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Exploring the complementarity between innovation and export for SMEs' growth

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Abstract

In this paper, we advance and test the idea that innovation and export are complementary strategies for SMEs' growth. We argue that innovation and export positively reinforce each other in a dynamic virtuous circle, and we identify and describe the process through which this complementarity relationship takes place. Participating in export markets can promote firms' learning, and thus enhance innovation performance. At the same time, through innovation, firms can enter new geographical markets with novel and better products, therefore making exports more successful, and, by the same token, they can also improve the quality – and consequently increase the sales – of the products sold domestically. We test our theory using an unbalanced panel of Spanish manufacturing firms over the period 1990–1999. We find robust empirical support for our hypothesis: consistent with the presence of complementarity, we show that the positive effect of innovation activity on firms' growth rate is higher for firms that also engage in exports, and vice versa. Furthermore, we show that, *Ceteris paribus*, firms' adoption of one growth strategy (e.g., entering export markets) positively influences the adoption of the other (e.g., innovation).

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INTRODUCTION

Growth is vital to small and medium-sized enterprises (SMEs). In the absence of growth, SMEs are confronted by a significantly lower likelihood of survival (e.g., Freeman, Carroll, & Hannan, 1983). When deciding their growth strategy, SMEs are faced with two major options (Ansoff, 1965). First, they can decide to expand and improve their product markets through innovation. Second, they can internationalize and enter new geographical markets, primarily by exporting.

A number of studies (e.g., Becchetti & Trovato, 2002; Lu & Beamish, 2001; Yasuda, 2005) have documented the positive impact of innovation and exports on SMEs' rate of growth. These studies, however, have explored the roles of exports and innovation in isolation, focusing on the effect of each of these activities as if it were independent from that of the other. Other studies have suggested that since the successful implementation of these two strategies depends on the concurrent utilization of limited organizational resources, such as qualified personnel and liquidity,

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exports and innovation might represent alternative growth strategies, which should not be jointly pursued. In particular, Roper and Love (2002: 1096) notice that the results of their study

> may suggest that for German plants a strategic trade-off exists between increasing innovation activity and export market development. This is perhaps easiest to see in managerial terms with German firms facing a choice as to whether to focus on product development specifically for the home market or to allocate fewer resources to innovation and more to developing new export markets.

Similarly, Kumar (2009) finds a negative association between product diversification and international diversification in the short run.

In this paper, we take a further step in the analysis of the effect of innovation and exports on firm growth, and in line with Filatotchev and Piesse (2009) we contend that these are in fact *complementary* activities (Milgrom & Roberts, 1990) for SMEs' sales growth, that is, that the return in terms of growth from engaging in one activity increases if a firm also engages in the other. Participating in export markets can promote firms' learning, and can thus enhance innovation performance. Exporting firms may in fact have access to knowledge sources not accessible in their domestic market, and can then exploit this knowledge to produce more and higher-quality innovations (e.g., Alvarez & Robertson, 2004; Salomon & Shaver, 2005a). At the same time, through innovation firms can enter new geographical markets with novel and better products, thus making exports more successful (e.g., Hitt, Hoskisson, & Kim, 1997), and, by the same token, they can also improve the quality – and consequently increase the sales – of the products sold domestically (Iacovone & Javorcik, 2009). Exports and innovation can thus give rise to a virtuous, reinforcing circle.

Consistent with the hypothesized existence of complementarity, analyzing an unbalanced panel of about 1400 Spanish SMEs over a period of 10 years, we find that the positive effect of innovation on sales growth is significantly higher for firms that also export, and vice versa. Furthermore, we show that, *Ceteris paribus*, the adoption of one strategy (e.g., entering export markets) positively influences the adoption of the other (e.g., innovation).

A more complete understanding of the determinants of SMEs' growth has rich theoretical and practical implications from the perspectives of international strategy and entrepreneurship. High-growth SMEs have been shown to account for a significant share of jobs created, and to represent fundamental players in countries' economic growth (e.g., OECD, 2002). As a consequence, the study of the drivers of SMEs' growth has naturally attracted considerable attention. Still, research in this area has not achieved conclusive results (e.g., Delmar, Davidsson, & Gartner, 2003). In particular, previous literature has often implicitly or explicitly argued that since SMEs face significant disadvantages in the marketplace in terms of managerial expertise, access to capital, and experience curve effects, they should focus their efforts on a specific growth strategy. Along these lines, Ebben and Johnson (2005) provide evidence indicating that small firms that pursue efficiency strategies or flexibility strategies outperform those that attempt to pursue both. By the same token, Siegel et al. (1993) find that ventures with a focused strategy, operationalized as more revenues being generated by a single product, display higher sales growth rate. In this paper, we show that the potential positive interaction of a growth strategy with other strategies should not be underestimated. In doing so, our results also shed some new light on the potential mechanisms through which exports can enhance firm performance.

