

How do Firms *Perceive* their Competitiveness? Measurement and Determinants

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Abstract

In this paper, we propose a novel approach for analysing firm-level competitiveness, namely, that of a firm's subjective perception. By using a large, integrated database and an econometric strategy based on a generalized order logit model, our results indicate the presence of sectoral specificities and group heterogeneity in the way firms perceive their competitiveness. Industrial and services firms perceive differently those factors of competitiveness such as profitability, technological innovation, knowledge capital, complex ownership structure and internationalization patterns. In addition, firms' top performers tend to score more positively a number of competitive factors indicating technological input and output, knowledge capital and managerial abilities. We suggest that the use of a perceived competitiveness indicator could provide useful insights for more focused competitiveness policies.

Keywords: Perceived Competitiveness, Industrial Census, European Community Innovation Survey, Generalized Order Logit model

1. Introduction

Although the notion of competitiveness is widely used in the economic debate, there is little agreement among managers, policy makers and academics about how to define and measure it. Nevertheless, the competitiveness issue is increasingly recognized at the centre of the political debate, particularly within the European Union².

The European Commission has recently adopted a recommendation on the establishment of national competitiveness boards within the Euro Area. These boards should monitor performance and policies in the field of competitiveness to improve the knowledge basis for European Union economic policy coordination. An important aspect characterizing the role of the national competitiveness boards is that they should consider competitiveness in a broad sense. The traditional analysis of competitiveness focused mainly on price-cost factors, although they reflect only one part of the story. It has been argued that to capture the multi-faceted nature of competitiveness and its long-run effects, it is important to enlarge the list of indicators used *"taking into account factors that can affect prices and quality content of goods and services relative to global competitors in the short term (including labour costs) as well as longer-term drivers such as productivity and innovation capacity, which are relevant not only for the relative performance of the economy but also for its growth potential and the capacity to attract investment, businesses and human capital"* (European Commission, 2015).

As a complement to this macroeconomic view, competitiveness may be analysed from the perspective of individual *success*, which, in turn, implies a firm's subjective perception of its business performance in relation to the achievement of its strategic objectives. This should

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² The views and opinions expressed in this article are those of the author and do not necessarily reflect the official position of the National Institute of Statistics.

be considered a relevant aspect in the competitiveness analysis, as when firms make plans in terms of production, employment, and investments in physical and financial assets, it is crucial for them to understand their correct position with respect to their competitors.

In the short run, the use of measures based on individual perception to gauge the future performance of selected economic variables is not new. The ZEW economic sentiment index for the Euro area, the IFO Business Climate Index for the Germany economy and the Economic Sentiment Indicator (ESI) developed by the European Commission are some of the most followed leading indicators. Nevertheless, it has been shown that the use of data based on perceived competitiveness may provide a more comprehensive picture because they may consider other non-cost factors affecting firms' positioning and, ultimately, because the perception of competitiveness may differ among firms, even among firms engaged in the same field of business (European Commission, 2013).

In this study, we adopt a micro-founded approach to the analysis of firm's perceived competitiveness, which allows us to enlarge the set of potential drivers and to include factors that are not restricted to price/cost considerations.

To operationalize this approach, we first build a conceptual framework that, according to the relevant empirical debate, identifies the main dimensions of a firm's competitiveness and then assesses their relevance for a firm's self-perception.

To our knowledge, this approach represents a novelty within empirical investigations at the firm level and may offer a new perspective for both academic research and policy analysis on the competitiveness issue. It may stimulate a reconsideration of the results derived from empirical research to consider individual perception, which may provide useful insights for more focused competitiveness policies.

The main dataset used in this study comes from the multipurpose module of the 2011 Italian Census for Industry and Services, which has been linked to the Community Innovation Survey (CIS) for the period 2010-2012. The final sample consists of more than 10,000 firms in both industry and services for which accounting financial and economic information is available from balance sheets.

Our investigation also aims to capture possible differences in firms' self-perceived competitiveness between the industrial and services sectors. This approach may offer a different perspective to analyse sectoral differences in the light of the fact that during the most recent decades, the industrial structure of the most advanced economies has changed, with the shift from industrial to services activities.

According to recent estimates (Foster-McGregor et al., 2015)³, the share of EU manufacturing value added in overall GDP declined from 20% to 16% in the period 1995-2011, whereas the share of services increased over the same time span. It is interesting to note that the same trend is still observed when a value chain perspective is adopted, i.e., by including in the productive process the upstream and downstream services, which might be conducted externally by services firms along the manufacturing value chain⁴. Following this approach, the EU contribution to world final demand of manufacturing products due to manufacturing activities declined from 25% in 1995 to 22% in 2011 (In Italy, the decline is even more pronounced, from 29% to 23%). Conversely, the share of services increased from 33% to 39% (from 34% to 40% in Italy).

This evidence indicates, on the one hand, the strong linkage between industry and services activity, and, on the other hand, the growing importance of services as inputs in the industrial production across European countries. Thus, it is reasonable to expect that industry and ser-

³ This study has been conducted for the European Commission, DG Enterprise and Industry within the framework programme "Industrial Competitiveness and Market Performance".

⁴ This exercise allows one to control for outsourced services activities, which may amplify the drop in the manufacturing share.

vices firms do not show significant differences in the way the determinants of competitiveness affect their subjective perception. Conversely, the presence of sectoral differences in firms' self-perception may indicate that the two sectors still differ because competitive advantages are perceived differently.

This paper is structured as follows. The next section presents an appraisal of the relevant empirical literature emphasizing the most important elements affecting a firm's ability to compete. Section 3 outlines the research focus by pinpointing the originality of the approach we intend to follow. The rich set of information coming from the integration of statistical and administrative data sources is also described. In Section 4, the econometric model is presented, while the regression results are discussed in Section 5. Section 6 provides a general discussion and concludes the paper.

2. The determinants of firm level competitiveness in the empirical debate

Competitiveness is a relatively new concept in economics, which reminds us of Porter's analysis of competitive advantages (Porter, 1985). It has been argued that the lack of solid theoretical foundations has generated scepticism among economists about the real possibility to measure it (Lall, 2001). However, the large body of empirical literature available so far have demonstrated the existence of a variety of driving forces of a firm's success and, through this route, the need for developing a comprehensive analytical framework that can consider the multidimensional nature of a firm's competitiveness. Indeed, in Porter's view of competitive advantages, firms combine favourable conditions (factor conditions, demand conditions, related and supporting industries and the context for firm strategy and rivalry) with internal capabilities to reach higher economic performance (Porter, 1990). Accordingly, in the empirical literature, there is a long history of efforts to test the validity of a variety of elements that may affect the ability of a firm to compete.

Among these, the debate on the robustness of the so-called SCP paradigm (Bain, 1956), which has dominated the industrial organization debate even during more recent years, has demonstrated that both firm-specific characteristics - i.e., size, efficiency measures or market share - and market structure - i.e., concentration - are both relevant in determining a firm's comparative advantages. The seminal studies by Demsetz (1973), Peltzman (1977) and, more controversially, Clarke et al. (1984) show that efficient firms grow and capture large shares of the market, thus claiming for the validity of the so-called firm efficiency view. However, the debate has continued even during more recent years, and the studies by Allen (1983), Delorme Jr et al. (2002), and Slade (2004), although using different methodological approaches, do find support for the SCP paradigm, thus claiming for the role of market structure in determining a firm's competitiveness.

Among the firm-efficiency conditions, innovation plays a crucial role. In the Schumpeterian view of competition (Schumpeter, 1934), firms engage in risky innovative efforts when they see prospects for gaining competitive advantages by creating products or services that are preferred by the market or by introducing new processes that increase production efficiency. From a strategic management perspective, the studies by Roberts (1999, 2001) and Hawawini et al. (2003) specifically recognize the role of managerial abilities - e.g., product innovation - in determining profitability and possibly its persistence. The view of permanent differences between innovative and non-innovative firms due to specific skills accumulated by the former may be found in the works by Geroski et al. (1993) and by Cefis and Ciccarelli (2005), which support the hypothesis of a positive relationship running from innovation to profitability. Their approach may be defined as the "process" view to innovation because it emphasizes the fact that persistent differences between innovative and non-innovative firms

do exist because of the bulk of superior competencies acquired over the years by innovative firms.

In addition, a firm may achieve competitive advantages on the basis of organizational improvements and learning processes that are developed over time. The accumulation of these strategic assets allows the firm to enhance its productivity by reducing unit cost over time (Arrow, 1962). Following this line of reasoning, the dynamic capabilities approach (Teece, 2010; Pisano et al., 1997) underlines the role played by knowledge assets such as human skills, marketing and organizational activities, external collaboration and intellectual properties.

Among firm internal conditions, financial leverage and the presence of possible financial constraints may crucially affect the cost of capital and, through this route, a firm's performance. However, the final impact on a firm's competitiveness remains not well-defined as, on the one hand, it is possible that more highly leveraged firms incur increasing debt costs, as suggested by the agency costs literature, implying a negative impact; on the other hand, one may underline the role of debt in reducing the free cash flow under managers' control (Jensen, 1986). Because seeking external financial resources exposes managers to increased monitoring, they are motivated to perform well. As a consequence, highly leveraged firms are expected to perform better.

Another important argument in understanding the determinants of firm competitiveness is the role of technological spillover. A number of different studies (Griliches, 1984, 1992; Mairesse and Sassenou, 1995; Los and Verspagen, 2000) has underlined the importance of R&D externalities in affecting firm economic performance in terms of productivity, but only a few have examined the impact on firm profitability. Previous studies suggest the presence of a clear negative effect of technological spillovers as measured by research inputs (Jaffe, 1986; Hanel and St-Pierre, 2002) and more controversial results when measured by research output (Geroski et al., 1993). In a different perspective, i.e., diffusion theory, Stoneman and Kwon (1996) found that a firm's profitability is negatively related to the number of adopters of new technologies. These results indicate that potential positive effect of knowledge dissemination may be contrasted by the negative effect of competition, which encourages other firms to imitate and then to erode their rivals' profitability.

