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Sailing through the storms towards Treasure Island

The relationships between strategies, obstacles and firm performance

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Abstract

Companies devise strategies to successfully navigate the treacherous waters of an uncertain business environment. They need to tackle regulatory or market obstacles in order to succeed and eventually achieve strong growth performance. This study aims to better understand the complex relationship between strategies, obstacles and firm performance. It uses regression techniques on a cross-national homogeneous sample of 37,150 European companies based in 14 Member States in order to study the correlation between: i) firms' perceptions about the importance of their strategies and the obstacles they face, and ii) firms' innovation and economic performance. The findings point out that the firms pursuing cost reduction strategies and perceiving the lack of demand and of adequate finance as important obstacles experience poor performance. By contrast, those pursuing adaptability strategies and perceiving the lack of qualified personnel as an important obstacle grow faster, and those with explicit product innovation strategies innovate more. Moreover, the results indicate specific needs of high-growth enterprises that, in comparison with other firms, appear less sensitive about financial constraints, more interested in the availability of skilled labour and benefiting more from cooperative strategies.

Keywords: entrepreneurship, firm growth, strategic management, strategies, obstacles, high-growth firms

1 Introduction

In order to succeed in an ever-changing environment, companies formulate strategies that guide their behaviour with respect to actual and potential customers, suppliers or the way they draw upon resources. Firms that choose the wrong strategies in their given circumstances, or firms that cannot implement the strategies due to regulatory or market obstacles are more likely to fail. By contrast, the successful ones (should they intend to) may achieve high growth, and become engines for economic growth and job creation. In this context, the analysis of strategies (e.g. developing new markets and flexibility and responsiveness of the organization) firms adopt and the obstacles (e.g. lack of finance and suitable skills) they have to tackle could reveal relevant policy insights.

The relationships between firms' strategies and obstacles and firms performance and innovation behaviour have been the object of widespread interest in the management and economics literature in order to identify patterns and conditions enabling business success. Yet, the existing literature on strategies typically relies on firms' outcomes, such as exporting and innovating, to infer the strategies adopted by the firm (i.e. Bierly and Chakrabarti, 1996; Katila and Ahuja, 2002). Moreover, previous studies typically conceive obstacles as barriers to innovation, so that existing evidence on obstacles has been focused mostly on innovation as the main outcome of interest (Iammarino et al. 2009, D'Este et al. 2012, Pellegrino and Savona 2017), neglecting the detrimental role of obstacles on additional outcomes.

This study is the first one to investigate the joint role of both strategies and obstacles for explaining both innovation outcomes and economic performances (conditional on realized innovations) in a comprehensive framework. It extends existing knowledge in two key aspects. First, by focusing on firms' perception about the importance of the strategies they adopt, our approach allows for failures in pursuing the goals embedded in the strategy a firm adopts. Second, rather than focusing on barriers to innovation, it focuses on the barriers firms have to cope with while trying to reach their general goals. Those goals are broader than the sole innovation adoption.

As for the first aspect, it is very difficult to identify and to measure the presence of firms' strategies and the degree of their implementation. Often in the economics of innovation literature, authors consider the strategies a firm adopts as "revealed" by *ex-post* observed outcomes such as exports or innovations or patents. The main problem with "revealed" strategies is that they do not capture the strategies themselves, rather a result of the strategy. As a consequence, measuring the importance of a strategy based on outcomes rather than intentions, disregards the possibility that a company can fail to achieve the goals while implementing its strategy mix. For instance, a company that pursues a strategy aimed at exporting and/or innovating (*intention*) can fail in serving external markets or introducing any innovation (*outcome*). In order to overcome this identification issue, in-depth qualitative surveys and interviews have sometimes been exploited in the literature (e.g. Bamiatzi and Kirchmaier, 2014; PricewaterhouseCoopers, 2013; He and Wong, 2004), although firms may be reluctant to disclose certain aspects of their strategies. Also budgetary choices have been used to reveal the mix of strategies and priorities adopted by firms (Bierly and Chakrabarti, 1996), though they are typically more helpful to study cost-reducing strategies rather than those aimed at developing new markets and innovating.

As for the second aspect, it is important to recognize that firms are heterogeneous agents, and not all of them intend to grow (e.g. by increasing turnover, market share or size) and/or innovate. On the one hand, companies can be reluctant to grow beyond a certain size (typically varying according to the institutional setting), fearing that growth results in a loss of control, increase in administrative and coordination burden, and a substantive change in established organizational practices and culture (Coad, 2009). On the other hand, evidence provided in recent studies (e.g. Pellegrino and Savona, 2017) indicates that a relatively large share of non-innovating firms is not innovation-oriented,

i.e. does not intend to innovate due to lack of interest or because of recent innovation activity. At the same time, it is most likely that a part of firms that do not experience any growth and do not introduce any innovation are unsuccessful in meeting their goals either because they adopt an inappropriate strategy mix or face obstacles they are not able to cope with (or a combination of the two).

The analysis draws on the Community Innovation Survey (CIS), which provides information on a wide set of European firms. It particularly exploits the ad-hoc module of the 2012 CIS on the perceived importance of a various strategies and obstacles. The 2012 wave of the CIS asks firms to rate the importance of a set of strategies (related to market development, cost reduction and innovation) and obstacles (related to financial barriers, the structure of present or new markets, low demand and institutional obstacles). Differently from previous waves, it operationalises obstacles in relation to firms' goals (that may include or not the introduction of innovations) rather than limiting to consider obstacles as impediments towards innovation.

Figure 1 The strategies and obstacles in the analysis

STRATEGIES	OBSTACLES
Market development	Financial barriers
Cost reduction	Present or new markets structure
Innovation	Low demand
	Institutional obstacles

Regression models are estimated using performance variables as dependent variables, measures of the importance of obstacles and strategies as key independent variables and other potential co-factors (most importantly firm size, industry and country) as control variables. The sample comprises 37,150 companies in 14 European Member States[1] with a comparable informative set on the variables of interest.

The measures of performance are the introduction of product, process and any (including marketing and organizational) innovations (constructed according to the Oslo manual), and the percentage change in turnover, employment and labour productivity. The importance of specific strategies and obstacles are measured in two different ways. We first create variables indicating whether the firm assessed as important (degrees of importance 2 and 3) or not (0 and 1) the given strategies and obstacles. In order to lessen the concerns on the comparability of assessments across respondents given the intrinsic subjectivity of assessments, we also adopt a relative measurement that, by exploiting heterogeneity across answers within (rather than between) firms, captures whether the respondent assessed the given strategies and obstacles as the *most* important ones.

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[1] Bulgaria, Cyprus, Estonia, Croatia, Germany, Hungary, Italy, Latvia, Lithuania, Portugal, Romania, Slovakia, Slovenia and Sweden.

In particular, we adopt the so-called '*probit' (probability unit)* models for the occurrence of at least one product or process innovation, or any innovation (including also organizational and marketing), *linear regression* models for the average change in turnover, employment and labour productivity growth, and *quantile models* for the change in the turnover, employment and labour productivity for particularly high- and low-growth firms.

As strategies, obstacles and performance variables are measured over a common two-year time frame, the analysis provides reliable inference on correlations between variables observed at a single point-in-time. In order to make inference on causal relationships, by contrast, strategies and obstacles should be measured before innovation and growth outcomes, and the time lag should be long enough to allow outcomes to materialize due to a certain strategy. The issue may be mitigated by the fact that strategies can be considerably persistent over time, as shown by Tavassoli and Karlsson (2015) for innovation strategies. Nevertheless, in an ideal setting, panel data offering the possibility to track firms across multiple years would be necessary for making reliable inference on causal relationships.

A large part of the findings is clear-cut, i.e. robust to the use of different measurement methods of the importance of strategies and obstacles and in line with economic theory and previous evidence. For instance, the strategy *reduction of costs of operation* and the obstacles *lack of demand* and the *lack of adequate finance* are negatively associated with all outcomes. Some other findings, by contrast, provide a rather mixed picture because results vary when changing measurement methods. The difference in results observed when moving across the considered measurement methods suggests that the estimates of the association between outcome variable and the importance a firm assigns to strategies and obstacles could be influenced by the subjectivity of the respondents.

The remaining of the paper includes four sections. Section 2 outlines testable predictions on the relationships between strategy and obstacles and innovation and economic performance originating from a review of the relevant theoretical and empirical literature. Section 3 outlines the empirical strategy, i.e. the data and methods used in the empirical analysis. Section 4 presents and discusses the results, while Section 5 concludes.

