obtain that innovation is positively related to markups.

In this study, we account for the firm's exporting and performing R&D activities in the calculation of productivity (in line with Aw *et al.*, 2011, and Máñez *et al.*, 2014). However, our main objective is to analyse the role that these firms' strategic decisions have on their ability to set prices above their marginal costs and, hence, their capacity to affect markups. Moreover, we are especially interested in SMEs. Not only because SMEs account for more than 90 per cent of Spanish manufacturing firms but also because they are more prone to face handicaps in the performance of these activities, such as the availability of internal funds, higher likelihood of being financially constrained, superior risk aversion, etc., which makes them to be in an inferior position to pay upfront costs required by these investments. From a policy and institutional standpoint, there is also a growing interest in SMEs as regards the performance of strategies contributing to their better positioning in the markets. In this respect, there are European policy plans aiming at encouraging firms, especially SMEs, [2] to invest in innovative activities to improve firms' competitiveness. The European research policy strategy "Horizon 2020" is mainly aimed at stimulating innovative SMEs (European Commission 2010).

Finally, our last but not least purpose in this study is to investigate: first, whether R&D and export strategies allowed SMEs to smooth the effect of the onset of the Great Recession on markups; second, whether the impact of these strategies on markups changed with the start of the crisis; and, third, whether the moderating effect of these strategies differs between SMEs and larger firms. To the best of our knowledge, this is the first paper combining both types of strategies to study their effects on firms' markups

[2] In relation to these activities, the Joint Research Center of the European Commission organized a workshop. Some of the papers presented were published in the Special Issue of the Small Business Economics Journal: "Drivers and Impacts of Corporate R&D in SMEs". Ortega-Argilés *et al.* (2009) provides a survey of the studies published in the special issue.

and to consider their ability as firms' instruments to face the hardest part of an economic and financial world crisis. To contribute to the literature, we will use information from a panel of Spanish manufacturing (SMEs and large) firms extracted from the business strategies survey (ESEE onwards) for the period 1993-2009.

In this paper we use a three-step methodology for estimating firms' markups. In the first one, we estimate industry-level production functions with firm-level data and, therefore, we obtain input elasticities for production factors. At this stage, we acknowledge both R&D and exporting decisions to impact future productivity (using an endogenous Markov process, see De Loecker, 2013, and Doraszelsky and Jaumandreu, 2013). In the second stage, we calculate firms' markups according to the methodology of De Loecker and Warzynski (2012). With the assumptions that firms are cost minimizers and use at least one variable factor in production, this methodology allows to calculate firms' markups using just information on the firms' production side. Finally, in the third stage we research the moderating roles of exports and R&D strategies on firms' markups.

The results in the paper are manifold. First, we obtain that for SMEs the strategy of only exporting implies that firms enjoy a 3.2% higher markups; and, 7,4% for the joint strategy of exporting and investing in R&D. However, the strategy of only investing in R&D has no effect on markups for this size group. Differently, for large firms the strategy of only investing in R&D also justifies an increase in markups. In any case, conditioning to a given strategy, large firms always obtain higher rewards in terms of markups than SMEs.

Second, conditioning on productivity (that is, heterogeneity in marginal costs) in the markups regression, implies only a small reduction in the export and R&D premia for SMEs. This suggests that the higher margins for SMEs that only export or both export and undertake R&D are not only explained by the possible increase in efficiency

associated to these strategies but also by their ability to set higher prices. At difference, for large firms, once we control for productivity differences among firms, the only exporting and only undertaking R&D strategies do not pay higher margins. This suggests that only exporting or only undertaking R&D increases large firms' markups *via* increases in efficiency but not through higher prices. The ability for large firms to establish prices above marginal costs only emerges for companies performing both activities jointly.

Finally, as for the effect of the crisis on the connection between firms' strategies and markups, the results obtained suggest that for SMEs the only R&D strategy pays higher markups at the onset of the Great Recession, as compared to previous years. Further, the joint strategy has also rewards in terms of markups for SMEs during this period, but only for those not facing a recessive market. Among large firms, both for firms pursuing an only R&D strategy and undertaking both strategies (R&D and exports) we find that they are able to set higher markups at the starting of the crisis (regardless of whether or not they face a recessive market beyond the general economic situation). These results uncover a leading role for performing R&D as a factor letting firms to increase prices and, hence, to set higher markups during the crisis.

The rest of the paper is organized as follows: in section 2 we present the data and descriptive statistics; in section 3 we explain the methodology used for estimating markups at the firm level; in section 4 we present the main results in the paper; and, finally, section 5 concludes.

## 2. Data and descriptive analysis.

In this study we use a panel data set obtained from the Spanish survey on business strategies (ESEE) for the period 1993 to 2009.[3] This is yearly survey, carried out by the SEPI Foundation, which is representative (by industry and size) of the manufacturing industry companies in Spain.

The sampling process of the ESEE is as follows. All companies with employees below 10 are not included in the sample. Firms with 10-200 employees (SMEs) are randomly included, being about 5% of the population of companies within this size range in 1990. All firms bigger than 200 workers (large firms) are invited to contribute in the survey, with a participation of about 70% in 1990. To minimize attrition in the initial sample, important efforts have been conducted. Thus, annually new firms are incorporated with the same criterion of the base year to preserve the sample representativeness across time.[4]

In our work, we drop out all firms that do not provide information on the relevant variables used in the analysis. Therefore, after cleansing those observations, we have a sample of 16,777 observations that correspond to 2,165 firms.

To obtain the firm's status for exporting and performing R&D from the survey we use the following two questions. The question to classify a firm as exporter is: 'Indicate if the firm has exported this year (including exports to the European Union), either directly or through other firms in the same group'. Firms are classified as R&D

[3] We do not use data from 1990, as it is not possible to calculate firms total factor productivity with available data for that year. In addition, we estimate firm total factor productivity and markups since the year 1993, as we need lagged instruments in our methodology to estimate the inputs elasticities in the firm production function.

[4] See https://www.fundacionsepi.es/investigacion/esee/en/spresentacion.asp for more details.

performers using this question: 'Indicate if the firm has performed or contracted any R&D activity this year'.