Internationalization is another factor affecting competitiveness at the firm level. The importance of considering the behaviour of the firm in the international context was underlined by Porter (1990) among the first scholars. Within the stream of empirical literature that has tested the validity of international trade theories, extensive empirical evidence has been provided that firms engaging in international trade perform better than firms operating mainly in local markets. This holds for different dimensions typically affecting a firm economic performance: size, productivity, R&D intensity and capital intensity Wagner (2012). Nonetheless, evidence that international competition may have a significant impact on a firm's profitability is not conclusive (Girma et al., 2004; Temouri et al., 2013; Grazzi, 2012). It has been argued that operating in international markets brings about additional costs due to difficulties in complying with, e.g., new customer requirements or local regulations (Baussola and Bartoloni, 2015).

Most often, internationalization is associated with trade performance, which, however, cannot fully describe a firm's internationalization choices. In recent decades, an increasing number of firms have started to operate in foreign markets by using foreign direct investments (FDIs), e.g., by establishing a subsidiary in the foreign country or by acquiring shares of an overseas company or by a merger or a joint venture. It has been argued that because of the uncertainty that characterizes a firm's investment decisions, the process of internationalization follows a stepwise approach (Johanson and Vahlne, 1977): starting from an occasional export, firms gradually intensify their activities in foreign markets.

Indeed, more recent literature has emphasized the role of dynamics in a firm's internationalization choices (Eaton et al., 2008; Aeberhardt et al., 2014; Alborno et al., 2012). These studies have shown that new exporters begin by exporting small amounts. Conditional on surviving, their exports grow and, for appropriate levels of profitability, they can start to invest abroad.

3. The research focus

3.1 General

Conventional wisdom in the economic literature has tried to link firms' competitiveness - variously measured - to factors affecting it. The review of the empirical literature has made it clear that there are not individual dimensions of competitiveness at the firm level but a variety of indicators, which should be analysed to fully describe the complex mechanisms at work.

In this contribution, we take a different approach, namely, we attempt to link a firm's perception of its competitiveness to a set of characteristics - both survey-based and from public registers - which may be considered proxies of the forces that are commonly indicated by the literature as mechanisms affecting a firm's competitive performance⁵.

From a sample of more than 10,000 firms, in both the industry and services sectors, we measure the perceived competitiveness through firms' self-assessment of their position with respect to competitors (higher, in line, lower).

The main dataset is derived from the multipurpose module of the 2011 Italian Census for Industry and Services, which has been linked to the Community Innovation Survey (CIS) for the period 2010-2012. The multipurpose module is based on a census sample for firms with 20 employees or more, and a sample survey for firms with less than 20 employees. It provides information at end-2011 on a comprehensive set of factors affecting a firm's competitiveness, including ownership structure, human capital, commercial relationships, reference markets, innovation, finance and internationalization. Additional information on various aspects of the development of an innovation, including objectives and strategies and collaboration for innovation, is drawn from the CIS survey. Originally focused on the industrial sector, as of 1994, it has been extended to private services. The CIS wave for the years 2010-2012 is based on a sample of more than 18,000 firms with more than 9 employees. Firms with less than 250 employees are selected at random, while the survey is a census for firms with 250 employees or more.

For the firms included both in the multipurpose module and in the CIS sample, we have collected economic and financial information from the Bureau van Dijk (AIDA) database⁶. The final linking resulted in a sample of 10,943 firms. The frequency distribution of the sample is reported in Appendix 1, where the samples obtained at intermediate linkages are also provided for comparison. Linking the CIS data with accounting information from administrative sources allows for the use of additional proxies for a firm's economic and financial performance typically not considered in the census and in the innovation survey micro-data.

⁵ This approach may be justified on the ground that, following the evidences within the European Union, "In general, there appears to be a relatively strong link between perceived competitiveness and price/cost competitiveness" (European Commission, 2013).

⁶ The AIDA (Analisi Informatizzata delle Aziende) database is the Italian component of the European Amadeus database, distributed by Bureau van Dijk, and contains balance sheet information on approximately one million companies in Italy.

3.2 Self-reported competitiveness and determinants: data description

Approximately 76% of firms in the final sample reported a level of competitiveness in line with competitors, while percentages equal to 10.8% and 12.8% respectively reported levels that are lower and higher than competitors.⁷ The average score is only slightly higher for services compared to industrial firms (Table 1), although these differences are statistically significant.

To capture the impact of different forces on a firm's competitiveness perception, we develop, in accordance with the reviewed literature, a comprehensive conceptual framework, which classifies individual indicators in groups of dimensions as follows:

Economic and technical efficiency This group includes a set of dimensions indicating a firm's performance in terms of economic and technical efficiency. According to previous empirical studies, a firm's economic performance may be measured both in terms of operating profitability as proxied by the return on sales ratio (*ros*) and in terms of productivity, given by the value added to employees ratio (*va*). In addition, market share (*share*), which is given by the ratio of a firm's sales to sectoral sales, is included as a proxy for a firm's market power. A measure of sales trend (*turn_ch*) is also included by computing the percentage change of a firm's turnover during the period 2010-2012.

A qualitative variable, which indicates whether the firm has introduced a technological innovation (a new product/service and-or a new process) during the years 2010-2012 (*inntech*), serves as a proxy for technical efficiency. Approximately 40% of our sample has introduced a technological innovation during the observed time-span, with the prevalence of the industrial sector (45%) compared to services (36%).

Physical and financial input. In this group, we include a set of quantitative variables capturing labour input and its characteristics: the number of employees (*empl*), the employment composition in terms of young workers (*young_w*) and female workers (*fem_w*), and labour compensation (*cost*).

Physical capital deepening is also considered with the *kl* ratio (tangible fixed assets per employee). In addition, a qualitative variable (*rmac*) is introduced indicating whether the firm has bought advanced machinery and equipment during the years 2010-2012.

As concerns financial inputs, we use a measure of a firm's leverage (*lev*), which is given by the ratio of total debt to net capital, thus reflecting the extent to which a firm uses borrowing instead of internal resources to finance its activity. Other qualitative indicators are considered: (i) to capture situations in which the firm is highly dependent on external financing due to liquidity constraints (*ext_fin_liq*) or due to the need of funding productive investments (*ext_fin_inv*) and (ii) to identify firms whose bank debts are highly concentrated (more than 50%) at the main bank (*bank*). It is well known that Italian firms are highly dependent on bank lending. They share this characteristic with other important industrial systems, such as Germany and Japan. It has been argued that firms that borrow from a limited number of banks face lower financial constraints than firms with multi-banking relationships (Elsas, 2005; De Mitri et al., 2010). With more than three-fourths of the firms having multiple lending relationships, our sample depicts a situation of low bank concentration at the firm level.

⁷ It is worth noting that in our final sample, the balance between firms in the higher and in the lower perception level is positive (+2 percentage points), whereas in the Industrial Census sample, the balance is negative and equal to -5 percentage points (even when the census sample is linked to the CIS sample of firms). As the final sample excludes small individual firms for which balance sheet information is not available, one can argue that the different composition in terms of perceived competitiveness of our final sample is related to the higher share of corporations that may be better positioned in facing competition than individual firms.

Knowledge capital. We include in this group of variables those firm-specific abilities or intangible assets that may affect its long-term competitiveness. We consider among these the ratio of high-skill workers to total employment (h_skill_w) and a dummy variable indicating whether high skill workers have been engaged during 2011 (h_skill_2011). Other dichotomous variables are included to capture a firm's attitude towards innovation and those activities that are typically connected to technological adoption, as follows:

(i) The introduction of marketing innovation ($innmkt$) is defined as "the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing" (OECD, 2005); firms focusing on marketing innovation are likely to be able to understand changes in market demand and thus to successfully cope with customer requirements compared to competitors. Approximately 34% of the firms in our sample introduced a marketing innovation in the period 2010-2012. The propensity to introduce marketing innovation in the industrial sector is somewhat lower (32%) than in services as a whole (37%). In addition, we observe a higher propensity to innovate in the group of firms with a high level of perceived competitiveness (44%) compared to the other groups.

(ii) The engagement in in-house R&D activities ($rrdin$) and the acquisition of R&D activities performed by other enterprises or other research organizations ($rrdex$) are inputs of the innovative process and may be thought as proxies of the innovative effort at the firm level. Only 18% of our sample performs in-house R&D, and the percentage is even lower if we consider extramural R&D (8%). A firm's innovative effort as measured by internal and external R&D activities is much higher in the group of firms showing a higher level of perceived competitiveness (23% and 11%, respectively).

(iii) The engagement in internal or external training activities for the development and/or the introduction of technological innovation (rtr).

(iv) A dummy variable that signals whether the firm has cooperated on innovation with other firms or institutions (co) refers to the ability to share knowledge and competencies with other organizations during the process of development of product and/or process innovation.

(v) Finally, to keep the pace of technological innovation, firms that develop new knowledge should protect it and bring it to the market as soon as possible. Thus, intellectual property rights (IPR) are important tools for stimulating firms' innovation and enhancing competitiveness. We include in this group of firm-specific characteristics a dummy variable indicating whether in 2011 and in the two years before, the firm has adopted tools such as copyrights, trademarks, patents and registered designs for intellectual property protection (int_prop). Sample statistics indicates that, on average, 18% of our firms have exploited some form of IPR during the observed period. The number of IPR users is relatively higher in the industrial sector (22%) compared to services (14%) and, interestingly, in the group of firms with a higher level of perceived competitiveness.

Market conditions. According to the reviewed literature, the business environment in which firms operate is another crucial determinant of competitiveness. In this group of dimensions, we have included the $CR5$ index as a proxy for market structure. Descriptive statistics show that higher levels of sales concentration characterize the industrial sectors (38%) compared to services (34%).

The proportion of sectoral innovators ($innset$, two-digit Nace classification level) serve as a proxy for new technological opportunities created by the increase in a sector's technological knowledge. We have, on average, 30% of firms that have introduced new products and/or new processes during the three-year time span, with significant differences between the industry and services sectors (33% and 26%, respectively).

Regional gaps in terms of both firms' economic performance and innovative efforts are generally recognized as stylized facts of the Italian industrial sector; thus, we have included

in this group four regional dummies (*nwest*, *neast*, *centre*, *south*) aimed at investigating the role of localization factors.

To provide more information about the nature of competition that firms need to face, an additional set of qualitative variables is also considered, as follows:

(i) A dummy variable indicating the presence of competitors that are localized abroad (*int_comp*). Of the firms in our sample, 28% compete internationally; however, international competition is more relevant for the industrial firms (the share of foreign competitors is equal to 34%) than for the services firms (21%).