2 Literature review and testable predictions

In this section, we review previous literature as to derive testable predictions on how growth and innovation outcomes are related with strategies firms adopt and obstacles they face. Table 1 summarizes the expected sign of the relationships of innovation and performance with strategies and Table 2 does the same for obstacles.

2.1 Strategies, innovation and firm performance

The management and economics literature provides theoretical and empirical insights on the relationships between strategic choices on firms' outcomes such as the introduction of innovations, turnover and employment growth. In line with Porter (1979 and 2008), this report considers strategies as important long-term objectives that help firms organize their daily routines and decisions in order to compete more successfully amidst an uncertain environment. Our data provides information on three general types of strategies: those aiming to develop new markets (within and outside Europe) that is often studied through exporting behaviour, those aiming to reduce (in-house operational and inputs') costs, and those aiming to introduce innovations, i.e. innovation strategies.

The relationship between *export* and economic performance as well as innovation has been the object of extensive research. An established finding is that, after controlling for observable characteristics, exporters grow faster than non-exporters in terms of both sales and employment (e.g. Bernard and Jensen, 1995 and 1999). Yet, empirical evidence typically shows causality from productivity to exporting but not the reverse. In other words, exporters are more productive than non-exporters and more productive firms self-select into export markets, while exporting does not necessarily improve productivity (see Wagner, 2007 for a literature review).

As for innovation, a positive association with *export* has been observed in a number of studies, and empirical evidence documents a bidirectional causal link. Several studies found evidence for the positive impact of exports on the various types of innovation, including product innovation (Bratti and Felice, 2012; Salomon and Shaver, 2005), process innovation (Damijan et al., 2010, which nevertheless found no significant relationships with product innovation), and technological as well as non-technological innovation (Gunday et al., 2011; Schmidt and Rammer, 2007). The typical channel, often referred to as "learning by exporting", rests on firms learning from new consumers and competitors in foreign markets, and adopting new production technologies subsequently enhances their productivity and performance. For the reverse impact, available evidence indicates that innovation has a positive effect on exports. This effect comes *indirectly* from the induced productivity increase by the earlier introduction of innovations that positively affects exports, and *directly* from the effect of new products on the propensity to export (Vanbeveren and Vandenbussche, 2010; Cassiman and Golovko, 2011).

The relationship between pursuing the strategic goal of *reducing costs* and firms performance and innovation propensity is rather complex. A cost-reduction strategy is commonly adopted by many companies, especially in mature markets where typically product price is the basis of competition (Utterback and Abernathy, 1975). Some studies show that such a strategy is positively associated, even in declining markets, with SMEs' sales growth (Grundström et al. 2012; Bamiatzi and Kirchmaier, 2014). Yet, it is obvious to consider that difficulties in performance amplify the importance of reducing costs. As for the relationships with innovation, Boone (2000) proposes a model to show that the extent to which rising competitive pressure influences innovation investments depends on the firm's efficiency level relative to that of its opponents. The model assumes that firms may choose to focus on their profit or their cost levels, arguing that competitive pressure increases investment in process innovation and at the same time reduces product innovation throughout the industry.

The other strategies considered in this study directly relate to some type of innovation, and the literature typically refers to them as *innovation strategies*. A distinctive characteristic of innovation strategies is the large uncertainty (related to future investments, the performance and cost of technology, and market viability), and consequently, the comparatively high probability that their adoption fails to achieve the desired innovation outcomes (Dodgson et al., 2008). In this context, *introducing new or significantly improved products* can be considered a product innovation strategy, which typically entails more radical changes, and *intensifying or improving the marketing of products* and *increasing organization flexibility/responsiveness* can be considered as marketing and organizational innovation strategies. *Building alliances with other enterprises or institutions* can be also thought as a specific type of organizational innovation strategy that concerns the external relationship of an enterprise with other enterprises, rather than internal changes in the organization itself (Armbruster et al, 2008).

Product innovation is generally shown to be beneficial for firm performance, in terms of sales (Cucculelli and Ermini, 2012; Grundström et al., 2012; Colombelli et al. 2013; Bamiatzi and Kirchmaier, 2014), employment (Cozza et al., 2012; Mason et al., 2012) and productivity (Hall et al., 2009) growth, though there is also evidence of a negative correlation with sales growth (Parker et al., 2010). Other innovation strategies such as intensifying or improving marketing of goods or services and increasing flexibility or responsiveness of the organization have been shown to be positively related with sales and employment growth (He and Wong, 2004; Zhou and Wit, 2009; Parker et al., 2010).

Successful performance of innovation on the market is intuitively associated with the success in *marketing* of the given product. In fact, not only product but also process innovators have been observed to incur in significant marketing expenditures (Manu and Sriram, 1996), which to a certain extent also depend on the concentration of the market (Kaiser, 2001).

Firms with *flexible organizational structure* have been shown to be better at product and process innovation than rigid firms (Utterback, 1979). At the same time, flexibility has a different meaning for different size of firms, and different firm size is associated with different kinds of innovation. Smaller firms are generally more flexible than larger firms (Acs and Audretsch, 1990), and may be more likely to introduce more radical or architectural, rather than incremental innovation (Henderson and Clark, 1990).

In the case of *organizational innovation*, moreover, the scale and time horizon of implementation can be significantly different from other types of innovation (i.e., a pilot project, limited to a small area of the enterprise, qualifies as an organizational innovation), which is why there could be no, lagged or even negative influences on the overall performance of enterprise in the shorter run as organizational changes may bring along a destruction of existing production capacities (Armbruster et al 2008).

Cooperation, finally, is a relevant strategy for reducing the influence of obstacles, as collaboration with external partners can create cost- and risk-sharing opportunities, allow to cope with the lack of skills and qualified personnel and can increase the capacity to enter new markets (Caloghirou et al., 2003; Hagedoorn et al., 2000). In addition to this, the presence of innovation barriers increases the probability of firms to engage in cooperation with different partners (Antonioli et al., 2016). It is therefore unsurprising that international operations and alliances are found to be positively related to firms' performance (e.g., Mohr et al., 2013) and innovation outcomes (Teece, 1992; Dittrich and Duysters, 2007).

In general terms, we expect to find that companies that follow a strategy to increase the flexibility or responsiveness of their organization (focus on intra-organizational changes) or building alliances with others (changes in inter-organizational practices) are more likely to report having organizational innovation, but inter-organizational changes may hamper product innovation in the short run.

Table 1 Predictions on the relationship between strategies, innovation and economic performance

Strategies	Sign of the predicted relationships with	
	Innovation	Economic performance
Developing new markets	+	+
Reducing in-house costs	- (product) and + (process)	+
Introducing new or significantly improved products	+	+
Intensifying or improving the marketing of products	+	+
Increasing organization flexibility/responsiveness	+ or -	+
Building alliances with other enterprises or institutions	+	+

2.2 Obstacles, innovation and firm performance

Previous literature has devoted considerable attention to investigate detrimental barriers that hamper innovation uptake and firm performance. We consider four broad groups of obstacles: financial barriers, those related to the structure of current or new markets (i.e. strong price competition, strong competition on product quality, reputation or brand, innovations by competitors, dominant market share held by competitor, and high cost of access to new markets), low demand, as well as institutional obstacles (lack of qualified personnel and high cost of meeting government regulations or legal requirements).

The presence of *financial barriers* has been probably the most studied barrier. Several studies covering different countries indicate the crucial role of access to financial resources for increasing sales (Beck et al., 2006; Olawale and Garwe, 2010; Ayyagari et al., 2007) and employment (Becchetti and Trovato, 2002) as well as for introducing innovation (Blanchard et al. 2013; Hall, 2002; Hottenrott and Peters, 2012; Mulkay et al. 2001; Harhoff, 1998; Mohnen et al. 2008; Gorodnichenko and Schnitzer, 2013; Savignac, 2008; Mancusi and Vezzulli, 2014). The detrimental effect of financial barriers on the introduction of innovations was found to be reinforced by the high degree of uncertainty that characterises innovation projects, their complexity and specificity (Canepa and Stoneman, 2007; Mina et al., 2013). Moreover, recent studies of the European Commission (2014) and D´Souza et al. (2014) identify a positive relationship between labour productivity growth and the lack of adequate finance.

Prevailing market conditions have also been shown to affect innovation and firm performance. Market structure is instead encompassing competition in the market, firm size as well as appropriability conditions. The obstacle *dominant market share held by competitor* is expected to hamper innovation and business performance. Conversely, strong competition could positively influence innovation while inhibiting firms' performance. The existence of well-established firms that dominate the market can be the cause of lock-ins that limit not only directly innovation but also, indirectly, market access (Unruh, 2000). Monopolistic markets typically deter radical innovations through a lack of competitive pressures, while incentivize incremental levels of innovation as to maintain market dominance (Aghion et al., 2005).