Figure 1 plots the progression, from 1993-2009, of the proportion of companies only exporting, firms that only perform R&D activities, companies carrying out both export and R&D, and, finally, firms that do not perform any activity. In the figure we observe that among Spanish manufacturing companies, exporting is much more frequent than investing in R&D. While the share of companies that export has increased considerably for the period analysed (from 41.26% in 1993 to 55.25% in 2009), the proportion of companies that perform R&D has remained stable (26.17% in 1993 and 25.75% in 2009).[5] It is also worth noting that the proportion of companies that carry out both activities increased steadily along the period (from 18.87% to 22.75%). This fact provides empirical support to the argument that exporting and carrying out R&D activities are linked and that, therefore, it points to the need to analyse their joint impact on firms' markups.

[Figure 1 around here]

Table 1 shows, for SMEs and large companies, the proportion of enterprises that have opted for each of the four possible strategies (not exporting/not performing R&D, only export, only R&D and both export and R&D). We observe significant differences comparing SMEs and large firms. While for large firms the most important strategy is to carry out both activities (70,29% throughout the sample period), for SMEs the most important strategy is Not export/Not R&D (45,19%). Therefore, the correlation of performing R&D and export activities appears to be higher for large companies than for SMEs. It is also relevant pointing out that the percentage of SMEs that Only export is

[5] To calculate these percentages, we have considered both enterprises only exporting (only carrying out R&D) and those that perform both activities together.

greater than that for large firms, since the latter, as has already been highlighted, tend to combine export with R&D activities.

[Table 1 around here]

With regard to the markups, Figure 2 displays the time progression of these throughout period analysed. The observation of this evolution confirms the pro-cyclicality of the markups posed by theory. This pro-cyclical evolution is especially evident in the first decade of the XXI century. The continuous expansion between 2005-2007 coincides with a sharp increase in the margins that plummeted with the onset of the global crisis.

[Figure 2 around here]

Table 2 shows the markups average, for all firms and for the size breakdown. We can observe that the average markup for all firms is 1.20, being the markups for SMEs and large firms 1.19 and 1.35, respectively. Therefore, a first factor to consider is that the evidence suggests that the markups are higher for large firms. With regard to the relation between exporting and performing R&D strategies with the markups, we perceive that: i) for both size groups, markups for firms not exporting and not carrying out R&D activities are very close to one, suggesting a reduced ability to exert market power (measured as the price minus the marginal cost); (ii) for both size groups, firms only exporting are able to set higher margins as compared to companies not exporting and not undertaking R&D activities; (iii) similarly, companies that only carry out R&D activities enjoy higher markups than those doing nothing, being this difference larger for bigger companies than for SMEs;[6] and, iv) finally, the highest markups correspond to firms (SMEs and large)

[6] This evidence might be related to the type of innovations obtained by SMEs and large firms from undertaking R&D activities. Thus, while the innovations of SMEs are generally incremental, those of large firms tend to be of higher quality.

both exporting and performing R&D activities.

[Table 2 around here]

## 3. Methodology.

### 3.1. Markups estimation.

This section explains the methodological approach we take to estimate markups using production data at the firm level (i.e., data on consumption of inputs and the firm's production value). This methodology, proposed by De Loecker and Warzynski (2012), stems from Hall (1988), which was the first work that used data on production to estimate markups. The main advantage of De Loecker and Warzynski (2012) approach is that it allows deriving an expression for calculating markups under two mild assumptions: first, firms are cost-minimizing; and, second, there exists at least one input of production that varies. In what follows, we describe this methodology to estimate markups.

We adopt that firms produce output thorough a Cobb-Douglas technological function:

$$Y_{it} = f_{it}(L_{it}, M_{it}, K_{it}, W_{it}) = L_{it}^{\beta_l} M_{it}^{\beta_m} K_{it}^{\beta_k} \exp(\omega_{it}) \quad (1)$$

where $L_{it}$ is the labour input, $M_{it}$ are materials or intermediate inputs, $K_{it}$ is the capital input and $\omega_{it}$ is productivity. We assume that that capital input is a dynamic factor that progresses according to a given law of motion and that is not correlated with current productivity shocks (this is like assuming that it is a state variable), while employment and intermediate materials are inputs that might be adjusted when the company perceives a shock in productivity (i.e., these inputs are variable).[7]

[7] The capital factor law of motion is a dynamic process as follows: $k_{it} = (1-\delta)k_{it-1} + I_{it-1}$. This implies that the capital used by a firm in a specific period $t$ was contracted in the previous year $t$–1 (this implies

Suppose further that companies are cost minimizers and, therefore, we should consider the following associated Lagrangian:

$$Lg(L_{it}, M_{it}, K_{it}, \omega_{it}, \lambda_{it}) = w_{it}L_{it} + s_{it}M_{it} + r_{it}K_{it} + \lambda_{it}\left(Y_{it} - f_{it}(L_{it}, M_{it}, K_{it}, \omega_{it})\right) \quad (2)$$

where $w_{it}$ and $s_{it}$ are labour and materials prices (i.e., the variable inputs prices), $r_{it}$ is the price of capital, and, finally, the marginal cost for a given level of output is given by $\lambda_{it} = \frac{\partial Lg}{\partial Y_{it}}$. The first order condition for the labour input is:

$$\frac{\partial Lg}{\partial L_{it}} = w_{it} - \lambda_{it}\beta_l L_{it}^{\beta_l - 1} M_{it}^{\beta_m} K_{it}^{\beta_k} \exp(\omega_{it}) = 0 \quad (3)$$

Multiplying both sides of equation (3) by $\frac{L_{it}}{Y_{it}}$ and reordering the terms we get:

$$\beta_l = \frac{1}{\lambda_{it}} \frac{w_{it}L_{it}}{Y_{it}} \quad (4)$$

Therefore, for firms that minimize costs the demand for labour optimal is fulfilled when the output elasticity of labour is equal to the product of the inverse of the marginal cost $\left(\frac{1}{\lambda_{it}}\right)$ times $\frac{w_{it}L_{it}}{Y_{it}}$.

Finally, the markup is calculated as the price to marginal cost ratio $\left(\mu_{it} = \frac{P_{it}}{\lambda_{it}}\right)$.

De Loecker and Warzynski (2012) emphasize that calculating markups using methodology is robust to different pricing models, and is independent of the particular

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that the firm needs a full production year for the capital to be ordered, received and fixed by the enterprise before it is in operation). Labour and intermediate materials factors (but not capital) are decided in year *t*, that is the period they are utilised by the firms (and, thus, can be a function of $\omega_{it}$). These assumptions as regards time suggest that both labour and intermediate materials are taken as non-dynamic inputs (differently to capital).

type of firms' price competition. However, the value of the markup does depend on the type of competition amongst companies.