(ii) A dummy variable (*ostob_est*) indicating the possible relevance of market factors (low demand, market dominated by established enterprises, intense price and/or quality competition), which may have hampered a firm's ability to fulfil its objectives. A large proportion of firms have indicated market factors as highly important (70%).

(iii) Finally, another dichotomous variable indicating, more specifically, whether a firm's innovative process may have been hindered by dominant competitors (*ostinn_mkt*). Indeed, only a limited proportion of firms within our sample (7%) have indicated market dominance as a possible threat to innovation, although the proportion increases significantly in the group of firms declaring a lower grade of competitiveness (16%).

Organizational patterns. A set of firm-specific dimensions, which are related to the firm internal conditions are used to describe its organizational behaviour. A firm's *age* is included. The effect of the variable *age* on a firm's competitiveness is ambiguous, as, on the one hand, it is likely that learning effects improve with time. According to this view, we should expect a positive relationship of this variable with a measure of a firm's competitiveness. On the other hand, technical and organizational learning require the development of skills and routines that are highly path-dependent (Nelson and Winter, 1982, 2002). In older firms, the cost of readjusting existing competencies to more recent practices may be higher than the marginal benefit generated from learning processes, thus suggesting a negative relationship as they may lose their ability to compete. The average age of our sample of firms is 23 years, with the firms in the services sector being slightly younger than those in industry.

The implementation of organizational changes such as new work organizations or new knowledge management systems may positively impact technological innovation. It has been argued that the complementarity use of technological capabilities and organizational competencies may improve a firm's economic performance. Thus, we have included a dummy variable (*innorg*) indicating whether the firm has introduced an organizational innovation (the implementation of a new organizational method in the firm's business practices, workplace organization or external relations, according to the definition proposed by the Oslo Manual (Oslo, 2005; p. 51). Of our firms, 41% have introduced in the observed period, an organizational innovation, without significant differences at the sectoral level, whereas interesting differences emerge according to the firms' perceived competitiveness: the propensity to introduce organizational innovation is equal to 52% in the "higher" group, compared to 34% in the "lower" group.

Other variables reflect changes in the firm's organizational structure. This information derives from the CIS questionnaire and concerns the corporate restructuring and outsourcing activities at the firm level, which may have occurred during the period 2010-2012. Thus, the dichotomous variable *change* assumes the unit value if one of these events have occurred during the observed time span. In addition, variable *newunits* indicates whether the firm has created new productive units in Italy or abroad. Summary statistics show that firms in the services industry are more dynamic compared to those in the industrial sector.

Finally, we also consider the role of internal barriers to the achievement of business objectives. In the CIS survey, firms are asked to assess the importance of different potential obstacles that are related to financial barriers, skill barriers and high costs of market entry.

From these answers, we construct a binary variable (*ostob_int*) that takes the value of 1 if the firm considers the degree of importance of these barriers as high or medium. The variable takes the value of 0 if the firm considers the barrier of low importance or not relevant at all. Another binary indicator is derived from the Industrial census (*ostinn_int*) and considers more specifically the degree of importance of internal factors hampering innovation, including the lack of information on technology and markets and on potential partners for innovation. The degree of importance of these obstacles is ranked higher for industry firms than for services and in the group of firms with a lower perception of their competitive level.

Internationalization. In this group, we include a set of variables that describe the spatial dimension of a firm's business activity. We have included a dummy variable indicating whether the firm went abroad to sell its product/services during 2011 (*intern*). The share of firms engaged in international trade is equal to 43%, with the high prevalence of firms operating in the industry compared to services sectors (47% vs. 39%). Additionally, the propensity to export is positively associated with a firm's perceived competitiveness: the share of exporting firms is significantly higher in the "higher" compared to the "lower" group of firms (+7 percentage points).

Productive internationalization is considered by including a dummy variable indicating whether the firm produced goods or services abroad (through FDI or other international agreements) in 2011 (*intern_pd*) and two dummy variables that indicate whether the firm created new productive units in Europe (*newunits1*) or in non-European countries (*newunits2*) during the years 2010-2012. Productive internationalization is modest according to our data: only 8% of our sample produced abroad in 2011, and only 2% of our firms declared that they established new productive units in non-EU countries during the period 2010-2012. This evidence confirms established stylized facts on the internationalization of Italian firms. It is interesting to note that in the services sector, firms tend to have a higher propensity to move abroad in Europe than in the industry (11%, +6 percentage points).

Motives underlying a firm's choice to invest abroad are important determinants in the process of internationalization; thus, we have included two dichotomous variables that are intended to capture the relevance of factors that are related to the need of acquiring resources at a lower cost (*int_cos*) or exploiting the possibilities granted by new markets (*int_mkt*).

Finally, the ratio of foreign employees to total employment (*w_ue*) is another dimension of a firm's internationalization that we have considered. This ratio is modest in our sample of firms (3%), emphasizing the low propensity of Italian firms to attract foreign staff.

Ownership structure. The corporate structure is another relevant dimension that may affect a firm's perception of its competitiveness. The ownership structure is captured by variable *gp*, a dummy variable indicating whether the firm is part of a corporate group, while the relevance of family ownership is captured by a dummy variable (*prop_fam*) assuming the unit value when at least one of the three main shareholders is a family. Another indicator (*manag*) considers the role of the managerial responsibility within the firm, compared to the cases where the responsibility is under an individual entrepreneur or under a family. A firm's ownership nationality is captured by variable (*prop_ita*), which considers the nationality of the shareholders and assumes the unit value when at least one has Italian nationality. These statistics indicate that Italian firms are mainly family-owned and family-managed: 68% of the firms in our sample are family run, and in less than one-fourth of the cases, the firm's management is under the responsibility of a professional manager. Additionally, note that foreign ownership plays only a minor role (on average, only 10% of our sample belongs to an international group; see variable *gp_int*), thus confirming the poor attractiveness of the

Italian economic system (UNCTAD, 2013). However, our data highlight sectoral differences: in services, the role of both family and national ownership is less strong than in industry.

4. Methodology

To model a firm's self-perception, we adopt an empirical specification that enables us to analyse the impact of different competitiveness dimensions by using a stepwise procedure. We first consider the impact of groups of homogeneous determinants for each type of dimensions (output, input, knowledge capital, market conditions, organizational patterns, internationalization, and ownership structure), and then, after determining the most meaningful characteristics that are relevant for self-perception, we will set up a comprehensive model, which may summarize the entire set of relevant dimensions.

Our econometric strategy is represented by a generalized order logit model (Fu, 1999; Williams, 2006), which can be formalized as follows:

$$P(comp_perc_i > j) = g(X\beta_j) = \frac{exp(\alpha_j + X_i\beta_j)}{1 + exp(\alpha_j + X_i\beta_j)} \quad (1)$$

$$j = 1, 2, \dots, M - 1 \quad i = 1, 2, \dots, N$$

where M is the number of categories of the dependent variable, X represents the set of explanatory variables, and the subscript i identifies the firm in the sample N .

Our dependent variable $comp_perc$ has three categories: 1, "lower"; 2, "in line"; 3, "higher". Thus, the probability that variable $comp_perc$ will take each of the three values is equal to:

$$P(comp_perc_i = 1) = 1 - g(X_i\beta_1)$$

$$P(comp_perc_i = 2) = g(X_i\beta_1) - g(X_i\beta_2) \quad (2)$$

$$P(comp_perc_i = 3) = g(X_i\beta_2)$$

When $M > 2$, this model is equivalent to estimating a set of binary logistic regressions where the ordered categories of the dependent variable are combined. If $M = 3$, for $j=1$, the category 1, "lower", is contrasted with the categories 2, "in line", and 3, "higher". For $j=2$, the categories 1, "lower", and 2, "in line", are contrasted with the category 3, "higher", and for $j=3$, the category 3, "higher", is contrasted with the categories 1, "lower", and 2, "in line".

It is worth noting that in the generalized ordered logit model, the *proportional odds* assumption is relaxed as the coefficients β 's may vary for each value of j . In other words, it is assumed that the relationship between each pair of outcome groups, say the "lower" versus the other two categories or the "higher" versus the first two categories, may be not the same. This methodology allows for a more precise estimation of the expected impacts, which may remain hidden when a "parallel-lines" model is assumed.

To provide a more precise measure of the effects of each of the explanatory variables with respect to the firm's competitiveness perception, we present estimates of the odds ratios, which we now discuss.

For a logit model with a set of variable X and an additional variable of interest z , the odds ratio (or) change when z changes by one unit is:

$$or = \frac{Pr(y_i = 1|X, z + 1)/Pr(y_i = 0|X, z + 1)}{Pr(y_i = 1|X, z)/Pr(y_i = 0|X, z)} = exp(\beta_z) \quad (3)$$

where β_k is the coefficient of z .

For a continuous variable, the odds ratio is the change in the probability for a unit change in that variable. For a dummy variable, it is the difference in the probability between firms with the characteristic described by the dummy variable and the rest of the population.

Recall that the ordered logit model estimates the regression coefficients over the levels of the dependent variable; thus, we need to compare individuals who are in groups greater than j with those who are in groups less than or equal to j , where j is the level of the response variable. The interpretation would be that for a one-unit change in the predictor variable, the odds for cases in a group that is greater than j versus less than or equal to j are the proportional odds times larger.

5. Econometric estimates

5.1 Results by groups of dimensions

Following the methodology outlined in the previous section, we first consider the impact on a firm's self-perception of groups of homogeneous determinants for each type of dimensions.

Economic and technical efficiency We observe a positive and significant effect of a firm's profitability. The effect of variable *ros* on the likelihood of having a positive perception is lower in the group of higher performers (+2.3%) compared to the larger group of non-negative performers (+3.9%). This may be justified on the grounds that higher performers should compete in a more complex environment, and this circumstance may negatively affect the likelihood of reporting a positive score. In the industrial sector, the probability gap between the two groups of performers becomes more pronounced, thus indicating that industrial firms may face greater complexity compared to firms operating in the services sector.