For innovation, the sign of the relationships with barriers related to accessing new markets cannot, by contrast, be predicted *ex ante* because of the presence of conflicting mechanisms related to market entry. This is the case of the high cost of access to new markets. If the cost of access is low, a firm could in principle enter in the new market (and steal the incumbent's market shares) by simply introducing a horizontally differentiated product, which is closer to the preferences of a relevant costumers share, or with no innovation at all by simply doing aggressive marketing campaign of the already existing products. Conversely, with high cost of access to new markets (e.g. because of saturation), a firm may be forced to innovate radically in order to get a

vertically differentiated product which is universally perceived to be the best one by all the consumers (and thus replaces the incumbent's old products which have become obsolete). This is also the case of the obstacles related to the innovation of competitors, which according to recent evidence could plausibly be negatively but also positively associated with innovation. In line with an open-innovation mode (Laursen and Salter, 2006 and 2014), innovative competitors may provide favorable conditions to innovate through cooperation and imitation.

Not only financial and market conditions, but also conditions related to demand and the institutional setting are documented to be crucial for innovation activities and firm performance.

Pellegrino and Savona (2017) and Garcia-Quevedo et al. (2014) provide recent empirical evidence on the detrimental impact of *sluggish demand*, the scarcity of qualified personnel and the presence of high cost of meeting administrative or legal requirements for innovation. The negative relationships between low demand and sales (Olawale & Garwe, 2010) and employment (Arrighetti and Lasagni, 2013) growth is also well documented.

The *availability of qualified personnel* with knowledge and organisational skills has been shown to be crucial for business success (Lee, 2014; Olawale & Garwe, 2010) and innovation (Gort and Klepper, 1982; Katila and Shane, 2005; D'Este et al., 2014). Interestingly, Hölzl and Janger (2014) show that the lack of skilled labour is strongly perceived as obstacle by firms close to the technological frontier, whereas firms far from the technological frontier perceive finance as a stronger obstacle.

Previous studies have also extensively documented the detrimental effect of the *high cost of meeting government regulations or legal requirements* on firm performances with respect to sales (Beck et al., 2006; Bravo-Biosca et al., 2013) and employment (Bravo-Biosca et al., 2013; D'Souza et al., 2014) growth.

Several studies show that the typically detrimental impact of most barriers on innovation and firm performance has relevant specificities. For instance, financial constraints are more severe for high-tech sectors (Canepa and Stoneman, 2007; Mina et al., 2013) and smaller firms (Watson and Wilson, 2002; Beck et al., 2008; Daskalakis and Psillaki, 2008; Degryse et al., 2012; Scherer and Harhoff, 2000; Freel, 2007; Won Kang et al., 2008; Mina et al., 2013). Innovative SMEs often find it the hardest to obtain finance (Mina et al., 2013), as they tend to be more risk lovers, and have business models more difficult to evaluate. More in general, there is converging evidence that SMEs are the group of firms most severely affected by financial and institutional constraints (e.g., Beck et al. 2005). Yet, SMEs typically account for a large share of job creation, and perform high sales and employment growth rates (Ayyagari et al. 2011). In this study, we focus on the average relationships between strategies and obstacle and innovation and firm performance, and leave to future research the study of potential specificities, for instance by size and closeness to the technological frontier.

Table 2 Predictions on the relationship between obstacles, innovation and economic performance

Obstacles	Sign of the predicted relationships with	
	Innovation	Economic performance
Strong price competition	+	+ or -
Strong competition on product quality, reputation or brand	+	-
Lack of demand	-	-
Innovations by competitors	+ or -	-
Dominant market share held by competitor	-	-
Lack of adequate personnel	-	-
Lack of adequate finance	-	-
High cost of access to new markets	+ or -	-
High cost of meeting government regulations or legal requirements	-	-

3 The empirical design: empirical strategy, sample selection and variables construction

The empirical analysis contained in this study is based on firm-level data collected by the Community Innovation Survey (CIS). Every two years CIS collects data on a wide range of aspects related to firms' innovation activities and performances over the three years prior to the interview. A major strength of CIS is that it collects data for very large samples of firms, representative of all manufacturing and service industries across Europe. This paper uses data from the 2012 CIS, i.e. the most recent CIS at the moment of writing, to construct a homogeneous cross-national sample of 37,150 companies with a comparable informative set on the variables of interest. By including an ad-hoc module asking respondents to assess the importance of a set of strategies and obstacles, the 2012 CIS provides a unique dataset to reach our objectives.

The preparation of the data entailed various steps. Since various question items and the coverage of certain industries (as well as the implementation) of the survey is left to the choice of each country on a voluntary basis, we first include only firms operating in industries covered in all countries, so that we reduce the initial sample by 21,806 firms. We exclude the agriculture and construction industries, as well as some services industries such as food, accommodation and real estate services. We additionally exclude firms with no information on turnover or employment in any of the years 2010 and 2012 (implying the exclusion of all Finnish companies as no information on performance in 2010 was collected in Finland), as no measure of the change across time in performance could be measured for them; those classified as micro firms (i.e. with less than 10 employees or 1 million euro of turnover) either in 2010 or 2012 (or in both years) and those having undergone a merger with or an acquisition of another company between 2010 and 2012, as to purge the measures of change in performance form spurious variation; and those with no information on strategies and obstacles (implying the exclusion of all Belgian, Czech, French, Luxembourgish, Norwegian and Spanish companies as information on obstacles, and in most cases strategies were not collected in these countries), as their relationship with innovativeness and change in performance is the object. These additional changes implied an overall reduction of the sample by further 88,564 companies. We finally excluded additional 316 firms with anomalous values in the growth variables through winsorization by trimming the 0.5% upper tail of the distribution of the change across time in turnover and employment, while the final sample size is obtained after the dropping of further 317 companies missing values in one or more of the variables of interest.

After all steps have been implemented, we obtain a consistent cross-national sample of 37,150 companies out of the 148,153 totally covered by the 2012 CIS. Using the sample weights provided by Eurostat to take into account the stratified sample design, our sample of firms refers to a universe of 214,615 companies. Following the praxis of cross-country studies using CIS data (e.g. Evangelista and Vezzani, 2011; Hashi and Stojčić 2013), we report results based on unweighted firm-level data. Yet, results from the statistical and econometric analysis have been obtained with both unweighted and weighted data, and the findings of the analysis are reassuringly similar and robust with respect to the use of weights.

We capture firms' performance trough measures of innovativeness (constructed by applying standard Oslo Manual's definitions, OECD/Eurostat, 2005) and the change of economic variables (turnover, employment and labour productivity defined as the ratio between them) between 2010 and 2012. As shown in Table 3, about 27% of firms in the sample report to have introduced at least one product or process and 48% to not have introduced any innovation (including marketing and organizational innovations) between 2010 and 2012. As for changes across time, firms in our sample improve their performance with average rises by about 12% in turnover, 5% in employment and 9% in labour productivity.

Table 3 The performance of the companies included in the sample

Innovators prevalence (weighted %)	
Product innovators	27%
Process innovators	27%
Organizational innovators	32%
Marketing innovators	30%
Non-innovators	48%
% change in turnover between 2010 and 2012	12%
% change in employment between 2010 and 2012	5%
% change in labour productivity between 2010 and 2012	9%

Notes: the sample includes 37,150 companies from the 2012 Community Innovation Survey.

Apart from the core questions on innovation and growth performance, firms surveyed by CIS 2012 replied to an additional set of questions where they had to rate on a 0 to 3 scale a series of 8 specific strategies and 9 specific obstacles they face with regards to reaching their goals. We cannot dismiss the possibility that firms found it difficult to interpret some of the questions on strategies and obstacles. In contrast to the core module of the CIS, firms may be less familiar with the questions of the ad-hoc module. Yet, most of them are intuitive. Figure 2 shows the wording of the questions and the specification of the set of strategies and obstacles to be assessed. The selected strategies and obstacles cover a wide set of issues. Strategies can be grouped in three broad categories related to market development, cost reduction and innovation strategies, obstacles in four ones related to financial barriers, the structure of present or new market, low demand and institutional obstacles.