Using the markup definition and after reordering terms we can write equation (4) as,

$$\beta_l = \mu_{it} \frac{w_{it} L_{it}}{P_{it} Y_{it}} \tag{5}$$

where defining $\frac{w_{it} L_{it}}{P_{it} Y_{it}} = \alpha_{it}$ as the part that the expenditure on labour ($w_{it}L_{it}$) represents in the value of sales ($P_{it}Y_{it}$), we can obtain markups as:

$$\mu_{it} = \frac{\beta_l}{\alpha_{it}} \tag{6}$$

The information needed to obtain $\alpha_{it}$ is observable in most firm databases, and the output elasticity of labour may be obtained estimating a production function.

### 3.2. Identification of output elasticities.

We take log version of the function for production (1):

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_t + \omega_{it} + \eta_{it} \tag{7}$$

In this expression $y_{it}$ is the natural log of production for company $i$ in time $t$, $l_{it}$ represents the natural log of labour, $k_{it}$ is the capital natural log and $m_{it}$ is the natural log of intermediate material inputs. With respect to the specification in (1) we add $\beta_t$ that account for time effects. In relation to the unobservable variables, $\omega_{it}$ represents the firm's productivity (that it is not observable by the econometrician, but firms might observe or predict it) and $\eta_{it}$ is a standard i.i.d. error term (this is not observed or predictable by the company).

Olley and Pakes (1996, henceforth OP), also assuming that capital is a state variable and labour and materials are adjustable inputs when a firm faces a productivity

shock, demonstrate how to get consistent estimates of the production function parameters through a semi-parametric approach (see also Levinsohn and Petrin, 2003, hereafter LP, for a similar related strategy for estimation).

In our methodology we use Wooldridge (2009) approach, who shows that OP and LP estimation methodologies can be reassessed as comprising two equations that might be jointly estimated by GMM: the initial equation accounts for endogeneity of the inputs non-dynamic (for the factors variable); and, the second equation tackles the law of motion of productivity matter. In what follows, we explain in detail both equations.

The first problem we consider is the endogeneity issue related to the non-dynamic factors. Thus, the fact that labour and intermediate factors might be correlated with firms' productivity makes the estimation of equation (7) complicate, as OLS is biased and either the instrumental variables or the fixed-effect methodologies are usually not consistent (see Ackerberg *et al.*, 2015). The solution to this problem proposed by OP and LP methodologies is to use a control function approach. They use the investment in capital function and the demand materials, respectively, to proxy for productivity, as this is 'unobserved'.

The methodology proposed by OP assumes that the company's demand investment in capital, $i_{it} = i\left(k_{it}, \omega_{it}\right)$, depends on capital and productivity, as a control function to recover 'unobserved' productivity. However, LP methodology uses the demand for intermediate materials, $m_{it} = m\left(k_{it}, \omega_{it}\right)$, as a proxy variable, to avoid the problem of zeros in the investment in capital demand for some firms. In this work we follow LP approach, so we will focus on the firms' demand of intermediate materials.

It is important to note that in the estimation of productivity using the standard OP and LP approaches (in a context where firms export or not, and where some firms undertake R&D activities while others do not) researchers adopt an identical demand for

materials for the different types of firms (as regards their export and R&D status). However, we consider that heterogeneity in firms' export and R&D strategies might have an impact on the demand of intermediate materials.

In this research, to tackle this issue, we introduce different demand functions for intermediate materials for different types of firms: firms that only export (*EX*); firms that only undertake R&D (*R&D*); companies performing both activities (*Both*); and, firms performing neither of them (*Nothing*). Thus, the demand function for intermediate inputs is as follows,

$$m_{it} = m_J\left(k_{it}, \omega_{it}\right) \tag{8}$$

where the subscript *J* indicates that the demand of intermediate materials is firm specific, according to the different exporting and R&D strategies taken by the firm. We assume that the demand for materials is monotonic in productivity, therefore it is invertible to obtain the inverse demand function for intermediate materials (i.e., the proxy for productivity),

$$\omega_{it} = h_J\left(k_{it}, m_{it}\right) \tag{9}$$

in this equation, $h_J$ represents an unknown function of $k_{it}$ and $m_{it}$. Hence, substituting equation (9) into equation (7), the production function, we get,

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_t + h_J\left(k_{it}, m_{it}\right) + \eta_{it} \tag{10}$$

From the above expression we obtain the first production function estimation equation as,

$$y_{it} = \beta_l l_{it} + \beta_t + \sum_{j=Nothing,EX,R\&D,Both} a_j H_j(k_{it}, m_{it}) + \eta_{it} \tag{11}$$

where $a_j$ represents an indicator taking on value one if a firm undertakes the exporting/R&D strategy *j* (and value 0 otherwise). In expression (11), the unknown

functions $H$ will be proxied by polynomials of degree 3 in their particular arguments.[8]

Notice that in equation (11), the inverse demand functions for firms with different strategies are different. And these differences are related to different estimated coefficients for $k_{it}$ and $m_{it}$, and also because each inverse demand function contains a dummy variable identifying the specific firm's strategy. It is important to stress that this is not equal to incorporate the dummies (capturing the different strategies) as supplementary inputs in the firm's production function, as every dummy is interacted with each term of $k_{it}$ and $m_{it}$ in the polynomial. For instance, introducing a specific dummy variable for the strategy only undertaking R&D as an additional input in the production function is problematic for at least two reasons. First, we incur in an identification issue, as there we will be necessary an extra estimation stage to identify the parameter for that variable. Second, it would imply that firms might substitute undertaking R&D with any factor at constant unit elasticity (De Loecker, 2007, 2013, raises a similar argument in a case with an export dummy).

In specification (11), neither $\beta_k$ nor $\beta_m$ are identified. The inclusion of a second equation in the GMM-system, that will deal with the law of motion of productivity, will help to identify these parameters. The OP/LP methods assume that productivity evolves as an exogenous Markov process:

$$\omega_{it} = E\left[\omega_{it} \left| \omega_{it-1} \right.\right] + \xi_{it} = f\left(\omega_{it-1}\right) + \xi_{it} \tag{12}$$

where $f$ is an unknown function that links productivity in period $t$ with productivity in

[8]Note that $\sum_{j=Nothing,EX,R\&D,Both} a_j H_j(k_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \beta_m m_{it} + h_j(k_{it}, m_{it})$, where we include the constant of the production function as it is not separately identifiable from the constant in the polynomial function.

period *t-1* and $\xi_{it}$ is an innovation term that by definition is uncorrelated with $k_{it}$. Yet, this supposition does not allow that previous experience in exporting and/or R&D might have an effect on future productivity. Therefore, in our approach we use a broader (endogenous Markov) process where prior firms' exporting and R&D experience might influence the dynamic process of productivity:

$$\begin{aligned}\omega_{it} &= E\left[\omega_{it} \mid \omega_{it-1}, EX_{it-1}, R\&D_{it-1}, Both_{it-1}\right] + \xi_{it} \\ &= f\left(\omega_{it-1}, EX_{it-1}, R\&D_{it-1}, Both_{it-1}\right) + \xi_{it}\end{aligned} \tag{13}$$

In the above expression, $EX_{it-1}$, $R\&D_{it-1}$ and $Both_{it-1}$ are indicator variables capturing whether a firm, was only exporting, only undertaking R&D, or performing both activities in period *t*-1, respectively. The omitted category is not undertaking any activity.