To capture the notion of "relative" competitiveness and how this affects individual perceptions, we also estimate a model where a firm's profitability and productivity are industry-adjusted (*dros* and *dva*). We derive these additional measures by subtracting the mean sectoral values from the individual firm's *ros* and *va*. The impacts we observe are mild, thus signalling a possible low self-perception of the firm's economic performance when this is evaluated in relative terms.

Another dimension with a positive impact on a firm's perception is its market *share*. Our estimates do not indicate any differentiation between categories of the dependent variables as the Wald test of parallel-lines assumption is statistically insignificant.⁸ Thus, a one-percent increase in the market share determines an increase in the likelihood of a positive perception equal to +2.5% without significant differences at the sectoral level.

The introduction of a product/process innovation, as measured by the *inntech* dummy, positively affects a firm's perception, particularly in the group of higher performers where the probability of a positive assessment is 55% higher than the rest of the sample (+65% in the services).

⁸ Within the *gologit2* procedure for Stata program the parallel-lines assumption is tested through an iterative process. First, a totally unconstrained model is fitted. Each variable is then submitted to a Wald test to verify whether its coefficients differ across equations, e.g., whether the variable meets the parallel-lines assumption. If the Wald test is statistically insignificant for one or more variables, the variable with the least significant value on the Wald test is constrained to have equal coefficients across groups. The model is then refitted with constraints, and the process is repeated until there are more variables that meet the parallel-lines assumption. A global Wald test is then performed on the final model with constraints versus the original unconstrained model; a statistically insignificant test value indicates that the final model does not violate the parallel-lines assumption.

Physical and financial input. Among this group of dimensions a firm's dependence on external financing plays a relevant role in affecting its competitiveness self-assessment. In particular, the leverage ratio negatively affect the probability of a positive score: a one percent increase in the debt to net capital ratio reduces the probability by 2.8% in the full sample of firms, although the coefficients estimated separately for the industry and the services activities are not significant at conventional significance levels. The effect we observe is non-significant when the *dlev* variable, which is industry-adjusted, is included.

Our results also suggest that being highly dependent on external financing reduces the likelihood of a positive perception regardless of whether external resources are required for productive investments or in order to face liquidity constraints. It is interesting to note that firms which borrow from a limited number of banks tend to have a lower perception. This result may indicate that Italian firms prefer to diversify external financing resources among several banks. Estimations by sector reveal a more controversial picture as the *bank* coefficient is not significant in the industry sector, whereas it is negative and significant in the services sector, where having established a close relationship with a limited number of bank reduces the probability of a positive perception by 22%.

The characteristics of physical inputs do not enter as important determinants of a firm's self-assessment: firm's size (*empl*) and labour compensation have a positive impact but the effect is very mild, while the workforce composition, both in terms of young and female workers, has a very mild effect.

Physical capital deepening (*kl*) does not play a key role, although it is worth noting that individual perceptions are positively influenced by the decision to invest in advanced machinery and equipment for innovation (*rmac*), with results that are differentiated by groups of firms according to their relative self-assessed performance. In particular, if we look at the entire sample (both industry and services firms), the probability of having a higher perception is increased by 16% in the group of "positive" performers, but it is much higher in the group of higher performers (+49%). These differences characterize specifically the industrial sector.

Knowledge capital. On average, skilled workers represent a limited component of the overall employment (5% in our sample of firms), and this may justify the very mild effect that variable *h_skill_w* has on a firm's competitiveness perception (mostly confined to the services sector). Despite this evidence, our estimates also suggest that a firm's decision to employ high-skilled workers during year 2011 (*hcapital_11*) positively and significantly affects a firm's perception. Estimates over the entire sample indicate a higher effect in the group of higher performers (+69%) compared to the group also including the firms "in line". In addition, we should expect a higher impact in the services sector compared to industry, although estimates by sector do not capture any significant difference between groups of performers.

Among the group of variables indicating a firm's innovation propensity, the engagement in marketing innovation exerts a positive and significant impact (+40%) only in the restricted group of higher performers, while in the broader group of non-negative performers, the impact is not significant, thus indicating the possible role of heterogeneity in the firm's perception. This evidence characterizes specifically the industrial sector, whereas in the services sector, we do not observe significant differences between the two groups of firms.

A firm's perception is also positively affected by the ability to put in place training activities for innovation, although the effect is significant within the services sector but not at the industry level. In line with this result, it is interesting to note that only within the restricted group of higher performers in the services sector, involvement in internal R&D activities positively and significantly affect a firm's competitiveness perception.

Finally, intellectual property protection, for which the variable *int_prop* serves as a proxy, exerts a positive and significant impact in both the industrial and services sectors, thus indi-

cating that intellectual property has increasingly been perceived as a source of competitive advantage for all businesses.

Organizational patterns and ownership structure In general, organizational changes significantly have an impact on a firm's perception: having established new productive units during the period 2010-2012 (*newunits*) together with the introduction of new organizational forms (*innorg*) show a significant impact on the probability of positive perception. Conversely, individual perception is negatively affected by obstacles to innovation and, more in general, to the successful achievement of business objectives. It is interesting to note that the estimated (negative) effect of variable *ostinn_int* is lower in the sub-group of higher performers, thus indicating that the impact of internal obstacles to innovation, although relevant, may be mitigated when the firm has a positive perception of its competitiveness level. A firm's *age* presents a negative impact, thus suggesting that older firms may face greater difficulties in competing.

Our estimates also show that firms' perception increases with more complex ownership structures. Taking part in a corporate group (*gp*) has a positive and significant impact in both the industrial sector and the services sector, while family ownership (*prop_fam*) exerts a negative impact, although not significant at conventional significance levels in the specifications by sector.

It is worth noting that the relationship between having managerial responsibility (*gest_manag*) and a firm's competitiveness self-assessment indicates a non-parallel slope, with the group of higher-performers showing a significant impact on the likelihood of a positive perception, while the effect does not appear significant when also including the firms "in line". This result holds for the services firms, while for the industrial firms, a constant coefficient (although not significant at the conventional levels) may indicate that the two groups of firms do not differ much.

Market conditions Our results show that sectoral characteristics such as industry concentration (*cr5*) or sectoral technological opportunities, for which the *innset* ratio serves as a proxy, do not significantly affect firms' perception.

Regional factors have a role in determining the positive self-perception of industrial firms: firms localized in the north-western, north-eastern and central regions show a better perception of their competitiveness compared to the firms localized in the South. Localization does not significantly affect the self-assessment of the services firms.

As concerns the international dimension of competition, for which the variable *int_comp* serves as a proxy, firms are more likely to have a negative perception when their competitors are localized abroad, although the estimated effect is not significant in the group of higher performers.

In addition, firms' perception is negatively affected by potential obstacles such as the presence of dominant competitors or market factors such as possible barriers to the achievement of business objectives. Our results show that the effect of the variable *ostinn_mkt* is relevant (-59% in the total sample of firms) and appears to be differentiated in the services sector, with a lower impact in the group of higher performers. Similarly, the coefficient estimate of the variable *ostob_est* shows effects that are differentiated in both the industry and services sectors: firms that perceive themselves as higher performers have a probability reduction, which is lower than in the group that also includes the firms "in line".

Internationalization Our estimates suggest that firms that are a part of an international group, for which the dummy *gp_int* serves as a proxy, tend to have a better perception of their

competitiveness. According to our model, the probability change is higher in the industrial sector (+45%) compared to the services sector (+25%).

Considering firms' internationalization choices, a firm's propensity to export (*intern*) significantly affects the probability of a positive self-assessment, but this effect is confined to the group of higher performers (+21%). Estimates by sector unveil a more differentiated pattern: in the services sector, the impact is positive and significant (+23%) without any relevant differentiation by groups of firms, while in the industrial sector, the impact is positive in the group of higher performers but it is negative - although not highly significant - in the broader group of firms that also includes the firms "in line". This result suggests a possible higher level of perceived complexity that may be felt by those industrial firms that decide to sell their products abroad.

Conversely, the propensity to produce services or goods abroad, for which the variable *intern_pd* serves as a proxy, does not produce a significant impact. This result is as expected, given the reduced number of firms engaged in productive internationalization, according to the industrial census results. Complementary information may be derived from the CIS survey: the decision to establish new units in other EU countries (variable *newunits1*) has a positive impact, while the impact of having established new plants in non-EU countries (variable *newunits2*) is not significant. This latter evidence is, however, as expected, given the modest proportion of firms reporting new plants in non-European countries during the observed time span. Finally, our estimates show that factors influencing productive internationalization may affect differently the probability of a positive self-assessment depending on the sector of activity: in the services sector, we observe a significant probability reduction (-51%) when delocalization is driven by the need to find resources at lower costs (variable *int_cos*). Conversely, in the industrial sector, the probability of providing a higher score increases more than double when the need to move abroad is justified on the grounds that firms want to exploit opportunities for new markets (variable *int_mkt*)

5.2 The full model: a parsimonious specification

In the previous section, we have modelled a firm's competitiveness self-perception and the factors affecting it by using a one-at-a-time approach instead of all simultaneously. This approach is relevant, as it allows one to pinpoint the best proxies for each of the factors we have suggested in Section 3.2.

In this section, we attempt to unify these preliminary results in order to propose a parsimonious specification that may fully describe the complex mechanisms at work. As a first step, a full specification is estimated to test for the joint significance of all the covariates in each group of dimensions. The results indicate that all the dimensions of competitiveness we have identified are relevant in shaping individual perception: the chi-square tests presented in Table 6 are significant for the complete sample of firms. Nevertheless, the tests performed by sector of activity unveil a quite controversial result for the industrial sector, as the variables included in the internationalization group are not jointly significant when combined with the full set of determinants, and the same is true for the group of variables indicating a firm's ownership structure, which is highly insignificant.

Although these tests only indicate that some of the variables used are jointly equal to zero in the industrial sector and thus do not imply that all of the estimated coefficients are equal to zero independently, we intend to explicitly investigate the role of sectoral differences in explaining possible heterogeneity in firms' self-perception.

In the specification shown in Table 7, we propose a parsimonious model, by including a restricted group of regressors, which may adequately synthesize our original set of factors. In the first two columns, we present the results for the complete sample of firms. In the first column, we also include a dummy variable indicating whether a firm operates in the

industrial sector, with the reference category being the services sector. The results indicate that industrial firms are expected to give a lower score to their competitive position compared to the services firms (-27%). On the basis of this evidence, a likely ratio test is used to test for structural change in the coefficients over the two sub-groups of industry and services firms. The test rejects the null hypothesis of equality between the two groups of coefficients, thus suggesting that firms operating in the industrial and services sectors do perceive differently competitiveness factors.