We measure the importance of specific strategies and obstacles in two different ways. As we are interested in assessing the presence of an obstacle, we first simply dichotomize the categorical variables shown in Figure 2 and consider as important those strategies and obstacles whose importance is perceived as medium or high (score respectively equal to 2 and 3, as compared to 1 for and 0 for no importance).[2] One concern with this measure of importance based on absolute scores is that the intrinsic subjectivity of assessment limits the comparability of answers across respondents. In other words, the fact that different firms assign the same score to a given strategy (or obstacle) does not imply the equal importance of such a strategy since the importance of absolute scores may differ across firms (e.g. because of different anchor points and scales of the respondents, Tourangeau et al. 2000).

In order to deal with the issue, we also construct a *relative measure* of the degree of importance of strategies and obstacles that exploits heterogeneity across answers within (rather than between) firms by jointly considering the full set of answers of the same firm to the questions on strategies and obstacles. In particular, we dichotomize the categorical variables shown in Figure 2 in order to consider as important those strategies and obstacles that received the largest scores across all strategies and obstacles. The absolute measurement of the perceived importance of obstacle provides more comparable variables across firms than relative measures under the assumption of some degree of internal coherence in respondents' behaviour.

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[2] This corresponds to the way Eurostat reports these statistics based on CIS2012.

11.2 During 2010 to 2012, how important were each of the following strategies for reaching your enterprise's goals?

	Degree of Importance				
	High	Medium	Low	Not relevant	
	3	2	1	0	
Developing new markets within Europe*	☐	☐	☐	☐	STMKEUR
Developing new markets outside Europe*	☐	☐	☐	☐	STMKOTH
Reducing in-house costs of operation	☐	☐	☐	☐	STIHCOS
Reducing costs of purchased materials, components or services	☐	☐	☐	☐	STEXCOS
Introducing new or significantly improved goods or services	☐	☐	☐	☐	STINNPD
Intensifying or improving the marketing of goods or services	☐	☐	☐	☐	STMKT
Increasing flexibility / responsiveness of your organisation	☐	☐	☐	☐	STFLEX
Building alliances with other enterprises or institutions	☐	☐	☐	☐	STALL

11.3 During 2010 to 2012, how important were the following factors as obstacles to meeting your enterprise's goals?

	Degree of Importance				
	High	Medium	Low	Not relevant	
	3	2	1	0	
Strong price competition	☐	☐	☐	☐	OBSPR
Strong competition on product quality, reputation or brand	☐	☐	☐	☐	OBSQL
Lack of demand	☐	☐	☐	☐	OBSLDE
Innovations by competitors	☐	☐	☐	☐	OBSCP
Dominant market share held by competitors	☐	☐	☐	☐	OBSDMK
Lack of qualified personnel	☐	☐	☐	☐	OBSPRS
Lack of adequate finance	☐	☐	☐	☐	OBSFIN
High cost of access to new markets	☐	☐	☐	☐	OBSAMK
High cost of meeting government regulations or legal requirements	☐	☐	☐	☐	OBSREG

Notes: taken from Section 11 of the 2012 Community Innovation Survey questionnaire.

Figure 3 describes the sample in relation to the assessment of firms on the importance of obstacles and strategies. The prevalence of firms deeming specific strategies and obstacles as important reduce as expected when moving from absolute to relative measures of importance by about 6 (for the strategy of developing new markets outside Europe) up to 21 (for the strategy of intensifying or improving the marketing of goods or service, and the obstacle related to dominant market share held by competitors) percentage points. Yet, the assessments of importance show broadly similar distributions over the absolute and relative definitions.

The strategies related to the reduction of costs and increase of flexibility and the obstacle related to the presence of strong price competition are those most frequently assessed as important (with percentages varying between 73% and 81% using the absolute measurement of importance and between 51% and 69% using the relative one). By contrast, the strategies related to the development of new markets and alliances and the obstacles related to the innovativeness of competitors and the lack of

qualified personnel are the least frequently assessed as important (with percentages ranging between 35% and 44% using the absolute measurement of importance and between 22% and 34% using the relative one). It is plausible that this distribution also reflects the timing of the 2012 CIS, which asks respondents to provide information on the three years period between 2010 and 2012, i.e. just in the aftermath of the economic crisis. It would be therefore of interest the replication of the ad-hoc module on strategies and obstacles in one of next CIS waves, so as to assess the influence of the business cycle on the assessment of the importance of obstacles and strategies.

Figure 3 The assessment on the importance of obstacles and strategies

	Percentage of firms assessing a given obstacle/strategy as:	
	important (assigning values 2 or 3 in the 0 to 3 scale)	*the most important* (assigning the maximum value across alternative strategies/obstacles)
	Absolute measurement	**Relative measurement**
Strategies		
Reducing in-house costs of operation	81%	69%
Reducing costs of purchased materials/components/services	77%	63%
Increasing flexibility/responsiveness of your organisation	73%	51%
Introducing new or significantly improved goods/services	58%	39%
Intensifying or improving the marketing of goods or services	58%	37%
Developing new markets within Europe	44%	34%
Building alliances with other enterprises or institutions	36%	24%
Developing new markets outside Europe	35%	29%
Obstacles		
Strong price competition	77%	68%
Lack of demand	64%	45%
Strong competition on product quality, reputation or brand	57%	37%
High cost of meeting administrative or legal requirements	53%	39%
Dominant market share held by competitors	52%	31%
High cost of access to new markets	47%	31%
Lack of adequate finance	46%	33%
Lack of qualified personnel	39%	27%
Innovations by competitors	36%	22%

Notes: the sample includes 37,150 companies from the 2012 Community Innovation Survey.

In order to test for the association between firm performance and assessments on the importance of strategies and obstacles, we estimate regression models using performance variables (y_e) as dependent variables, measures of the importance of strategies (S_e) and obstacles (O_e) as key independent variables and other potential co-factors (most importantly firm size, industry and country) as control variables (X_e). The empirical strategy takes the following general form:

$$y_e = f(S_e, O_e, X_e) + u_e \hspace{4cm} (1)$$

where e indexes enterprises, and $f()$ and u_e indicates the functional form and error term defining the specific regression model adopted for each dependent variable.

Different estimators are used in order to account for the specific nature of each dependent variable. More specifically, probit models are exploited to assess the occurrence of at least one product or process innovation, or any innovation, linear regression models for the average change in turnover, employment and labour productivity growth, and quantile models for the change in the turnover, employment and labour productivity for particularly high- and low-growth firms.

It is worth repeating that, due to the cross-sectional nature of the data, the adopted empirical strategy provides reliable inference on multivariate correlations between variables at a single point-in-time, and no causal interpretation can be associated with the estimated relationships.

Figure 4 describes the composition of the sample with respect to the control variables used in the regression analysis. Firms are based in 14 European Union (EU) Member States (MS) - namely Bulgaria, Cyprus, Estonia, Croatia, Germany, Hungary, Italy, Latvia, Lithuania, Portugal, Romania, Slovakia, Slovenia and Sweden – with Italy being the most represented MS (22%). They operate in the mining and utilities industry, the manufacturing industry (further divided according to their technological level in line with the Eurostat classification of High-tech industry and Knowledge-intensive services), the wholesale trade industry, ICT services, transportation and storage services, and financial, insurance and professional activities.[3] Throughout all regression models in the empirical analysis, we control for country and industry fixed effects.[4] We also control for firm size (based on 2010 employment, with 47%, 39% and 16% of firms being small, medium and large respectively), for their activity in international markets (with 61% serving international markets), as well as for being part of an enterprise group (with 26% being part of a domestic and 17% of an international group).

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[3] Table A1 in the Statistical Annex documents in detail the association of the categories in the classification of industries adopted in this study with the NACE Rev. 2 codes at the 1- and 2-digit levels.

[4] We also used specifications with controls for the interaction of countries and industries, which provided nearly identical results to those obtained using the more parsimonious specification with industry and country controls, yet did not reach convergence in a few quantile regressions.

Figure 4 The characteristics of the companies included in the sample

Firms' characteristics	Prevalence
Country of headquarter	
IT	22%
RO	12%
BG	11%
PT	10%
DE	8%
HU	8%
SE	8%
SK	5%
HR	4%
SI	4%
EE	3%
LT	3%
CY	2%
LV	2%
Industry	
Wholesale trade	21%
Low-technology manufacturing	19%
Medium-low-technology manufacturing	14%
Medium-high- and high-technology manufacturing	13%
Transportation and storage services	10%
Mining and utilities	9%
Financial, insurance and professional activities	9%
ICT services	6%
Size	
Small	47%
Medium	39%
Large	14%
Internationalisation	
Serving domestic markets	39%
Serving international markets	61%
Being part of an enterprise group	
Not part of an enterprise group	57%
Part of a domestic group	26%
Part of an international group	17%

Notes: the sample includes 37,150 companies from the 2012 Community Innovation Survey.