Consequently, now we rewrite the production equation in (7) substituting expression (13) as follows,

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_t + f\left(\omega_{it-1}, EX_{it-1}, R\&D_{it-1}, Both_{it-1}\right) + u_{it} \tag{14}$$

where the error term, $u_{it} = \xi_{it} + \eta_{it}$, comprises two terms. Additionally, as $\omega_{it} = h_J\left(k_{it}, m_{it}\right)$ we might write $f\left(\omega_{it-1}, EX_{it-1}, R\&D_{it-1}, Both_{it-1}\right)$ as,

$$\begin{aligned}&f\left(\omega_{it-1}, EX_{it-1}, R\&D_{it-1}, Both_{it-1}\right) = \\ &f\left[h_J\left(k_{it-1}, m_{it-1}\right), EX_{it-1}, R\&D_{it-1}, Both_{it-1}\right] = \\ &F_J\left(k_{it-1}, m_{it-1}\right) = \sum_{j=Nothing,EX,R\&D,Both} a_j F_j\left(k_{it-1}, m_{it-1}\right)\end{aligned} \tag{15}$$

where $F_J$ are functions not known that would be proxied by polynomials of degree 3 in their arguments. As before, see equation (11), we incorporate the dummies capturing the firms' strategies to define the polynomials as well as in the polynomials themselves.

Finally, we plug (15) into (14), to obtain the second equation for the estimation of the production function,

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_t + \sum_{j=Nothing,EX,R\&D,Both} a_j F_j\left(k_{it-1}, m_{it-1}\right) + u_{it} \tag{16}$$

Wooldridge (2009) suggests estimating the system of equations (11) and (16) jointly by GMM, utilising the suitable instruments and moment conditions in each corresponding equation. Ackerberg *et al.* (2015) indicated that there might exist an identification issue in the first step estimation of the coefficients for the variable factors (that would affect the labour variable) in those methods that rely on a two-stage procedure (such as OP and LP). To solve this problem they proposed an approach mixing OP and LP methodologies, which still consists on a two-step procedure. In this discussion, Wooldridge (2009) claimed that both OP and LP methodologies might be reassessed as containing two equations, which can be estimated together by GMM within a one-step method. Estimating equations (11) and (16) jointly has some benefits: i) efficiency is higher as compared to two-step procedures; ii) there is not need to perform bootstrapping to calculate the standard errors; and, iii) it resolves the identification problem raised above.

We use Wooldridge (2009) method to get industry estimates for the output elasticity of labour that will be used to calculate the markups as defined in equation (6). We also obtain estimates of firms' TFP using the following formula:

$$\hat{\omega}_{it}^{s} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_m m_{it} - \hat{\beta}_t \tag{17}$$

where $\hat{\omega}_{it}^{s}$ is the estimated log TFP for company *i* operating in industry *s* in period *t*.

## 4. Do firms with different export and R&D statuses differ in markups?

### 4.1. All manufacturing firms.

The aforementioned methodology of markups estimation allows the calculous of specific firm-year markups. Then we use these markups as a dependent variable in an equation where the explanatory variables are firms' exports and R&D strategies and some controls.

The aim is to study whether exporters and/or R&D performers enjoy higher margins. In particular, the equation that we estimate is the following:

$$\ln \mu_{it} = \alpha + \beta_1 EX_{it} + \beta_2 R\&D_{it} + \beta_3 Both + X_{it}'\gamma + \beta_i + v_{it} \quad (18)$$

where *EX*, *R&D* and *Both* are a set of dummies that would take on value 1 when a firm *i* only exports, only performs R&D, or performs both exporting and R&D activities, respectively. Thus, $\beta_1$, $\beta_2$ and $\beta_3$ measure the percentage difference in markups (markup premium) between companies not performing any of these activities and firms only exporting, only undertaking R&D and companies combining exports and R&D activities, respectively.

In equation (18), $X_{it}$ is a set of control variables that incorporates the log number of workers and the log of capital to account for firms' size and capital intensity differences. If exporters/innovators are larger or systematically more capital intensive and we do not control for it, we could estimate the relationship between exporting and/or undertaking innovation activities and markups with a bias. $X_{it}$ also includes a vector of year-industry interaction terms with the purpose of capturing industry-specific time trends or business cycle effects on markups. Furthermore, we consider firm-specific unobserved fixed effects ($\beta_i$) that would control for companies specific issues (and to the sector which the firm belongs to) that are constant over time and that could affect markups. In all our estimations, we reject the null of non-existence of individual effects and the absence of correlation between them and the explanatory variables.

In Table 3 we present the estimates corresponding to equation (18), see Column 1. The positive and significant estimates for $\beta_1$ and $\beta_3$ suggest that both only exporters and firms performing both activities enjoy positive markup premia with respect to firms that do not export and do not undertake R&D activities. These markup premia are 3.1%

and 7.5% for only exporters and firms performing both activities, respectively. Nevertheless, firms undertaking only R&D do not enjoy any significant market premium ($\beta_2$ is not statistically significant using conventional levels). These results are consistent with previous empirical evidence reported in De Loecker and Warzynski (2012) for Slovenian exporters *versus* non-exporters (7.8% difference in markups)[9] and Cassiman and Vanormelingen (2013) for Spanish innovators *versus* non-innovators (2.8% difference in markups for process innovators and 3.9% for product innovators).