The *ros* index and the *inntech* dummy are proxies for the economic and technical efficiency. The positive effect of a firm's profitability on individual perceptions continues to be strong and differentiated among sectors and groups of firms. The effect of technological innovation is confirmed positive and significant although the parallel-line assumption is not violated, and thus, we do not observe differences between groups of performers when the effect is conditional on additional regressors. Nevertheless, the results for the services sector confirm the higher impact on the likelihood of a positive perception compared to the industrial sector.

From the group of physical and financial inputs, we have selected the leverage index (physical inputs do not play a key role in the restricted specification in Table 2, part B). The effect of variable *lev* continues to be negative although not highly significant in the full sample of firms and not significant at the conventional significance levels in the sub-samples at the sector level. The evidence that the *lev* coefficient is not highly significant when conditioning to the effect of other regressors is not surprising if one considers that the leverage index is derived from an administrative source of data (balance sheets), which is not designed for statistical purposes. Nevertheless, this result is consistent with the evidence in the restricted specification where we do find support that being highly dependent on external financing reduces the probability of a positive perception, without significant differences at the sectoral level.

Among the group of variables reflecting knowledge capital, we have selected three dummies indicating a firm's decision to employ high-skilled workers (*hcapital_11*), its propensity to introduce marketing innovation (*inmkt*) and the intellectual protection variable *int_prop*. All these variables positively and significantly affect a firm's self-assessment in the restricted specification of Table 3 and confirm their impact in the full model. In particular, the effect of variable *hcapital_11* continues to be higher compared to the industrial sector, although with homogeneous slope coefficients in the full model.

Among the factors affecting firms' internationalization, the two variables indicating a firm's export propensity and its decision to establish new units in other EU countries have been retained. The impacts on individual perceived competitiveness continue to be positive and significant over the entire sample of firms, although in the industrial sector, the estimated coefficient for variable *newunits1* appears not significant at the conventional significance levels. The effect of export propensity confirms a possible larger difficulty, which may be perceived by industrial firms compared to services firms.

The coefficient of the dummy *gest_manag*, which we have selected among the factors capturing the effect of complex ownership structures, is confirmed positive and significant. Note that in the industrial sector, the coefficient is now significant, although the effect continues to be milder compared to the services sector.

Finally, we have considered a firm's market condition by including the dummy variable indicating whether its competitors are located abroad (*int_comp*) and the firm's localization dummies. When conditional on the additional set of regressors, the negative impact of the *int_comp* dummy on individual perception is more precisely estimated in the group of higher performers: in fact, we observe in the full specification a negative and significant impact, which is, however, less pronounced than in the broader group of non-negative performers. This result indicates that firms that are better positioned than competitors perceive themselves

as less constrained by international competition compared to the group of firms that are in line with competitors.

The impact of the localization dummies in the industry sub-sample is now less significant, compared to the restricted specification in Table 5, particularly for the northeast and central areas. This result is not surprising, as other variables included in the full model (i.e., *inn_tech*, *int_prop* and *gest_manag*) are related to geographical characteristics and thus may pick-up regional differences.

6. Discussion and conclusions

In this paper, we have proposed a novel approach for analysing firm-level competitiveness, as it adopts a different point of view, namely, that of a firm's subjective perception. We have defined a conceptual framework that has enabled us to investigate how firms perceive their competitiveness level and how they feel the influence of competition factors.

By using a large, integrated database, we have identified groups of homogeneous determinants - both survey-based and derived from administrative archives, which are commonly indicated by the literature as mechanisms affecting a firm's competitiveness (economic and technical efficiency, physical and financial input, knowledge capital, market conditions, organizational patterns, internationalization, and ownership structure).

We have adopted a stepwise procedure that allows one to first analyse the impact of each group of determinants and then, after determining the most meaningful characteristics that are relevant for self-perception, to set up a comprehensive model, which may summarize the entire set of relevant dimensions. Our econometric strategy is represented by a generalized order logit model, which has been used to predict an ordinal dependent variable derived from a self-reported status (higher, in line, lower than competitors). By allowing regression coefficients to vary across different categories of the dependent variable, this methodology provides a more precise estimate of the expected impacts, which may remain hidden when a "parallel-lines" model is assumed.

Our results indicate the presence of sectoral specificities and group heterogeneity in the way firms perceive their competitiveness. We show that industrial and services firms perceive differently those factors of competitiveness such as profitability, technological innovation, knowledge capital, complex ownership structure and internationalization patterns. Indeed, differences also emerge if one looks at the sectoral sample means. It is worth noting that services firms are smaller, endowed with more female-intensive workers and less exposed to international competition. They are younger and with more younger, skilled workers than those operating in the industrial sector. These latter characteristics may in part explain a somewhat more advanced organizational structure (less family managed and more open to foreign ownership). Although we are aware of the fact that the services sector considered in this study includes a collection of tertiary activities, which are highly diversified, there is room to believe that this evidence could offer interesting suggestions for further research.

We have also found that firms' top performers, according to their perception, tend to score more positively, compared to the other firms with non-negative self-perception a number of competitive factors indicating technological input and output, knowledge capital and managerial abilities. They also tend to be less constrained by threats such as liquidity pressures, internal obstacles to innovation, market factors hampering business goals and international competition.

We further note that the heterogeneity we observe by groups of performers is not always confirmed when moving to the parsimonious specification. Thus, we conclude that although the sign of the variables included remains confirmed and significant, group-specific differences, which are captured in the set of regressions by homogeneous determinants, may be lost in the full model, which combines the various mechanisms at work.

In other cases, sectoral specificities and group heterogeneity are robust to the model specification. Our estimates show that for the top performers in the industrial sector, the impact of operating profitability on the likelihood of a positive perception is lower than in the group of non-negative performers, thus indicating that industrial firms may face greater complexity compared to firms operating in the services industry. However, we observe that in the services industry, having an ownership structure based on managerial responsibility positively and significantly affects the likelihood of a positive assessment only in the group of top performers.

The evidence outlined should certainly not be regarded as a rigorous test of the hypothesized relationships but rather as a proposed conceptual framework for competitiveness analysis. The methodology proposed in this work allows us to predict firms' confidence in their competitive position by linking self-reported data on perceived competitiveness to a wide range of possible determinants, both quantitative and qualitative, which are not confined to the typical price-cost aspects of competitiveness.

Our suggestion is that the use of a perceived competitiveness indicator, which may be developed by gathering the responses coming from structural business statistics, could provide useful insights for more focused competitiveness policies. When a micro-founded approach to self-reported competitiveness is adopted, as the one that is the basis of the present work, both academics and policy analysts may be better oriented for a comprehensive interpretation of possible mismatches observed between individual perception and what they actually observe in the real economy.

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Appendix 1 - Samples' comparison: distribution by sector, localization, size and perceived competitiveness

	Final sample (Business Census linked to CIS 2010-2012 and balance sheets)	2011 Business Census (multipurpose survey)	Business Census linked to CIS 2010-2012
<i>by sector (Nace classification)</i>		percentages	
Mining and quarrying	1.1	0.4	1.0
Food, beverages and tobacco	2.9	4.8	2.9
Textile industries	1.1	2.2	1.0
Dressmaking and garments	1.0	2.7	1.0
Leather and footwear	1.1	2.2	1.1
Wood and wood products	0.8	1.7	0.9
Paper	0.9	1.1	0.8
Graphic art and recorded media	0.8	1.2	0.8
Coke products and petroleum refinery	0.5	0.1	0.4
Chemical industries	1.4	1.5	1.3
Pharmaceutical products	0.7	0.3	0.6
Rubber and plastic materials	1.3	2.7	1.2
Other non metallic mineral products	1.2	2.7	1.1
Metallurgy	1.2	1.3	1.1
Metal products	2.5	7.6	2.4
Computer products, electronics and optics	1.0	1.3	0.9
Materials and electric machinery	1.2	2.1	1.1
Mechanical machinery and ncaa equipment	3.0	6.6	2.7
Motor vehicles, trailers and semi-trailers	1.1	0.9	1.0
Other transport materials	0.7	0.6	0.6
Furnitures	1.0	1.9	0.9
Other manufacturing industries	0.9	1.4	0.8
Repair and installation of machinery and equipment	1.0	1.9	0.9
Electricity, gas, steam and air conditioning supply	2.2	0.5	2.0
Water supply; sewerage, waste and remediation	4.4	1.8	4.1
Costruction	17.4	11.0	17.3
Wholesale and retail trade	27.2	22.2	27.3
Transportation and storage	8.7	7.6	8.1
Information and communication	4.4	3.2	3.9
Financial and insurance activities	0.5	1.2	4.5
Professional, scientific and technical activities	6.9	3.3	6.3
<i>by size class (employees)</i>			
less than 50	54.5	80.0	56.7
50-249	30.8	17.2	29.0
250 and more	14.7	2.8	14.3
<i>by area</i>			
north-west	31.5	35.6	30.8
north-east	30.6	28.0	31.2
centre	17.9	19.2	17.7
south	20.0	17.2	20.3
<i>by perceived competitiveness</i>			
lower	10.8	15.2	15.2
in line	76.5	74.7	74.7
higher	12.8	10.2	10.2
TOTAL	10,943	98,481	12,622