4 Results

This section describes the results of the analysis. Table 4 reports the sign of the parameter estimates of strategies and obstacles obtained using probit regressions on innovation outcomes and linear regressions on the change in economic performances. Table 5 reports the sign of the parameter estimates of strategies obtained using linear and quantile regressions on the change in economic performances, in order to compare the correlation of average vis-a-vis particularly high- and low-growth firms. Table 6 does the same as Table 5 but for obstacles.

As for strategies, our findings indicate that the perception of *reducing in-house costs of operation* as important is the only case of a strategy negatively associated with all outcomes, i.e. product, process and any innovations as well as employment and turnover growth. It is also negatively associated with the change in labour productivity of high-growth firms (75% and 90% percentiles). The evidence indicates that this strategy provides limited support in promoting firms potential, and its assessment as important could be taken as a signal of structural issues obstructing positive performances.

The strategy of *increasing flexibility and responsiveness* is, on the contrary, positively associated with the introduction of process and any innovations and with turnover and employment growth (uncorrelated with labour productivity growth) for all firms across the growth distribution, but negatively associated with product innovation. The evidence indicates that this strategy is in general beneficial in promoting firms performance, but inappropriate to succeed in more radical innovations such as product innovation.

This goal seems better achieved, unsurprisingly, by the firms that explicitly consider as important the strategy of *introducing new or significantly improved products*, which display positive correlations with all innovation outcomes and with change in employment (but uncorrelated with turnover change). Product innovation is also positively associated with the strategy of *developing new markets* within and outside Europe. While the strategy of developing new markets within Europe is positively associated also with the introduction of process and any innovations and turnover and employment change, the strategy of developing new markets outside Europe is, by contrast, not associated with positive outcomes but in the case of most radical innovations (i.e. product innovations) and change in turnover for very high-growth firms (90% percentile). The evidence suggests that this strategy could reveal to be too ambitious for most firms.

Finally, we also observe a positive correlation between the strategy of *building alliances* with other enterprises and institutions and the changes in turnover, employment and labour productivity for high-growth firms (75% and 90% percentiles).

As for obstacles, firms considering the *lack of demand* or the *lack of adequate finance* as important have bad performance in all innovation outcomes and in the turnover and employment change. The evidence is consistent with all the existing literature on obstacles to innovation, as tight demand and financial constraints negatively affect investments and hamper firms' ability to translate innovation activities into new innovation outputs. Yet, we observe that the correlation between the lack of adequate finance and the change in turnover and employment turns from being negative to being not significant for very high-growth firms (90% percentile), suggesting that this obstacle is less relevant for better performing firms, which can plausibly rely on larger amounts of internal financial resources (e.g. cash flow). As for the change in labour productivity, lack of demand is negatively related to it, while the lack of adequate finance is positively related for high-growth firms (75% and 90% percentiles) and negatively for low-growth firms.

High cost of access to new markets is positively associated to innovation outputs. The result is consistent with a strategy of entering in new markets with the minimum innovation effort, that is, when the cost of access is low, a firm could in principle enter in the new market with simply horizontal differentiation or no innovation at all (by simply

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doing aggressive marketing campaign). Conversely, with high cost of access to new markets the last resort (and more costly) option for a firm to enter is with vertical differentiation and radical innovation (resulting in a higher innovation effort).

Perceiving the *lack of qualified personnel* as an important obstacle is positively correlated with turnover, employment and labour productivity changes. The finding could be explained arguing that firms that perform better are more sensitive about the difficulties of finding skilled personnel. This would be in line with findings of recent studies pointing out that knowledge obstacles (D'Este et al, 2012; Pellegrino and Savona, 2017), such as the lack of qualified personnel, are found to play more a *revealed* role, i.e. exerting a negative effect only for firms that do actually engage in innovation activities, rather than a *deterring* role, i.e. exerting a negative effect preventing firms from engaging in innovation activities. All in all, the innovation experience can thus be interpreted as a step that helped innovative firms to learn how to overcome the obstacle, turning the sign from a negative to a positive one.

We also observe a few inconsistent results. The *high cost of meeting administrative or legal requirements* is uncorrelated with most outcomes, but for product innovation (with which the correlation is negative) and employment change (with which the correlation is positive, especially for low-growth firms). *Dominant market share held by competitors* is negatively associated to innovation outputs when we use the absolute measurement. This is consistent with part of the existing literature, as the existence of established firms that dominate the market can create path dependence and lock-ins that hamper innovation, as well as impede market access for new (potentially innovative) firms. This market dominance barrier could result in weak competitive pressure and low innovation incentives in already established firms (also because of the fear of cannibalization of their existing profits), which is coherent with low innovation and a stable outlook. Yet, the negative associate vanishes turning to be not significant when using the relative method. Analogous inconsistencies across measurement methods are observed for the correlations of the strategy s*trong price competition* and obstacle *innovation by competitors*, so that we are unable to identify the sign of the correlation in spite of plausible explanations for both a positive and a negative link with innovation[5]. We finally notice that *strong competition on product quality, reputation or brand* is typically not associated with innovation outcomes, positively associated with employment changes, and shows inconsistent correlations (not significant and positive) with turnover change when the measurement methods varies.

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[5] A positive correlation of innovation by competitors with innovation outcomes may appear at a first glance this result might be seen as counter-intuitive, a closer look into the so called "Open Innovation" literature allows appreciating this finding. Laursen and Salter (2006) seminal contribution acknowledges external information sources and cooperation in R&D with external partners (including competitors) as a source of innovation. Being a source of innovation, innovations developed by competitors can turn to be an innovation source for the firm in case the firm is capable of transforming and manage such knowledge. The positive sign is thus reasonable and it indicates there might be an "open innovation" mode at stake. Furthermore, a further positive side effect of this open innovation mode, is that it can also allow to cope with the lack of skills and qualified personnel (Caloghirou et al. 2003) and it can increase the capacity to enter new markets (Hagedoorn et al. 2000).

Table 4 Results of probit and linear regressions on innovation behaviour and economic performance

	Product innovation		Process innovation		Any innovation		Turnover change		Employment change		Labour productivity change	
	Measurement of obstacles and strategies											
	absolute	relative	absolute	relative	absolute	relative	absolute	relative	absolute	relative	absolute	relative
Strategies												
Developing new markets within Europe	++	n.s.	+++	+	++	n.s.	+++	+++	+++	+++	n.s.	n.s.
Developing new markets outside Europe	+++	+++	-	--	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Reducing in-house costs of operation	---	---	--	---	---	---	---	---	---	---	-	-
Reducing costs of purchased materials/components/services	---	---	n.s.	---	---	---	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Introducing new or significantly improved products	+++	+++	+++	+++	+++	+++	n.s.	n.s.	+	+	n.s.	-
Intensifying or improving the marketing of products	+++	n.s.	n.s.	n.s.	+++	+++	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Increasing flexibility/responsiveness	---	---	+++	+++	+++	+++	+++	+++	+++	+++	n.s.	n.s.
Building alliances with other enterprises or institutions	n.s.	---	n.s.	---	+++	---	++	n.s.	n.s.	n.s.	+++	+
Obstacles												
Strong price competition	n.s.	--	n.s.	n.s.	++	-	n.s.	---	n.s.	---	n.s.	--
Strong competition on product quality, reputation or brand	+	n.s.	n.s.	-	n.s.	n.s.	n.s.	+++	++	+++	n.s.	n.s.
Lack of demand	---	---	---	---	---	---	---	---	---	---	---	---
Innovations by competitors	+++	-	++	n.s.	+++	---	n.s.	++	--	n.s.	+	+++
Dominant market share held by competitors	---	n.s.	---	n.s.	-	-	n.s.	n.s.	-	n.s.	n.s.	+++
Lack of qualified personnel	n.s.	---	++	--	n.s.	---	+++	+++	+++	+++	+	++
Lack of adequate finance	---	---	---	---	---	---	---	---	---	---	n.s.	n.s.
High cost of access to new markets	+++	+	+	n.s.	+++	++	--	n.s.	n.s.	-	n.s.	n.s.
High cost of meeting administrative or legal requirements	---	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	+	+++	-	n.s.