[Table 3 about here]

Since markups are jointly determined by marginal costs and prices, at least part of the estimated markup premia for firms only exporting and firms performing both activities might result from higher productivity (and so lower marginal costs). More productive companies (with higher technical efficiency) enjoy minor marginal costs, and if there is not a full transmission to lower prices, these groups of firms could set higher markups without losing competitiveness. With the goal of providing evidence about this question, in column 2 of Table 3 we widen specification (18) to include as an additional control variable firms productivity ($\omega_{it}$, variable in logs):

$$\ln \mu_{it} = \alpha + \beta_1 EX_{it} + \beta_2 R\&D_{it} + \beta_3 Both + \beta_3 \omega_{it} + X'_{it}\gamma + \beta_i + v_{it} \quad (19)$$

Including total factor productivity as an additional regressor results in a reduction of the markup premia associated to only exporting (from 3.1% to 2.6%), and to both exporting and undertaking R&D (from 7.5% to 6.5%). Note that $\ln\mu_{it} = \ln P_{it} - \ln\lambda_{it}$ and, therefore, if $\omega_{it}$ controls for the differences in marginal costs ($\ln\lambda_{it}$), the estimated

[9] Moreno Martín and Rodríguez Rodríguez (2010), using data from the ESEE for the period 1990-1999, also find that exporters enjoy higher markups.

coefficients for the strategies of exporting and undertaking R&D in specification (19) would capture the ability of only exporters or companies that both export and perform R&D to establish higher prices than firms pursuing other strategies. That is, they might be capturing aspects related to their market power, the demand characteristics they face or the differential quality of the products they sell.

Higher prices for only exporters and for companies that are jointly exporting and performing R&D may have their origin in differences in the quality or superiority of the products and/or in the elasticity of demand. As for product quality, Hallak and Sivadasan (2009) and Kugler and Verhoogen (2012) report evidence for the existence of higher quality of the products sold by exporting firms. Further, R&D investments addressed to obtain product innovations, if successful, could result both in product quality upgrading or new higher quality products. Further, it should be considered that quite often a successful strategy to survive in international markets is related to product differentiation, which contributes to reduce the price elasticity of demand. In the same line, those product innovations that contribute to differentiate the company's product should result in a less price elastic demand.

In column 3 of Table 3 we repeat specification (19) but widening the vector of control variables, $X_{it,}$ with a set of dummy variables indicating firms' failure, firms absorbing or merging another, firms created after an excision, or firms that are merged or absorbed by another one. Potentially, these events could be simultaneously correlated both with firms' markups and their R&D and exporting statuses. The omitted category is the group of firms without changes in their status. We would like to note that our previous estimation results are robust to the inclusion of these variables. As regards the results of the new variables, only firm failure seems to have a negative and significant impact on markups.

In Table 3 (see column 4), with the aim of controlling for persistence in exporting and R&D strategies, we further widen our specification including three additional variables controlling for firm R&D and export status in *t*-1 and *t*-2. We get that these variables are not statistically significant. Further, after including them in estimation our main results (in column 3) remain unaltered.

Finally, in column 5 we wide our specification in column 3 by adding interactions of the export and R&D status variables and a dummy variable that identifies years 2008 and 2009, i.e. the initial years of the Great Recession. We aim at analysing if the association between markups and the strategies of export and undertaking R&D, suffered a change with the onset of the crisis. Our estimates suggest the following (always using as reference category the group of firms not performing any strategy): first, the markup premium of only exporters is not affected by the crisis; second, while in the period before the starting of the Great Recession, firms performing only R&D did not enjoy any markup advantage, with the start of the crisis they enjoy a 15.7% markup premium; and, third, the onset of the crisis enlarges the markup premium of firms performing both activities (from 5.7% to 13%).[10]

[10] In column 5, that incorporates the cross products with the dummy variable for the onset of the crisis, we tested the difference between the coefficients for the dummy variables of the years 2007 and 2008, and for the years 2008 and 2009, respectively. The results from the testing procedure indicate, on the one hand, that the coefficient for 2008 is smaller than the one for 2007 (the difference between them is -0.079, with a *p-value* = 0.074) and, on the other hand, that the coefficient for 2009 is also smaller than the one for 2008 (-0.173, with a *p-value* = 0.000). Additionally, these decreases in coefficients of year dummies are the largest ones during our period of analysis. Even the coefficient changes from positive to negative from 2008 to 2009.

### 4.2. SMEs versus large manufacturing firms.

In Table 4 we repeat estimations in Table 3 (excluding column 4 of Table 3) but allowing coefficients $\beta_1$, $\beta_2$, $\beta_3$ and $\beta_4$ to differ between large companies and SMEs (those with more than 200 workers and with less than 200 workers, respectively). Our estimates without controlling for productivity (column 1), uncover interesting differences between large companies and SMEs. Large firms' markup premia are higher than SMEs premia in all strategies (firms only exporting, firms undertaking only R&D and companies undertaking both strategies). Thus, for only exporters the markup premium is 5.0% for large companies and 3.2% for SMEs. Among firms undertaking only R&D, whereas the markup premia for large firms is 8.1%, SMEs do not enjoy a significant markup premium (over companies neither exporting nor performing R&D activities). For firms performing both strategies, markup premia for large firms and SMEs are 9.9% and 7.4%, respectively. Finally, it is worth to mention that both for SMEs and larger firms, the strategy that pays higher markups is combining exporting and R&D.

[Table 4 about here]

In column 2, we control for the possible role of productivity on markups. As before, including productivity in estimation (to control for marginal costs heterogeneity) has a relevant impact in the estimated coefficients of the variables of interest. The main changes are as follows: i) for large firms, only those combining R&D and exporting activities enjoy a positive and significant markup premium (the estimates corresponding to the markup premia of firms only exporting and firms undertaking only R&D are not longer significant); and, ii) for SMEs, there is a reduction in the markups premia both for only exporters and for companies that combine exporting and R&D activities.

These results indicate that whilst the higher markups for large firms only exporting or only performing R&D are very probable related to lower marginal costs but not to

higher prices, the higher markups for large firms than combine exporting and performing R&D are at least partially related to higher prices (the corresponding estimate is positive and statistically significant even with the inclusion of productivity). For SMEs, the fact that the estimates of the markups premia for only exporters and firms that combine both activities are positive and significant, provides evidence of the ability of these firms to set higher prices. Mayer and Ottaviano (2007) and Máñez *et al.* (2010) provide evidence that large firms serve more 'difficult' markets (higher competition markets), whereas SMEs export to 'easier' markets. Thus, we can conclude that more competition in exporting markets for large firms can be simultaneously disciplining their prices and eliminating the most inefficient firms in the market (selection mechanism). Therefore, the increase in their markups comes from companies with inferior marginal costs not fully transferred onto their prices.