Appendix 2 - List of variables

Name	Type	Description	Source
comp_perc	1,2,3	Perceived competitiveness (1=lower; 2=in line; 3=higher)	Industrial Census 2011
Economic and technical efficiency			
ros	%	Return on sales. The ratio between gross operating profits and sales. An index of operating profitability	balance sheets
va	c	Labour productivity. Value added per employee ratio	balance sheets
share	%	Market share. The ratio of a firm's sales to sectoral sales	balance sheets
turn_ch	%	Sales change 2012-2010	Cis 2010-2012
inntech	0/1	The firm has introduced a technological innovation	Cis 2010-2013
Physical and financial input			
empl	c	Number of employees	Asia register
young_w	%	Share of young workers (aged 15-29)	Industrial Census 2011
fem_w	%	Share of female workers	Industrial Census 2011
kl	c	Capital deepening. Tangible fixed assets per employee	balance sheets
cosl	c	Labour cost per employee	balance sheets
rmac	0/1	Acquisition of advanced machinery, equipment (including computer hardware) or software	Cis 2010-2012
lev	%	Leverage. The ratio of total debts to shareholders' funding	balance sheets
ext_fin_liq	0/1	High external borrowing due to liquidity constraints	Industrial Census 2011
ext_fin_inv	0/1	High external borrowing due to productive investments	Industrial Census 2011
bank	0/1	Bank debt concentrated at the main bank (more than 50%)	Industrial Census 2011
Knowledge capital			
h_skill_w	%	Share of high-skill workers	Industrial Census 2011
h_skill_2011	0/1	The firm has engaged high-skill workers during 2011	Industrial Census 2011
innmkt	0/1	The firm has introduced a marketing innovation	Cis 2010-2012
rrdin	0/1	The firm has performed in-house R&D	Cis 2010-2012
rrdex	0/1	The firm has acquired external R&D	Cis 2010-2012
rtr	0/1	The firm has been engaged in training activities for innovation	Cis 2010-2012
co	0/1	The firm has cooperated on innovation with other firms or institutions	Cis 2010-2012
int_prop	0/1	The firm has adopted tools for intellectual property protection	Industrial Census 2011

Appendix 2 continued - List of variables

Name	Type	Description	Source
Market conditions			
CR5	%	Concentration ratio. The market share of the five largest firms (sales)	balance sheets
inset	%	Sectoral innovators (technological innovation)	Cis 2010-2012
nwest	0/1	Regional areas	Asia register
neast	0/1		Asia register
centre	0/1		Asia register
south	0/1		Asia register
int_comp	0/1	Competitors localized abroad	Industrial Census 2011
ostob_est	0/1	Obstacles to business objectives: market factors highly important	Cis 2010-2012
ostinn_mkt	0/1	Obstacles to innovation: dominant competitors	Industrial Census 2011
Organizational patterns			
age	c	Firm's age (years)	Asia register
innorg	0/1	The firm has introduced an organizational innovation	Cis 2010-2012
change	0/1	Corporate restructuring/outsourcing	Cis 2010-2012
newunits	0/1	Created new productive units in Italy or abroad	Cis 2010-2012
ostob_int	0/1	Obstacles to business objectives: internal factors highly important	Cis 2010-2012
ostinn_int	0/1	Obstacles to innovation: internal factors	Industrial Census 2011
Internationalization			
gp_int	0/1	The firm takes part of an international group	Cis 2010-2012
intern	0/1	The firm has sold abroad its products/services	Industrial Census 2011
intern_pd	0/1	The firm has produced goods/services abroad	Industrial Census 2011
newunits1	0/1	Created new productive units in EU	Cis 2010-2012
newunits2	0/1	Created new productive units in non-EU countries	Cis 2010-2012
int_cos	0/1	Factors affecting productive internationalization: cost factors very important	Industrial Census 2011
int_mkt	0/1	Factors affecting productive internationalization: exploring new markets very important	Industrial Census 2011
w_ue	%	Share of foreign employees (EU)	Industrial Census 2011
Ownership structure			
prop_fam	0/1	Family ownership. At least one of the first three shareholders is a family	Industrial Census 2011
manag	0/1	Firm management under professional managers	Industrial Census 2011
gp	0/1	The firm takes part of a group	Cis 2010-2012
prop_ita	0/1	National Ownership. At least one of the first three shareholders is Italian	Industrial Census 2011

Appendix 3 - Descriptive statistics by perceived competitiveness

Variable	all (N=10,943)			comp_perc = 1 (N=1,178)			comp_perc = 2 (N=8,369)			comp_perc = 3 (N=1,139)		
	Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
ros	3.31	7.52	0.77	8.79	3.46	7.31	4.52	7.13	3.46	7.31	4.52	7.13
va	71.44	133.96	53.37	57.07	71.27	122.40	87.63	218.02	71.27	122.40	87.63	218.02
turn_ch	127.64	8476.65	73.32	1199.56	32.51	512.62	742.46	23651.05	32.51	512.62	742.46	23651.05
share	0.47	2.41	0.29	1.22	0.45	2.29	0.73	3.58	0.45	2.29	0.73	3.58
innotech	0.41	0.49	0.36	0.48	0.40	0.49	0.51	0.50	0.40	0.49	0.51	0.50
dtros	2.71	282.86	-93.40	353.44	7.93	269.71	51.68	275.86	7.93	269.71	51.68	275.86
dva	23.04	163.29	-2.48	106.15	23.52	168.79	41.59	166.64	23.52	168.79	41.59	166.64
empl	201.05	1680.10	122.22	479.05	179.64	753.30	395.96	4300.85	179.64	753.30	395.96	4300.85
kl	100.73	509.72	84.18	325.48	101.16	528.90	112.05	518.97	101.16	528.90	112.05	518.97
cosl	43.21	44.21	40.01	19.26	43.29	47.78	45.38	36.13	43.29	47.78	45.38	36.13
rmac	0.30	0.46	0.26	0.44	0.29	0.46	0.39	0.49	0.29	0.46	0.39	0.49
young_w	15.38	16.15	13.73	15.00	15.37	16.18	16.82	16.78	15.37	16.18	16.82	16.78
fem_w	14.42	12.67	13.87	12.54	14.29	12.67	15.68	12.72	14.29	12.67	15.68	12.72
lev	1.22	1.94	1.38	2.23	1.23	1.94	1.08	1.62	1.23	1.94	1.08	1.62
est_fin_liq	0.21	0.41	0.33	0.47	0.20	0.40	0.16	0.37	0.20	0.40	0.16	0.37
est_fin_inv	0.17	0.37	0.28	0.45	0.16	0.37	0.12	0.33	0.16	0.37	0.12	0.33
bank	0.23	0.42	0.28	0.45	0.23	0.42	0.21	0.41	0.23	0.42	0.21	0.41
dcl	409.87	4562.73	423.93	6008.80	390.20	3997.53	516.03	6086.64	390.20	3997.53	516.03	6086.64
dcosl	7.87	104.61	1.04	44.28	8.22	115.31	11.45	65.84	8.22	115.31	11.45	65.84
dlev	115.33	589.13	130.77	534.12	115.63	616.65	100.71	446.92	115.63	616.65	100.71	446.92
h_skill_w	5.33	12.08	4.30	11.34	5.17	11.74	7.21	14.32	5.17	11.74	7.21	14.32
h_skill_2011	0.31	0.46	0.23	0.42	0.29	0.46	0.43	0.50	0.29	0.46	0.43	0.50
innmkt	0.34	0.48	0.31	0.46	0.33	0.47	0.44	0.50	0.33	0.47	0.44	0.50
int_prop	0.18	0.39	0.15	0.36	0.17	0.38	0.26	0.44	0.17	0.38	0.26	0.44
rrdin	0.18	0.38	0.16	0.37	0.17	0.37	0.23	0.42	0.17	0.37	0.23	0.42
rrdex	0.08	0.28	0.07	0.25	0.08	0.27	0.11	0.32	0.08	0.27	0.11	0.32
co	0.09	0.29	0.09	0.28	0.09	0.28	0.12	0.33	0.09	0.28	0.12	0.33
rrr	0.18	0.38	0.16	0.36	0.17	0.38	0.24	0.43	0.17	0.38	0.24	0.43

Appendix 3 continued - Descriptive statistics by perceived competitiveness

Variable	all (N=10,943)		q406 = 1 (N=1,178)		q406 = 2 (N=8,369)		> q406 = 3 (N=1,139)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
cr5	35.85	15.26	35.97	14.98	35.75	15.21	36.34	15.79
imset	29.66	17.09	30.41	17.87	29.21	16.92	31.73	17.22
int_comp	0.28	0.45	0.34	0.47	0.27	0.44	0.29	0.46
ostinn_mkt	0.07	0.26	0.16	0.36	0.07	0.25	0.04	0.19
ostob_est	0.70	0.46	0.82	0.39	0.70	0.46	0.61	0.49
invest	0.31	0.46	0.29	0.45	0.32	0.46	0.33	0.47
neast	0.31	0.46	0.31	0.46	0.30	0.46	0.31	0.46
centre	0.18	0.38	0.17	0.38	0.18	0.39	0.17	0.38
south	0.20	0.40	0.23	0.42	0.20	0.40	0.19	0.39
change	0.17	0.38	0.16	0.37	0.17	0.37	0.20	0.40
newunits	0.09	0.29	0.07	0.25	0.09	0.29	0.13	0.34
ostinn_int	0.45	0.50	0.70	0.46	0.44	0.50	0.33	0.47
ostob_int	0.44	0.50	0.55	0.50	0.43	0.50	0.38	0.48
innorg	0.41	0.49	0.34	0.47	0.40	0.49	0.52	0.50
age	23.39	16.13	23.85	17.34	23.38	15.97	23.06	16.05
gp_int	0.10	0.30	0.08	0.27	0.10	0.30	0.14	0.34
newunits1	0.08	0.28	0.06	0.23	0.08	0.27	0.12	0.32
newunits2	0.02	0.14	0.01	0.11	0.02	0.13	0.03	0.16
intern	0.43	0.49	0.41	0.49	0.42	0.49	0.48	0.50
intern_pd	0.08	0.28	0.08	0.27	0.08	0.28	0.10	0.30
int_mkt	0.06	0.23	0.04	0.20	0.06	0.23	0.07	0.26
int_cos	0.05	0.21	0.05	0.22	0.05	0.21	0.05	0.21
w_ue	3.27	7.97	3.63	7.98	3.22	7.99	3.25	7.88
gp	0.57	0.49	0.50	0.50	0.56	0.50	0.65	0.48
prop_fam	0.68	0.47	0.73	0.45	0.69	0.46	0.61	0.49
prop_ita	0.93	0.25	0.94	0.24	0.93	0.25	0.91	0.28
gest_manag	0.22	0.41	0.20	0.40	0.21	0.41	0.29	0.45