Legend: +++, ++, +   positive correlation significant respectively at the 1%, 5% or 10% level

             ---, --, -   negative correlation significant respectively at the 1%, 5% or 10% level

             n.s.   correlation not significantly different from zero

Notes: results from probit regressions on innovation probabilities and linear regressions estimated on a sample of 37,150 companies. All models control for the company being small or medium on the basis of the average number of employees in 2010 (large firms are the reference category), being part of an enterprise group with head office within or outside the country (firms that are not part of a group are the reference category), serving international markets, , as well as for the country and industry of activity. Linear models also control for the company having introduced a product, process, organizational, marketing or any of the mentioned innovations between 2010 and 2012. Significance is based on robust standard errors. Parameter estimates with associated standard errors and model statistics are reported in the Statistical Annex.

Table 5 Results of linear and quantile regressions on the relationships between economic performances and strategies

	Regression method	Turnover change		Employment change		Labour productivity change	
		Measurement of obstacles and strategies					
		absolute	relative	absolute	relative	absolute	relative
Strategies							
Developing new markets within Europe	ols	+++	+++	+++	+++	n.s.	n.s.
	quantile 90%	++	+++		+++	n.s.	n.s.
	quantile 75%	+++	+++	+++	+++	+++	n.s.
	quantile 50%	+++	+++	+++	+++	+++	++
	quantile 25%	+++	++	++	++	n.s.	n.s.
	quantile 10%	++	n.s.	n.s.	n.s.	+	n.s.
Developing new markets outside Europe	ols	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 90%	++	n.s.		n.s.	+++	+++
	quantile 75%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 50%	n.s.	n.s.	n.s.	n.s.	n.s.	--
	quantile 25%	n.s.	n.s.	n.s.	n.s.	---	---
	quantile 10%	--	---	n.s.	n.s.	---	---
Reducing in-house costs of operation	ols	---	---	---	---	-	-
	quantile 90%	---	---		---	---	--
	quantile 75%	---	---	---	---	-	--
	quantile 50%	---	---	---	---	---	-
	quantile 25%	---	---	---	---	n.s.	n.s.
	quantile 10%	---	---	---	---	n.s.	n.s.
Reducing costs of purchased materials/ components/ services	ols	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 90%	n.s.	n.s.		n.s.	n.s.	n.s.
	quantile 75%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 50%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 25%	n.s.	n.s.	n.s.	+	n.s.	n.s.
	quantile 10%	n.s.	n.s.	n.s.	+	n.s.	n.s.
Introducing new or significantly improved goods/ services	ols	n.s.	n.s.	+	+	n.s.	-
	quantile 90%	n.s.	n.s.		n.s.	-	---
	quantile 75%	n.s.	n.s.	n.s.	n.s.	n.s.	---
	quantile 50%	+	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 25%	+++	n.s.	+++	+++	++	n.s.
	quantile 10%	++	n.s.	+++	+	+++	n.s.
Intensifying or improving the marketing of goods or services	ols	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 90%	n.s.	n.s.		n.s.	---	n.s.
	quantile 75%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 50%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 25%	n.s.	n.s.	++	n.s.	n.s.	n.s.
	quantile 10%	n.s.	+++	++	n.s.	n.s.	n.s.
Increasing flexibility/ responsiveness of your organisation	ols	+++	+++	+++	+++	n.s.	n.s.
	quantile 90%	++	+++		+++	n.s.	n.s.
	quantile 75%	++	+++	+++	+++	n.s.	n.s.
	quantile 50%	+++	+++	+++	+++	n.s.	n.s.
	quantile 25%	+++	+++	+++	+++	n.s.	n.s.
	quantile 10%	+++	++	+++	++	n.s.	n.s.

	Regression method	Turnover change		Employment change		Labour productivity change	
		Measurement of obstacles and strategies					
		absolute	relative	absolute	relative	absolute	relative
Strategies							
Building alliances with other enterprises or institutions	ols	++	n.s.	n.s.	n.s.	+++	+
	quantile 90%	+++	++		n.s.	+++	+
	quantile 75%	+++	+++	+++	n.s.	++	++
	quantile 50%	n.s.	n.s.	n.s.	n.s.	n.s.	++
	quantile 25%	n.s.	n.s.	--	n.s.	n.s.	n.s.
	quantile 10%	---	n.s.	---	---	n.s.	n.s.

Legend: +++, ++, +   positive correlation significant respectively at the 1%, 5% or 10% level

‒‒‒, --, -   negative correlation significant respectively at the 1%, 5% or 10% level

n.s.   correlation not significantly different from zero

Notes: results from linear and quantile regression models on the change in economic performances estimated on a sample of 37,150 companies. The models control for the company being small or medium on the basis of the average number of employees in 2010 (large firms are the reference category), being part of an enterprise group with head office within or outside the country (firms that are not part of a group are the reference category), serving international markets, having introduced a product, process, organizational, marketing or any of the mentioned innovations between 2010 and 2012, as well as for the country and industry of activity. Significance is based on robust standard errors.

Table 6 Results of linear and quantile regressions on the relationships between economic performances and obstacles

	Regression method	Turnover change		Employment change		Labour productivity change	
		Measurement of obstacles and strategies					
		absolute	relative	absolute	relative	absolute	relative
Obstacles							
Strong price competition	ols	n.s.	---	n.s.	---	n.s.	--
	quantile 90%	n.s.	---		---	--	---
	quantile 75%	-	---	n.s.	---	n.s.	--
	quantile 50%	--	---	n.s.	---	n.s.	-
	quantile 25%	n.s.	--	n.s.	n.s.	n.s.	n.s.
	quantile 10%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Strong competition on product quality, reputation or brand	ols	n.s.	+++	++	+++	n.s.	n.s.
	quantile 90%	n.s.	+++		+++	n.s.	n.s.
	quantile 75%	+++	+++	+++	+++	n.s.	+++
	quantile 50%	+++	+++	+	+++	n.s.	++
	quantile 25%	n.s.	+++	++	+++	n.s.	++
	quantile 10%	n.s.	++	n.s.	+++	n.s.	++
Lack of demand	ols	---	---	---	---	---	---
	quantile 90%	---	---		---	---	---
	quantile 75%	---	---	---	---	---	---
	quantile 50%	---	---	---	---	---	---
	quantile 25%	---	---	---	---	---	---
	quantile 10%	---	---	---	---	---	---
Innovations by competitors	ols	n.s.	++	--	n.s.	+	+++
	quantile 90%	n.s.	++		n.s.	n.s.	++
	quantile 75%	n.s.	+	n.s.	n.s.	++	+++
	quantile 50%	n.s.	+++	n.s.	n.s.	+++	+++
	quantile 25%	++	+++	n.s.	++	+++	+++
	quantile 10%	n.s.	n.s.	n.s.	n.s.	++	++

Dominant market share held by competitors	ols	n.s.	n.s.	-	n.s.	n.s.	+++
	quantile 90%	n.s.	n.s.		n.s.	n.s.	+
	quantile 75%	n.s.	++	n.s.	n.s.	n.s.	++
	quantile 50%	n.s.	++	-	n.s.	n.s.	+
	quantile 25%	---	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 10%	--	n.s.	n.s.	n.s.	n.s.	n.s.
Lack of qualified personnel	ols	+++	+++	+++	+++	+	++
	quantile 90%	+++	+++		+++	++	++
	quantile 75%	+++	+++	+++	+++	+	++
	quantile 50%	+++	+++	+++	+++	+++	+++
	quantile 25%	+++	+++	+++	+++	+++	+++
	quantile 10%	+++	+++	+++	+++	+++	+++
Lack of adequate finance	ols	---	---	---	---	n.s.	n.s.
	quantile 90%	n.s.	n.s.		n.s.	+++	+++
	quantile 75%	---	---	---	---	+	n.s.
	quantile 50%	---	---	---	---	--	--
	quantile 25%	---	---	---	---	---	---
	quantile 10%	---	---	---	---	---	---
High cost of access to new markets	ols	--	n.s.	n.s.	-	n.s.	n.s.
	quantile 90%	--	n.s.		n.s.	n.s.	n.s.
	quantile 75%	---	n.s.	n.s.	n.s.	n.s.	n.s.
	quantile 50%	--	n.s.	--	n.s.	n.s.	n.s.
	quantile 25%	--	n.s.	---	---	n.s.	++
	quantile 10%	---	n.s.	---	---	---	n.s.
High cost of meeting administrative or legal requirements	ols	n.s.	n.s.	+	+++	-	n.s.
	quantile 90%	n.s.	n.s.		+	-	n.s.
	quantile 75%	++	+	n.s.	++	n.s.	n.s.
	quantile 50%	n.s.	+++	++	+++	+	n.s.
	quantile 25%	n.s.	+++	+++	+++	n.s.	n.s.
	quantile 10%	+	++	+++	+++	n.s.	n.s.