In Table 4, see column 3, we present the results for an estimation where we augment the set of control variables to include variables catching changes in firms' status, such as failure, mergers and takeovers. The estimates on our main variables are robust to including these variables (compare results in columns 2 and 3). Among the new variables, the only relevant result is, as before, that firms' failure is associated to a drop in markups.

Next, column 4 incorporates interactions between our main variables (distinguishing between SMEs and large firms) and a dummy variable that takes on value 1 for those years capturing the onset of the Great Recession (years 2008 and 2009). Our estimates suggest that: i) independently of firm's size, the onset of the crisis does not affect the markup premium of only exporters; ii) the advent of the crisis grants higher markup premium to firms only performing R&D (9.7% and 31.3% for SMEs and large

firms, respectively)[11], whilst in the pre-crisis period these firms did not enjoy a significant markup premium; and, iii) whereas previously to the start of the crisis large firms combining exporting and R&D did not enjoy a significant markup premium, during the crisis years large firms pursuing this strategy enjoy a sizeable markup premium (15.7%, with a *p-value* equal to 0.000).

Finally, in Table 5 we show an extension for the estimates presented in the last column in Table 4. This extension consists on crossing the strategies undertaken by companies during the onset of the crisis with a variable, *Recessive market*, that identifies if the firm faces a recessive market. This variable is calculated as a weighted index of the market dynamism faced by the company in the markets it operates, and ranges from value 0 to 100.[12] This variable takes on value 1 whenever the company has a weighted index below 35. The company's market recessiveness on the onset of the crisis may either be the result of macroeconomic changes affecting all companies equally, or, otherwise, from changes that have a different effect on markets for specific industries or firms. The advantage of using this variable is that firms declare the information and, thus, it is a measure related directly to the evolution of the market attended by the company.

[Table 5 about here]

The objective of reporting this extension is to uncover whether the reinforcing role of the R&D strategies on markups during the onset of the crisis, benefited all firms, or more to those that declared facing a non-recessive market. In this respect, Table 5 results

[11] Both are significant at the 5% level.

[12] Doraszelski and Jaumandreu (2013) also used the same information in the ESEE to build a market dynamism variable. They reported that in Spain during the 1990s, that was a period with an important output growth, companies in the survey reported massively that the markets they were serving were in expansion. Similarly, Beneito *et al.* (2015) use this information to capture firms' market size evolution.

indicate, on the one hand, that both SMEs and large firms suffered in general from a decrease in markups when they faced a recessive demand in the marked they served (9.4% decrease for SMEs and 5.4% decrease for large companies, respectively). On the other hand, and remarkably, SMEs performing R&D or both R&D and exports enjoyed higher markups during the onset of the crisis only if they served a stable or expansive market but not if they faced a recessive market. However, for large companies we do not find different results in terms of markups rewards by considering the evolution of the market served.

It is worth pointing that in Table 4, column 4, we did not discover any extra-reward, in terms of markups, for SMEs performing both activities during the onset of the crisis (only for those who only perform R&D). However, in the second column of Table 5 we uncover an extra-reward for SMEs performing both activities during the onset of the crisis for those not facing a recessive market.

## 5. Concluding remarks.

This paper investigates the association between exporting and performing R&D activities and firms' markups (expressed as the ratio of prices over marginal costs). Although our interest is on SMEs, we do compare results for SMEs with those obtained for large firms. With this aim, we use De Loecker and Warzynski (2012) methodology to estimate firms' markups. This methodology has as advantages a minimal requirement of assumptions and the flexibility about demand systems or about the mode of market competition. Furthermore, requires data from the firms' production side, usually available in firm datasets. This methodology implies to estimate production functions and, in this respect, in this work we have followed the procedure in, based on an endogenous Markov process characterising the progression of firms' productivity across time. Although there are

several papers that study the relationship between the export and R&D decisions by companies and their productivity, the study of the relationship with their markups is scarcer, and even more when considering the joint study of the two firm choices. This is precisely one of the goals in the paper. In addition, another objective is checking whether the performance of these activities during the onset of the recent Great Recession has contributed to reinforce the role of them in explaining SMEs higher markups. The dataset used in this work comes from the ESEE for 1993-2009. This survey is a panel data on business strategies, that is representative manufacturing firms in Spain.

The results we obtain in this research are multiple. First, we obtain that for SMEs the strategy of only exporting implies enjoying a 3.2% and the strategy of jointly exporting and performing R&D implies a 7,4% higher markups. However, the strategy of only investing in R&D has no effect on markups for SMEs. Differently, for large firms the strategy of only investing in R&D justifies an increase in markups. In any case, conditioning to a given strategy, large firms always obtain higher rewards in terms of markups than SMEs.

Second, once conditioning to productivity (that is, heterogeneity in marginal costs) in the markups regression, there is only a small reduction in the previous percentages for SMEs. This indicates that most of the effect of the strategy of only exporting and the joint decision (investing also in R&D) strategy on markups works through the higher capacity of this type of SMEs to charge higher prices, and not only because of higher efficiency derived from the performance of these activities. Differently, for large firms, the two only strategies do not affect any longer markups when controlling for productivity in estimation for the markups equations. Hence, for large firms the effect of only exporting or only undertaking R&D activities on markups is due to their impact on higher productivity/efficiency (that is, lower marginal costs), but not due to a higher

capacity to set prices above marginal costs. This capacity for large firms only occurs for firms performing jointly both activities.

Finally, with respect to the role of these strategies at the beginning of the Great Recession, we obtain extra rewards, in terms of markups, for SMEs that only undertake R&D activities, and for those performing both exports and R&D activities should they do not face a recessive market. For large firms the extra rewards at the onset of the crisis emerge for firms performing only R&D and firms performing the joint strategy (exporting and R&D), regardless if they are facing or not a recessive market. These extra effects suggest an increasing role for R&D activities (for SMEs and also for large companies) during a crisis period, as performing R&D might let companies to increase prices and, hence, to set higher markups.