Table 1 - Average values by sectors

Variable	Industry (N=5,730)	Services (N=5,213)	significance (t-test)	Variable	Industry (N=5,730)	Services (N=5,213)	significance (t-test)
comp_perc	1.99	2.05	***				
ros	3.89	2.67	***	cr5	37.71	33.81	***
va	77.14	65.19	***	innset	32.58	26.46	***
turn_ch	184.13	65.43		int_comp	0.34	0.21	***
share	0.58	0.35	***	ostinn_mkt	0.07	0.07	
inntech	0.45	0.36	***	ostob_est	0.71	0.68	***
dros	1.51	4.03		nwest	0.28	0.35	***
dva	19.33	27.12	**	neast	0.32	0.29	***
				centre	0.19	0.17	***
empl ^a	47.00	36.00	***	south	0.20	0.19	*
kl	119.63	80.01	***				
cosl	43.60	42.78		change	0.16	0.18	**
rmac	0.34	0.26	***	newunits	0.07	0.12	***
young_w	13.82	17.09	***	ostinn_int	0.48	0.43	***
fem_w	10.76	18.45	***	ostob_int	0.46	0.41	***
lev	1.33	1.11	***	innorg	0.41	0.40	
est_fin_liq	0.24	0.18	***	age	24.31	22.37	***
est_fin_inv	0.19	0.15	***				
bank	0.23	0.24	**	gp_int	0.09	0.12	***
dkl	155.97	688.33	***	newunits1	0.05	0.11	***
dcosl	5.33	10.65	***	newunits2	0.02	0.01	***
dlev	82.01	151.96	***	intern	0.47	0.39	***
				intern_pd	0.10	0.07	***
h_skill_w	4.18	6.60	***	int_mkt	0.07	0.04	***
h_skill_2011	0.32	0.29	***	int_cos	0.06	0.03	***
innmkt	0.32	0.37	***	w_ue	3.71	2.78	***
int_prop	0.22	0.14	***				
rrdin	0.24	0.10	***	gp	0.56	0.57	
rrdex	0.11	0.05	***	prop_fam	0.70	0.66	***
co	0.11	0.08	***	prop_ita	0.94	0.92	***
rtr	0.20	0.16	***	manag	0.20	0.24	***

Two-sample *t*-test with equal variances (confidence level=0.95).

(a) Medians are reported. The Wilcoxon rank-sum-test is performed.

Table 2 - Firm's perceived position against competitors - Economic and technical efficiency (Part A) and Physical and financial inputs (Part B) (odds ratios)

Part A: Economic and technical efficiency

variables	<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>	
	All sectors	Industry	Services	All sectors	Industry	Services	All sectors	Industry	Services	
ros	1.037*** [0.00409]	1.023*** [0.00430]	1.039*** [0.00539]	1.016*** [0.00608]	1.036*** [0.00465]					
va	1.004*** [0.000829]	1.000** [0.000193]	1.003*** [0.00101]	1.001*** [0.000252]	1.005*** [0.00140]	1.000 [0.000326]				
turn_ch	1.000 0.00015	0.999 0.00082	1.000 0.00016	1.000 0.00016	1.000 0.00015	1.000 0.00015	0.999 0.00082	1.000 0.00016	1.000 0.00016	1.000 0.00016
share	1.025*** [0.00880]	1.028** [0.0130]	1.027** [0.0127]	1.027** [0.0127]	1.026*** [0.00888]	1.026*** [0.00888]	1.028** [0.0128]	1.028** [0.0128]	1.029** [0.0129]	1.029** [0.0129]
inntech	1.180** [0.0790]	1.551*** [0.0921]	1.209** [0.105]	1.552*** [0.136]	1.225* [0.131]	1.656*** [0.136]	1.189*** [0.0793]	1.559*** [0.0927]	1.203** [0.105]	1.541*** [0.135]
dros					1.001*** [0.00082]	1.001*** [0.000181]	1.001*** [0.000181]	1.001*** [0.000181]	1.001*** [0.000181]	1.001*** [0.000181]
dva					1.003*** [0.000580]	1.000** [0.000161]	1.003*** [0.000580]	1.001** [0.000258]	1.003*** [0.000580]	1.000 [0.000221]
Constant	5.782*** [0.332]	0.104*** [0.00481]	5.035*** [0.383]	0.0862*** [0.00617]	6.422*** [0.566]	0.119*** [0.00720]	7.735*** [0.313]	0.114*** [0.00478]	6.985*** [0.394]	0.0955*** [0.00620]
LL(0)	-7,366.45		-3,790.88		-3,556.39		-7,366.45		-3,790.88	
LL(full)	-7,235.32		-3,718.18		-3,480.94		-7,229.74		-3,716.36	
LR chi2(k)	268.28 (8)		145.40 (8)		150.90 (7)		273.43 (7)		149.03 (8)	
McFadden's R ²	0.0178		0.0192		0.0212		0.0186		0.0197	
Observations	10,450		5,471		4,979		10,450		5,471	

Part B: Physical and financial inputs

variables	<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>		<i>in line and higher vs. higher vs. lower and in lower</i>	
	All sectors	Industry	Services	All sectors	Industry	Services	All sectors	Industry	Services	
empl	1.000*** 0.00025	1.000** 0.00041	1.000*** 0.00034	1.000*** 0.00041	1.000*** 0.00025	1.000** 0.00041	1.000*** 0.00034	1.000*** 0.00041	1.000*** 0.00034	
kl	1.000 0.00042	1.000 0.00047	1.000 0.00047	1.000 [0.000111]	1.000 [0.000111]	1.000 [0.000111]	1.000 [0.000111]	1.000 [0.000111]	1.000 [0.000111]	
cosl	1.007*** [0.00196]	1.001* [0.000491]	1.008*** [0.00303]	1 [0.000839]	1.007*** [0.00263]	1.001* [0.000731]	1.007*** [0.00263]	1.001* [0.000731]	1.007*** [0.00263]	
rmac	1.162** [0.0833]	1.491*** [0.0907]	1.152 [0.107]	1.573*** [0.138]	1.409*** [0.105]	1.409*** [0.105]	1.172** [0.0839]	1.491*** [0.0907]	1.165* [0.108]	1.577*** [0.138]
young_w	1.007*** [0.00143]	1.008*** [0.00231]	1.008*** [0.00231]	1.006*** [0.00185]	1.007*** [0.00143]	1.007*** [0.00143]	1.008*** [0.00231]	1.008*** [0.00231]	1.006*** [0.00184]	
fem_w	1.001 [0.00255]	1.007*** [0.00230]	1.003 [0.00307]	1.003 [0.00307]	1.001 [0.00255]	1.007*** [0.00230]	1.001 [0.00255]	1.007*** [0.00230]	1.003 [0.00307]	
lev	0.972** [0.0116]	0.976 [0.0163]	0.974 [0.0166]	0.974 [0.0166]	0.972** [0.0116]	0.976 [0.0163]	0.974 [0.0166]	0.974 [0.0166]	0.972** [0.0116]	
est_fin_liq	0.628*** [0.0790]	0.932 [0.117]	0.636*** [0.100]	1.025 [0.164]	0.645** [0.136]	0.884 [0.181]	0.620*** [0.0775]	0.92 [0.115]	0.640*** [0.100]	1.032 [0.165]
est_fin_inv	0.741** [0.0923]	0.773* [0.121]	0.686* [0.142]	0.686* [0.142]	0.742** [0.0922]	0.742** [0.0922]	0.766* [0.119]	0.766* [0.119]	0.697* [0.144]	
bank	0.850*** [0.0464]	0.911 [0.0702]	0.782*** [0.0607]	0.782*** [0.0607]	0.846*** [0.0461]	0.846*** [0.0461]	0.912 [0.0703]	0.912 [0.0703]	0.776*** [0.0603]	
dki					1.000 [0.000058]	1.000 [0.000058]	1.000 [0.000149]	1.000 [0.000149]	1.000 [0.000062]	
dcosl					1.003*** [0.000863]	1.000 [0.000204]	1.003*** [0.00131]	1.000 [0.000357]	1.003*** [0.00116]	1.000 [0.000258]
dlev					1.000 [0.000373]	1.000 [0.000373]	1.000 [0.000113]	1.000 [0.000113]	1.000 [0.000401]	
Constant	6.733*** [0.701]	0.109*** [0.00695]	5.548*** [0.835]	0.0927*** [0.00832]	7.684*** [1.036]	0.151*** [0.0125]	8.764*** [0.535]	0.110*** [0.00643]	7.645*** [0.580]	0.0936*** [0.00745]
LL(0)	-7,461.11		-3,832.99		-3,608.02		-7,451.45		-3,832.99	
LL(full)	-7,326.53		-3,769.07		-3,451.27		-7,322.26		-3,770.53	
LR chi2(k)	269.16 (14)		127.84 (13)		133.49 (12)		258.37 (14)		124.91 (13)	
McFadden's R ²	0.0180		0.0167		0.0185		0.0173		0.0163	
Observations	10,569		5,530		5,039		10,561		5,530	

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 3 - Firm's perceived position against competitors - Knowledge capital (Odds ratios)

variables	<i>in line and higher vs. lower higher vs. lower and in line</i>		<i>in line and higher vs. lower higher vs. lower and in line</i>		<i>in line and higher vs. lower higher vs. lower and in line</i>	
	All sectors		Industry		Services	
h_skill_w	1.006***		1,003		1.004*	
	[0.00190]		[0.00331]		[0.00237]	
h_skill_11	1.388***	1.693***	1.496***		1.682***	
	[0.103]	[0.105]	[0.109]		[0.126]	
innmkt	1,082	1.403***	1,018	1.388***	1.214***	
	[0.0741]	[0.0859]	[0.0957]	[0.127]	[0.0849]	
int_prop	1.267***		1.245**		1.384***	
	[0.0791]		[0.107]		[0.128]	
rrdin	0.971		1.093		0.597***	1.303**
	[0.0689]		[0.0998]		[0.0947]	[0.166]
rrdex	1.064		1.073		1.160	
	[0.0983]		[0.125]		[0.177]	
co	0.879		0.926		0.805	
	[0.0780]		[0.109]		[0.108]	
rtr	1.156**		1.079		1.287***	
	[0.0745]		[0.0943]		[0.123]	
Constant	6.835***	0.0962***	6.044***	0.0849***	7.542***	0.115***
	[0.280]	[0.00431]	[0.313]	[0.00522]	[0.426]	[0.00655]
LL(0)	-7,744.39		-3,989.42		-3,732.98	
LL(full)	-7,634.52		-3,940.27		-3,661.41	
LR chi2(k)	219.74 (10)		98.29 (9)		143.13 (9)	
McFadden's R ²	0.0142		0.0123		0.019	
Observations	10,943		5,730		5,213	