Legend: +++, ++, + positive correlation significant respectively at the 1%, 5% or 10% level

---, --, - negative correlation significant respectively at the 1%, 5% or 10% level

n.s. correlation not significantly different from zero

Notes: results from linear and quantile regression models on the change in economic performances estimated on a sample of 37,150 companies. The models control for the company being small or medium on the basis of the average number of employees in 2010 (large firms are the reference category), being part of an enterprise group with head office within or outside the country (firms that are not part of a group are the reference category), serving international markets, having introduced a product, process, organizational, marketing or any of the mentioned innovations between 2010 and 2012, as well as for the country and industry of activity. Significance is based on robust standard errors.

5 Conclusions

The study deals, in a novel way, with the joint role of strategies and obstacles for explaining both innovation outcomes and performance. It provides fresh evidence on the associations between perceived (rather than revealed) strategies and obstacles to goals (rather than to innovation) on the one side and key policy outcomes (innovation and growth) on the other one. Due to the cross-sectional nature of the data, findings cannot be interpreted in terms of causal relationships. A large part of the findings are clear-cut, i.e. robust to the use of different measurement methods of the importance of strategies and obstacles and in line with economic theory and previous evidence. Some other findings, on the contrary, provide a rather mixed picture because results vary when changing measurement methods.

As for strategies, the *reduction of costs of operation* is negatively associated with all outcomes, and can be seen as a reaction to business problems. The *flexibility and responsiveness of the organization* is, on the contrary, positively related to turnover and employment growth and process innovation, but negatively related to product innovation. Firms that consider important the *introduction of new or significantly improved products* have, as expected, the best innovation performance, yet the association with turnover and employment growth is hardly significant. High- growth firms that consider important the strategy of *building alliances* with other enterprises and institutions have better economic performance.

As for obstacles, perceiving the *lack of demand* or the *lack of adequate finance* as important is associated with poor performance in all innovation and growth outcomes. Interestingly, the association turns to be not significant for the *lack of adequate finance* (just) in the case of very high-growth firms, suggesting that this obstacle is less relevant for the best performing firms. *High cost of access to new markets* is positively correlated with innovation outputs and with product innovation in particular, consistently with entry strategies based on vertical differentiation and radical innovation resulting in a higher innovation effort in the case of high costs of access to new markets. Perceiving the *lack of qualified personnel* as an important obstacle is positively correlated with turnover, employment and labour productivity changes, which we explain arguing that firms that perform better are more sensitive about the difficulties of finding skilled personnel.

The evidence is mixed when looking at strategies aimed at *developing new markets*, the institutional obstacle *high cost of meeting administrative or legal requirements* as well as some obstacles related to the market structure, in particular *dominant market share held by competitors*, s*trong price competition*, *innovation by competitors*, and *strong competition on product quality, reputation or brand*. In most of these cases we observe that the sign of the estimated correlations changes when considering the same outcome. The difference in results observed when moving across the considered measurement methods suggests that the estimates of the association between outcome variable and the importance a firm assigns to strategies and obstacles could be influenced by the subjectivity embedded in firms' assessments. This issue may be alleviated by adopting instruments developed in the survey literature in order to increase the comparability of assessments across respondents, such as anchoring vignettes (King et al, 2004).

Overall, point out that the firms pursuing cost reduction strategies and perceiving the lack of demand and of adequate finance as important obstacles experience poor performance. By contrast, those pursuing adaptability strategies and perceiving the lack of qualified personnel as an important obstacle grow faster, and those with explicit product innovation strategies innovate more. Moreover, the results indicate specific needs of high-growth enterprises that, in comparison with other firms, appear less sensitive about financial constraints, more interested in the availability of skilled labour and benefiting more from cooperative strategies.

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Statistical Annex

Table A1 The classification of industries adopted in the empirical analysis

Industry category	NACE Rev. 2 codes	
	1-digit level	**2-digit level**
Mining and utilities	B, D and E	All
Low-technology manufacturing	C	10 to 18, 31 and 32
Medium-low-technology manufacturing	C	19, 22 to 25 and 33
Medium-high- and high-technology manufacturing	C	20 and 27 to 30 (medium-high-), 21 and 26 (high-)
Wholesale trade service	G	46
Transportation and storage services	H	All
ICT services	J	All
Financial, insurance and professional activities	K and M	All

Notes: the classification is created by the authors in accordance with, for the manufacturing industries, the Eurostat definition of High-tech industry and Knowledge-intensive services http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf.

Table A2 Estimates of probit regression on innovation probabilities

	Product innovation		Process innovation		Any innovation	
	Measurement of obstacles and strategies					
	absolute	relative	absolute	relative	absolute	relative
Strategies						
Developing new markets within Europe	0.0498**	0.0225	0.0650***	0.0371*	0.0516**	0.00717
	(0.0226)	(0.0209)	(0.0216)	(0.0201)	(0.0209)	(0.0196)
Developing new markets outside Europe	0.0629***	0.0716***	-0.0353*	-0.0415**	-0.0347*	-0.0192
	(0.0218)	(0.0215)	(0.0210)	(0.0209)	(0.0205)	(0.0203)
Reducing in-house costs of operation	-0.182***	-0.207***	-0.0669**	-0.0897***	-0.118***	-0.158***
	(0.0285)	(0.0196)	(0.0273)	(0.0189)	(0.0259)	(0.0182)
Reducing costs of purchased materials/components/services	-0.195***	-0.169***	-0.0397	-0.103***	-0.113***	-0.183***
	(0.0262)	(0.0187)	(0.0250)	(0.0180)	(0.0238)	(0.0173)
Introducing new or significantly improved goods/services	0.968***	0.815***	0.590***	0.479***	0.685***	0.564***
	(0.0216)	(0.0185)	(0.0194)	(0.0176)	(0.0187)	(0.0170)
Intensifying or improving the marketing of goods or services	0.0542***	-0.0264	0.0284	-0.00879	0.189***	0.114***
	(0.0202)	(0.0200)	(0.0190)	(0.0190)	(0.0185)	(0.0184)
Increasing flexibility / responsiveness of your organisation	-0.0618***	-0.0543***	0.134***	0.0788***	0.108***	0.0698***
	(0.0221)	(0.0178)	(0.0209)	(0.0168)	(0.0201)	(0.0163)
Building alliances with other enterprises or institutions	-0.00406	-0.187***	-0.000851	-0.177***	0.0714***	-0.153***
	(0.0187)	(0.0228)	(0.0178)	(0.0216)	(0.0173)	(0.0206)
Obstacles						
Strong price competition	0.0194	-0.0370**	0.0162	-0.0227	0.0473**	-0.0329*
	(0.0243)	(0.0183)	(0.0228)	(0.0176)	(0.0222)	(0.0170)
Strong competition on product quality, reputation or brand	0.0370*	0.00220	-0.0267	-0.0302*	-0.00427	-0.0181
	(0.0200)	(0.0189)	(0.0189)	(0.0181)	(0.0183)	(0.0175)
Lack of demand	-0.124***	-0.140***	-0.143***	-0.163***	-0.111***	-0.154***
	(0.0183)	(0.0169)	(0.0175)	(0.0162)	(0.0170)	(0.0156)
Innovations by competitors	0.108***	-0.0522*	0.0433**	-0.0318	0.0625***	-0.0906***
	(0.0203)	(0.0275)	(0.0196)	(0.0259)	(0.0190)	(0.0251)
Dominant market share held by competitors	-0.0625***	-0.0126	-0.0831***	-0.0315	-0.0316*	-0.0334*
	(0.0192)	(0.0212)	(0.0184)	(0.0203)	(0.0178)	(0.0194)
Lack of qualified personnel	-0.00471	-0.122***	0.0434**	-0.0437**	-0.00801	-0.144***
	(0.0187)	(0.0225)	(0.0178)	(0.0211)	(0.0174)	(0.0205)