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**Table 1. Export and R&D strategies.**

| | All firms | SMEs | Large |
|---|---|---|---|
| Not Export/ Not R&D | 43.99 | 45.19 | 3.47 |
| Only Export | 31.88 | 32.16 | 22.61 |
| Only R&D | 4.85 | 4.89 | 3.63 |
| Both | 19.28 | 17.76 | 70.29 |

**Table 2. Average *markups*.**

| | All firms | SMEs | Large |
|---|---|---|---|
| Not Export, Not R&D | 0.96 | 0.96 | 1.05 |
| Only Export | 1.39 | 1.39 | 1.33 |
| Only R&D | 1.07 | 1.06 | 1.35 |
| Both | 1.46 | 1.47 | 1.37 |
| *Total* | 1.20 | 1.19 | 1.35 |

**Table 3. The relationship between firms' markups and the export and R&D decisions.**

| $\ln\mu_{it}$ | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $Only\_E_{it}$ | 0.031** | 0.026* | 0.026* | 0.026** | 0.026* |
| | (0.050) | (0.100) | (0.100) | (0.046) | (0.100) |
| $Only\_RD_{it}$ | -0.001 | 0.002 | 0.002 | 0.011 | -0.012 |
| | (0.973) | (0.896) | (0.891) | (0.507) | (0.527) |
| $Both_{it}$ | 0.075*** | 0.065*** | 0.065*** | 0.060*** | 0.057*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.002) |
| $Only\_E_{it-1}+Only\_E_{it-2}$ | | | | -0.004 | |
| | | | | (0.605) | |
| $Only\_RD_{it-1}+Only\_RD_{it-2}$ | | | | -0.015 | |
| | | | | (0.182) | |
| $Both_{it-1}+Both_{it-2}$ | | | | 0.009 | |
| | | | | (0.372) | |
| $Crisis\_Only\_E_{it}$ | | | | | 0.007 |
| | | | | | (0.778) |
| $Crisis\_Only\_RD_{it}$ | | | | | 0.169*** |
| | | | | | (0.006) |
| $Crisis\_Both_{it}$ | | | | | 0.073*** |
| | | | | | (0.002) |
| $\omega_{it}$ | | 0.486*** | 0.485*** | 0.486*** | 0.488*** |
| | | (0.000) | (0.000) | (0.000) | (0.000) |
| $Failure_{it}$ | | | -0.030** | -0.031** | -0.029** |
| | | | (0.011) | (0.010) | (0.014) |
| $Absorbing_{it}$ | | | 0.006 | 0.007 | 0.006 |
| | | | (0.727) | (0.692) | (0.714) |
| $Excision_{it}$ | | | 0.004 | 0.002 | 0.005 |
| | | | (0.861) | (0.931) | (0.836) |
| $Absorbed_{it}$ | | | -0.015 | -0.015 | -0.014 |
| | | | (0.779) | (0.771) | (0.780) |
| Observations | 16.777 | 16.777 | 16.777 | 16.517 | 16.777 |
| *R*-squared within | 0.156 | 0.249 | 0.250 | 0.252 | 0.251 |
| Number of firms | 2.165 | 2.165 | 2.165 | 2.106 | 2.165 |

Notes:
1. All regressions include log of labour and log of capital, the full interaction of industry and year dummies, plus firm fixed effects.
2. The null $H_0$ of non-existence of individual effects is always rejected (*p-values* = 0.000).
3. The null $H_0$ of non-existence of correlation between individual effects and explanatory variables is always rejected (Hausman tests with *p-values* = 0.000).
4. Robust *p-values* in parenthesis.
5. ***, ** and * mean statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 4. The relationship between firms' markups and the export and R&D decisions: SMEs *versus* large firms.**

| $\ln\mu_{it}$ | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $Only\_E_{it}$ (SMEs) | 0.032** | 0.028* | 0.028* | 0.029* |
| | (0.048) | (0.074) | (0.076) | (0.072) |
| $Only\_RD_{it}$ (SMEs) | -0.020 | -0.014 | -0.014 | -0.024 |
| | (0.317) | (0.468) | (0.465) | (0.222) |
| $Both_{it}$ (SMEs) | 0.074*** | 0.067*** | 0.067*** | 0.063*** |
| | (0.001) | (0.001) | (0.001) | (0.003) |
| $Only\_E_{it}$ (large) | 0.050* | 0.017 | 0.017 | 0.010 |
| | (0.094) | (0.676) | (0.668) | (0.799) |
| $Only\_RD_{it}$ (large) | 0.081** | 0.058 | 0.059 | 0.026 |
| | (0.047) | (0.204) | (0.193) | (0.592) |
| $Both_{it}$ (large) | 0.099*** | 0.064* | 0.065* | 0.049 |
| | (0.000) | (0.085) | (0.082) | (0.193) |
| $Crisis\_Only\_E_{it}$ (SMEs) | | | | 0.001 |
| | | | | (0.977) |
| $Crisis\_Only\_RD_{it}$ (SMEs) | | | | 0.121** |
| | | | | (0.016) |
| $Crisis\_Both_{it}$ (SMEs) | | | | 0.032 |
| | | | | (0.279) |
| $Crisis\_Only\_E_{it}$ (large) | | | | 0.022 |
| | | | | (0.664) |
| $Crisis\_Only\_RD_{it}$ (large) | | | | 0.287* |
| | | | | (0.077) |
| $Crisis\_Both_{it}$ (large) | | | | 0.108*** |
| | | | | (0.000) |
| $\omega_{it}$ (SMEs) | | 0.484*** | 0.483*** | 0.486*** |
| | | (0.000) | (0.000) | (0.000) |
| $\omega_{it}$ (large) | | 0.489*** | 0.488*** | 0.492*** |
| | | (0.000) | (0.000) | (0.000) |
| $Failure_{it}$ | | | -0.031*** | -0.030** |
| | | | (0.010) | (0.011) |
| $Absorbing_{it}$ | | | 0.006 | 0.006 |
| | | | (0.716) | (0.705) |
| $Excision_{it}$ | | | 0.005 | 0.005 |
| | | | (0.832) | (0.847) |
| $Absorbed_{it}$ | | | -0.014 | -0.017 |
| | | | (0.789) | (0.743) |
| Observations | 16.777 | 16.777 | 16.777 | 16.777 |
| *R*-squared within | 0.156 | 0.250 | 0.251 | 0.254 |
| Number of firms | 2.165 | 2.165 | 2.165 | 2.165 |