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 4 - Firm's perceived position against competitors - Organizational patterns (Part A) and Ownership structure (Part B) (Odds ratios)**Part A: Organizational patterns**

variables	<i>in line and higher vs. higher vs. lower and lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. higher vs. lower and lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. higher vs. lower and lower</i>	<i>higher vs. lower and in line</i>
	All sectors		Industry		Services	
change	0.992 [0.0601]		1.009 [0.0878]		0.970 [0.0826]	
newunits	1.389*** [0.107]		1.353** [0.170]		1.332*** [0.132]	
ostinn_int	0.324*** [0.0219]	0.562*** [0.0345]	0.322*** [0.0296]	0.618*** [0.0547]	0.329*** [0.0332]	0.529*** [0.0453]
ostob_int	0.774*** [0.0360]		0.755*** [0.0491]		0.809*** [0.0540]	
innorg	1.400*** [0.0929]		1.463*** [0.0956]		1.712*** [0.116]	
age	0.996*** [0.00140]		0.997* [0.00195]		0.996* [0.00204]	
Constant	16.76*** [1.208]	0.169*** [0.0101]	15.42*** [1.519]	0.152*** [0.0126]	16.58*** [1.667]	0.195*** [0.0153]
LL(0)	-7,744.39		-3,989.42		-3,732.98	
LL(full)	-7,463.18		-3,851.21		-3,598.72	
LR chi2(k)	562.42 (8)		276.42 (7)		268.51 (7)	
McFadden's R ²	0.0363		0.0346		0.0360	
Observations	10,943		5,730		5,213	

Part B: Ownership structure

variables	<i>in line and higher vs. higher vs. lower and lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. higher vs. lower and lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. higher vs. lower and lower</i>	<i>higher vs. lower and in line</i>
	All sectors		Industry		Services	
gp	1.295*** [0.0675]		1.222*** [0.0883]		1.394*** [0.105]	
prop_fam	0.888** [0.0531]		0.886 [0.0759]		0.904 [0.0756]	
prop_ita	1.038 [0.0976]		0.944 [0.137]		1.162 [0.145]	
gest_manag	0.971 [0.0804]	1.334*** [0.0947]	1.115 [0.0997]	1.115 [0.0997]	0.880 [0.105]	1.453*** [0.138]
Constant	7.613*** [0.820]	0.122*** [0.0132]	7.530*** [1.209]	0.123*** [0.0198]	7.618*** [1.126]	0.118*** [0.0175]
LL(0)	-7,744.39		-3,989.42		-3,732.98	
LL(full)	-7,701.20		-3,975.83		-3,701.79	
LR chi2(k)	68.07 (5)		27.16 (4)		62.38 (5)	
McFadden's R ²	0.0044		0.0034		0.0084	
Observations	10,943		5,730		5,213	

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 5 - Firm's perceived position against competitors - Market conditions (Part A) and Internationalization (Part B) (Odds ratios)

Part A: Market conditions						
variables	<i>in line and higher vs. lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. lower</i>	<i>higher vs. lower and in line</i>
	All sectors		Industry		Services	
cr5	1.000		0.999		1.003	
	[0.00149]		[0.00235]		[0.00201]	
innset	1.002	1.008***	1.008***		0.997	1.011***
	[0.00201]	[0.00183]	[0.00192]		[0.00378]	[0.00304]
int_comp	0.706***	0.961	0.616***	1.003	0.786**	1.072
	[0.0526]	[0.0679]	[0.0590]	[0.0992]	[0.0892]	[0.103]
ostinn_mkt		0.407***		0.473***	0.288***	0.552***
		[0.0345]		[0.0546]	[0.0382]	[0.104]
ostob_est	0.503***	0.661***	0.516***	0.678***	0.491***	0.667***
	[0.0398]	[0.0395]	[0.0549]	[0.0605]	[0.0589]	[0.0541]
nwest		1.232***		1.293***		1.084
		[0.0804]		[0.119]		[0.101]
neast		1.140**		1.266***		1.005
		[0.0745]		[0.113]		[0.0969]
centre		1.108		1.207*		1.000
		[0.0816]		[0.121]		[0.109]
Constant	14.19***	0.138***	10.71***	0.112***	18.90***	0.150***
	[1.551]	[0.0130]	[1.623]	[0.0157]	[3.147]	[0.0194]
LL(0)		-7,744.39		-3,989.42		-3,732.98
LL(full)		-7,593.26		-3,915.19		-3,644.49
LR chi2(k)		302.26 (11)		148.45 (10)		176.98 (12)
McFadden's R ²		0.0195		0.0186		0.0237
Observations		10,943		5,730		5,213
Part B: Internationalization						
variables	<i>in line and higher vs. lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. lower</i>	<i>higher vs. lower and in line</i>	<i>in line and higher vs. lower</i>	<i>higher vs. lower and in line</i>
	All sectors		Industry		Services	
gp_int		1.379***		1.451***		1.253**
		[0.102]		[0.161]		[0.124]
newunits1		1.491***		1.371**		1.445***
		[0.121]		[0.193]		[0.145]
newunits2		1.252		1.204		1.367
		[0.210]		[0.266]		[0.366]
intern	1.029	1.209***	0.852*	1.326***		1.235***
	[0.0663]	[0.0724]	[0.0730]	[0.119]		[0.0845]
intern_pd		1.041		0.900		1.322
		[0.180]		[0.212]		[0.337]
int_mkt		1.270		2.135***		0.935
		[0.211]		[0.563]		[0.246]
int_cos		0.704**		0.889		0.486***
		[0.108]		[0.184]		[0.122]
w_ue		0.997		0.996		1.001
		[0.00281]		[0.00363]		[0.00445]
Constant	7.788***	0.125***	7.530***	0.102***	8.296***	0.146***
	[0.328]	[0.00522]	[0.445]	[0.00656]	[0.458]	[0.00765]
LL(0)		-7,744.39		-3,989.42		-3,732.98
LL(full)		-7,705.80		-3,963.28		-3,712.09
LR chi2(k)		77.17 (9)		52.28 (10)		41.77 (8)
McFadden's R ²		0.0050		0.0066		0.0056
Observations		10,943		5,730		5,213

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6 - Test for the joint significance of covariates by group of dimensions

Groups of dimensions	All sectors		Industry		Services	
	chi2	p. value	chi2	p. value	chi2	p. value
Economic and technical efficiency	81.74	0.0000	45.31	0.0000	49.4	0.0000
Physical and financial inputs	60.32	0.0000	30.35	0.0014	33.66	0.0002
Knowledge capital	93.25	0.0000	44.57	0.0000	60.15	0.0000
Organizational patterns	210.09	0.0000	111.41	0.0000	90.95	0.0000
Ownership structure	16.77	0.0050	0.86	0.9302	23.59	0.0002
Market conditions	197.32	0.0000	100.34	0.0000	114.36	0.0000
Internationalization	21.93	0.0051	12.95	0.1135	27.57	0.0021

Table 7 - Firm's perceived position against competitors - Restricted model

variables	<i>in line and higher vs. lower</i>		<i>higher vs. lower and in line</i>		<i>in line and higher vs. lower</i>		<i>higher vs. lower and in line</i>	
	All sectors	All sectors	All sectors	All sectors	Industry	Industry	Services	Services
ros	1.043*** [0.00389]	1.027*** [0.00432]	1.042*** [0.00388]	1.025*** [0.00429]	1.044*** [0.00515]	1.018*** [0.00608]	1.038*** [0.00452]	
inntech		1.192*** [0.0649]		1.151*** [0.0623]		1.149* [0.0882]		1.250*** [0.0972]
lev		0.984 [0.0120]		0.980* [0.0119]		0.981 [0.0166]		0.986 [0.0174]
h_skill_11		1.578*** [0.0846]		1.572*** [0.0843]		1.517*** [0.113]		1.639*** [0.127]
int_prop		1.346*** [0.0864]		1.306*** [0.0837]		1.338*** [0.118]		1.405*** [0.135]
innmkt	1.038 [0.0762]	1.315*** [0.0849]	1.077 [0.0786]	1.361*** [0.0876]		1.206** [0.0929]		1.187** [0.0892]
newunits1		1.253*** [0.105]		1.324*** [0.111]		1.248 [0.178]		1.266** [0.133]
intern		1.213*** [0.0708]		1.214*** [0.0709]		1.193* [0.107]		1.244*** [0.0962]
gest_manag		1.246*** [0.0720]		1.268*** [0.0732]		1.193** [0.0984]	0.979 [0.118]	1.509*** [0.140]
int_comp	0.534*** [0.0425]	0.750*** [0.0569]	0.511*** [0.0404]	0.711*** [0.0538]	0.504*** [0.0543]	0.737*** [0.0799]	0.576*** [0.0715]	0.777** [0.0841]
nwest		1.049 [0.0725]		1.082 [0.0745]		1.206* [0.117]		0.888 [0.0882]
neast		1.03 [0.0705]		1.034 [0.0707]		1.156 [0.108]		0.894 [0.0903]
centre		1.054 [0.0811]		1.055 [0.0811]		1.175 [0.123]		0.911 [0.104]
dind		0.733*** [0.0356]						
Constant	7.297*** [0.527]	0.0927*** [0.00691]	6.220*** [0.419]	0.0806*** [0.00578]	5.112*** [0.466]	0.0692*** [0.00699]	7.604*** [0.742]	0.0955*** [0.00935]
LL(0)			-7,744					-3,733
LL(full)		-7,038		-7,059		-3,641		-3,386
LR chi2(k)		484.29 (17)		443.12 (16)		216.67 (15)		253.04 (16)
McFadden's R2		0.0333		0.0304		0.0289		0.036
ll ratio test for structural stability						63.77 (26)		
Observations	10,342	10,342	10,342	10,342	5,413	5,413	4,929	4,929

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. The log likelihoods ratio test for structural stability is a chi2 test for equality between two sets of coefficients. The 95% critical value is equal to 48.29