	Product innovation		Process innovation		Any innovation	
	Measurement of obstacles and strategies					
	absolute	relative	absolute	relative	absolute	relative
Lack of adequate finance	-0.0742***	-0.0685***	-0.0769***	-0.0708***	-0.0699***	-0.0804***
	(0.0192)	(0.0206)	(0.0182)	(0.0194)	(0.0178)	(0.0187)
High cost of access to new markets	0.0711***	0.0393*	0.0332*	-0.0164	0.0601***	0.0448**
	(0.0203)	(0.0216)	(0.0192)	(0.0205)	(0.0187)	(0.0198)
High cost of meeting administrative or legal requirements	-0.0490***	-0.0336*	-0.00713	0.0197	-0.00284	-0.0153
	(0.0189)	(0.0189)	(0.0178)	(0.0179)	(0.0174)	(0.0173)
Control variables						
Small firm	-0.575***	-0.626***	-0.597***	-0.639***	-0.593***	-0.640***
	(0.0261)	(0.0260)	(0.0245)	(0.0245)	(0.0244)	(0.0242)
Medium firm	-0.371***	-0.390***	-0.395***	-0.409***	-0.405***	-0.419***
	(0.0245)	(0.0243)	(0.0230)	(0.0229)	(0.0230)	(0.0227)
Part of a domestic group	0.145***	0.162***	0.167***	0.182***	0.197***	0.211***
	(0.0199)	(0.0197)	(0.0190)	(0.0189)	(0.0185)	(0.0184)
Part of a foreign group	0.143***	0.132***	0.175***	0.169***	0.200***	0.182***
	(0.0243)	(0.0238)	(0.0228)	(0.0225)	(0.0221)	(0.0217)
Serving an international market	0.260***	0.315***	0.192***	0.235***	0.214***	0.270***
	(0.0207)	(0.0195)	(0.0195)	(0.0185)	(0.0187)	(0.0177)
Observations	37,150	37,150	37,150	37,150	37,150	37,150
Log-likelihood	-16619	-16866	-18484	-18672	-19904	-20293
Pseudo R-squared	0.230	0.219	0.147	0.138	0.169	0.153

Notes: parameter estimates and related robust standard errors (in parenthesis) of probit regressions for product, process and any (including also organizational and marketing) innovation outcomes. The reference categories are large firms and firms that are not part of a group are the reference category. Estimates related to industry and country dummies are not reported for brevity reasons. Legend: *** p<0.01, ** p<0.05, * p<0.1

Table A3 Estimates of linear regressions on the change in economic performances

	Turnover change		Employment change		Labour productivity change	
	Measurement of obstacles and strategies					
	absolute	relative	absolute	relative	absolute	relative
Strategies						
Developing new markets within Europe	0.0215***	0.0170***	0.0137***	0.0149***	0.0115	0.00222
	(0.00607)	(0.00573)	(0.00383)	(0.00364)	(0.00715)	(0.00615)
Developing new markets outside Europe	0.00325	0.00296	0.00632	0.00332	-0.00338	-0.000459
	(0.00609)	(0.00604)	(0.00391)	(0.00383)	(0.00703)	(0.00643)
Reducing in-house costs of operation	-0.0526***	-0.0541***	-0.0274***	-0.0382***	-0.0159*	-0.0115*
	(0.00795)	(0.00533)	(0.00511)	(0.00343)	(0.00912)	(0.00626)
Reducing costs of purchased materials/components/services	0.00246	9.99e-05	-0.00447	0.00189	0.00580	0.000220
	(0.00697)	(0.00493)	(0.00460)	(0.00321)	(0.00855)	(0.00597)
Introducing new or significantly improved goods/services	0.00427	-0.00349	0.00646*	0.00590*	-0.00327	-0.00952*
	(0.00534)	(0.00500)	(0.00351)	(0.00332)	(0.00546)	(0.00493)
Intensifying or improving the marketing of goods or services	0.000116	0.00622	-0.00103	0.00216	-0.00355	-0.00283
	(0.00526)	(0.00526)	(0.00348)	(0.00345)	(0.00527)	(0.00523)
Increasing flexibility / responsiveness of your organisation	0.0188***	0.0164***	0.0167***	0.0116***	0.000186	0.00630
	(0.00557)	(0.00459)	(0.00366)	(0.00303)	(0.00593)	(0.00483)
Building alliances with other enterprises or institutions	0.0129**	0.00897	0.00160	-0.00345	0.0134***	0.0114*
	(0.00504)	(0.00606)	(0.00326)	(0.00400)	(0.00518)	(0.00617)
Obstacles						
Strong price competition	0.00163	-0.0149***	-0.00115	-0.0101***	-0.00960	-0.0133**
	(0.00635)	(0.00489)	(0.00423)	(0.00326)	(0.00739)	(0.00550)
Strong competition on product quality, reputation or brand	0.00853	0.0219***	0.00857**	0.0127***	-0.000683	0.00798
	(0.00523)	(0.00500)	(0.00335)	(0.00325)	(0.00538)	(0.00496)
Lack of demand	-0.0883***	-0.0820***	-0.0430***	-0.0358***	-0.0378***	-0.0401***
	(0.00496)	(0.00435)	(0.00322)	(0.00290)	(0.00567)	(0.00497)
Innovations by competitors	-0.00127	0.0170**	-0.00812**	-0.000119	0.00967*	0.0232***
	(0.00536)	(0.00725)	(0.00347)	(0.00479)	(0.00542)	(0.00786)
Dominant market share held by competitors	-0.00788	0.00858	-0.00635*	-0.00307	-0.00120	0.0158***
	(0.00499)	(0.00566)	(0.00327)	(0.00364)	(0.00499)	(0.00609)
Lack of qualified personnel	0.0547***	0.0609***	0.0411***	0.0425***	0.00984*	0.0147**
	(0.00496)	(0.00599)	(0.00327)	(0.00406)	(0.00522)	(0.00634)
Lack of adequate finance	-0.0209***	-0.0250***	-0.0194***	-0.0171***	-0.00267	-0.00761
	(0.00500)	(0.00548)	(0.00325)	(0.00363)	(0.00526)	(0.00587)

	Turnover change		Employment change		Labour productivity change	
	Measurement of obstacles and strategies					
	absolute	relative	absolute	relative	absolute	relative
High cost of access to new markets	-0.0128**	-0.00150	-0.00498	-0.00661*	-0.00271	0.00577
	(0.00529)	(0.00570)	(0.00344)	(0.00381)	(0.00541)	(0.00559)
High cost of meeting administrative or legal requirements	0.00152	0.00614	0.00583*	0.00844***	-0.00903*	-0.00607
	(0.00485)	(0.00484)	(0.00309)	(0.00318)	(0.00504)	(0.00485)
Control variables						
Small firm	0.0978***	0.0892***	0.116***	0.111***	-0.0458***	-0.0482***
	(0.00671)	(0.00671)	(0.00450)	(0.00451)	(0.0115)	(0.0115)
Medium firm	0.0513***	0.0470***	0.0531***	0.0507***	-0.0278***	-0.0292***
	(0.00613)	(0.00614)	(0.00398)	(0.00400)	(0.0104)	(0.0104)
Part of a domestic group	0.00262	0.00444	-0.00777**	-0.00685**	0.00801	0.00923
	(0.00543)	(0.00542)	(0.00342)	(0.00341)	(0.00573)	(0.00571)
Part of a foreign group	0.0333***	0.0350***	0.00877**	0.00923**	0.0233***	0.0242***
	(0.00698)	(0.00694)	(0.00431)	(0.00427)	(0.00745)	(0.00731)
Serving an international market	0.0319***	0.0328***	0.0184***	0.0194***	0.00799	0.00959*
	(0.00539)	(0.00511)	(0.00356)	(0.00340)	(0.00614)	(0.00580)
Product innovator	0.000923	-3.13e-06	0.00696*	0.00532	-0.0133**	-0.0124**
	(0.00569)	(0.00571)	(0.00362)	(0.00363)	(0.00615)	(0.00618)
Process innovator	0.0286***	0.0303***	0.0184***	0.0193***	0.00481	0.00561
	(0.00567)	(0.00564)	(0.00349)	(0.00348)	(0.00592)	(0.00593)
Organization innovator	0.0291***	0.0289***	0.0176***	0.0178***	0.0135**	0.0129**
	(0.00535)	(0.00532)	(0.00346)	(0.00344)	(0.00559)	(0.00566)
Marketing innovator	-0.0187***	-0.0227***	-0.00993***	-0.0120***	-0.00858	-0.01000*
	(0.00519)	(0.00515)	(0.00334)	(0.00331)	(0.00533)	(0.00526)
Observations	37,150	37,150	37,150	37,150	37,150	37,150
R-squared	0.070	0.072	0.056	0.057	0.022	0.023

Notes: parameter estimates and related robust standard errors (in parenthesis) of linear regressions for outcomes in change. The reference categories are large firms and firms that are not part of a group are the reference category. Estimates related to industry and country dummies are not reported for brevity reasons. Legend: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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