Notes:
1. All regressions include log of labour and log of capital, the full interaction of industry and year dummies, plus firm fixed effects.
2. The null $H_0$ of non-existence of individual effects is always rejected (*p-values* = 0.000).
3. The null $H_0$ of non-existence of correlation between individual effects and explanatory variables is always rejected (Hausman tests with *p-values* = 0.000).
4. Robust *p-values* in parenthesis.
5. ***, ** and * mean statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 5. The relationship between firms' markups and the export and R&D decisions, distinguishing whether firms face a recessive market. SMEs *versus* large firms.**

| $\ln\mu_{it}$ | (1) | $\ln\mu_{it}$ | (2) |
|---|---|---|---|
| $Only\_E_{it}$ | 0.027* | $Only\_E_{it}$ (SMEs) | 0.030* |
| | (0.077) | | (0.059) |
| | | $Only\_E_{it}$ (large) | 0.010 |
| | | | (0.804) |
| $Only\_RD_{it}$ | -0.012 | $Only\_RD_{it}$ (SMEs) | -0.023 |
| | (0.528) | | (0.219) |
| | | $Only\_RD_{it}$ (large) | 0.021 |
| | | | (0.671) |
| $Both_{it}$ | 0.059*** | $Both_{it}$ (SMEs) | 0.065*** |
| | (0.001) | | (0.002) |
| | | $Both_{it}$ (large) | 0.045 |
| | | | (0.236) |
| $Crisis\_Only\_E_{it}$ | 0.028 | $Crisis\_Only\_E_{it}$ (SMEs) | 0.030 |
| | (0.293) | | (0.254) |
| | | $Crisis\_Only\_E_{it}$ (large) | 0.025 |
| | | | (0.672) |
| $Crisis\_Only\_RD_{it}$ | 0.196*** | $Crisis\_Only\_RD_{it}$ (SMEs) | 0.202*** |
| | (0.000) | | (0.001) |
| | | $Crisis\_Only\_RD_{it}$ (large) | 0.178*** |
| | | | (0.000) |
| $Crisis\_Both_{it}$ | 0.093*** | $Crisis\_Both_{it}$ (SMEs) | 0.079** |
| | (0.001) | | (0.028) |
| | | $Crisis\_Both_{it}$ (large) | 0.103*** |
| | | | (0.000) |
| $Crisis\_Only\_E_{it}\_Recessive\ market_{it}$ | -0.044 | $Crisis\_Only\_E_{it}\_Recessive\ market_{it}$ (SMEs) | -0.042 |
| | (0.153) | | (0.169) |
| | | $Crisis\_Only\_E_{it}\_Recessive\ market_{it}$ (large) | -0.016 |
| | | | (0.841) |
| $Crisis\_Only\_RD_{it}\_Recessive\ market_{it}$ | -0.061 | $Crisis\_Only\_RD_{it}\_Recessive\ market_{it}$ (SMEs) | -0.178** |
| | (0.610) | | (0.025) |
| | | $Crisis\_Only\_RD_{it}\_Recessive\ market_{it}$ (large) | 0.255 |
| | | | (0.402) |
| $Crisis\_Both_{it}\_Recessive\ market_{it}$ | -0.038 | $Crisis\_Both_{it}\_Recessive\ market_{it}$ (SMEs) | -0.080** |
| | (0.106) | | (0.024) |
| | | $Crisis\_Both_{it}\_Recessive\ market_{it}$ (large) | 0.009 |
| | | | (0.772) |
| $\omega_{it}$ | 0.476*** | $\omega_{it}$ (SMEs) | 0.475*** |
| | (0.000) | | (0.000) |
| | | $\omega_{it}$ (large) | 0.481*** |
| | | | (0.000) |
| $Failure_{it}$ | -0.027** | | -0.027** |
| | (0.023) | | (0.020) |
| $Absorbing_{it}$ | 0.008 | | 0.009 |
| | (0.625) | | (0.585) |
| $Excision_{it}$ | 0.007 | | 0.006 |
| | (0.782) | | (0.813) |
| $Absorbed_{it}$ | -0.014 | | -0.016 |
| | (0.788) | | (0.746) |
| Recessive $market_{it}$ | -0.084*** | Recessive $market_{it}$ (SMEs) | -0.094*** |

| | | | |
|---|---|---|---|
| | (0.000) | | (0.000) |
| | | Recessive market$_{it}$ (large) | -0.054*** |
| | | | (0.000) |
| Observations | 16,767 | | 16,767 |
| R-squared within | 0.267 | | 0.269 |
| Number of firms | 2,165 | | 2,165 |

Notes:
1. All regressions include log of labour and log of capital, the full interaction of industry and year dummies, plus firm fixed effects.
2. The null $H_0$ of non-existence of individual effects is always rejected (*p-values* = 0.000).
3. The null $H_0$ of non-existence of correlation between individual effects and explanatory variables is always rejected (Hausman tests with *p-values* = 0.000).
4. Robust *p-values* in parenthesis.
5. ***, ** and * mean statistical significance at the 1%, 5% and 10% levels, respectively.

**Figure 1. Export and R&D strategies across time.**

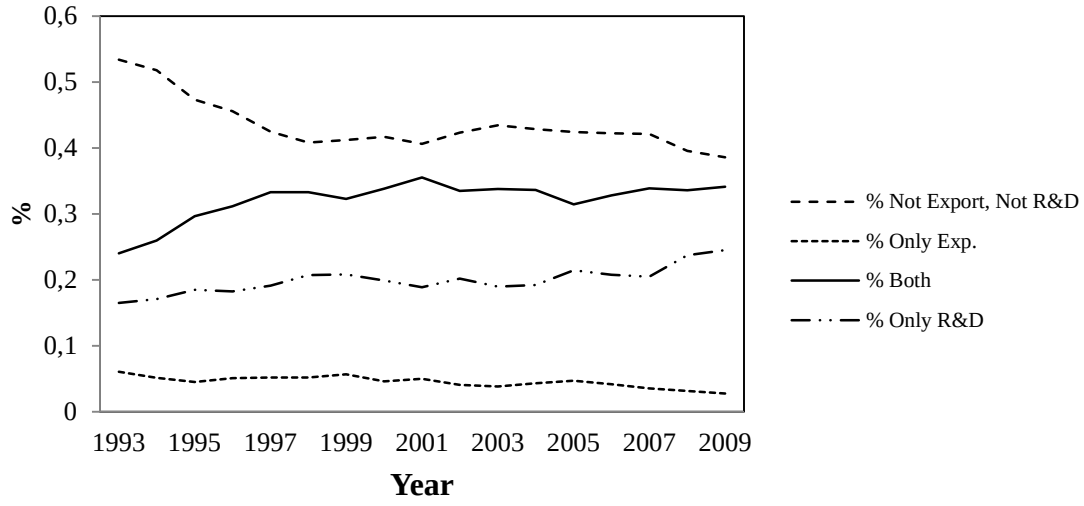


**Figure 2. *Markups* over time.**