The remainder of the paper is structured as follows. First, we review the related literature and discuss why exports and innovation are hypothesized to be complementary activities. We then describe the sample and methods. Next, we present the results of our econometric analyses. Concluding remarks follow.

BACKGROUND

While export and innovation can impact on SMEs' performance on a number of dimensions, in this study we focus on top-line growth. SMEs relate to organizational growth in specific and relevant ways (Gilbert, McDougall, & Audretsch, 2006). First, whereas the growth of large and established firms is about sustaining viability, small ventures' growth is about obtaining viability. A liability of smallness seriously undermines their survival (Carroll, 1983). Second, the variance of growth rates across firms diminishes with firm size, thus making the explanation of the drivers of SMEs' growth take on special significance.

In the quest for growth, SMEs strive to find new customers and new markets. To this end, firms may follow different strategies. In particular, they can innovate, looking for new or better products and processes, or they can look for new geographical

markets, deciding to internationalize. International expansion may be achieved through both export and foreign direct investments (FDI). Compared with FDI, exporting is a relatively easy and fast way to enter foreign markets, because it involves comparatively low levels of commitment and risk. When exporting, a firm does not have to make as substantial a resource commitment to a foreign market as it does when making a foreign investment. Furthermore, a firm does not have to deal with the complexities of establishing a foreign subsidiary (e.g., Lu & Beamish, 2006). Export thus constitutes the initial preferred way of internationalization for SMEs (e.g., Young, Wheeler, & Davies, 1989).

International expansion exerts a positive impact on ventures' performance (e.g., McDougall & Oviatt, 1996). *Inter alia*, Robson and Bennett (2000) report a significant positive effect of exports on employment growth, as well as turnover growth for a sample of UK firms. Similarly, Becchetti and Trovato (2002) show that the access to export markets boosts SMEs' employment growth, and Filatotchev and Piesse (2009) find that export intensity is positively associated with the sales growth of newly listed firms.

Prior literature has highlighted how the observed positive impact of export on firms' growth, besides the direct effect on sales, is also due to indirect gains from the diversification of revenues (e.g., Shaver, 2011) and the facilitated development of new capabilities promoted by internationalization, which in turn enhance organizations' ability to pursue growth opportunities (e.g., Sapienza, Autio, George, & Zahra, 2006).

Still, the positive relationship between export and firm performance may also be endogenous. Several studies have shown that firms that decide to export display higher productivity and higher productivity growth than non-exporting firms (e.g., Bernard & Jensen, 1999; Clerides, Lach, & Tybout, 1998). The higher productivity, however, is a cause and not a consequence of firms' export behavior. Since entering foreign markets is costly, only the most productive firms can self-select into exports (e.g., Bernard & Jensen, 1999; Roberts & Tybout, 1997). As a consequence, exports may be correlated with superior performance, but this superior performance may be at the roots of exports, and not an outcome of internationalization. Specific attention to the endogeneity of the decision to engage in export activities is therefore needed.

Together with export, innovation is the other key engine of SMEs' growth. Owing to rapid technological change, short product life cycles, and global competition, continuous innovation has become increasingly important in achieving commercial and economic success (e.g., Cho & Pucik, 2005). Accordingly, several studies have provided empirical evidence on the positive impact of innovation activities on SMEs' rate of growth. *Inter alia*, Yasuda (2005) finds that R&D expenditure per employee has a significant positive effect on a sample of Japanese SMEs' growth in terms of employees, and Robson and Bennett (2000), using data from the UK, find that innovation positively affects firm profitability and turnover growth.

Innovation can exert a positive impact on growth in a number of ways. In particular, innovation can create new, uncontested product markets, as well as increase consumers' willingness to pay by adding or improving product features (e.g., Cho & Pucik, 2005; Cohen & Klepper, 1996). Moreover, innovative firms are better able to benefit from spillovers, and are less sensitive to adverse macroeconomic shocks (Geroski, Machin, & Van Reenen, 1993).

While most previous studies have analyzed the impact of innovation and exports on SMEs' growth as if they had independent effects, in this study we contend that innovation and exports are *complementary* activities. To provide an operational definition of complementarity, we draw upon the work of Milgrom and Roberts (1990).

> **Definition**: Let us suppose there are two activities, A1 and A2. Each activity can be performed by the firm (Ai=1) or not (Ai=0) and i {1, 2}. The function Π(A1, A2) is supermodular, and A1 and A2 are complements if and only if $\Pi(1, 1) - \Pi(0, 1) \geqslant \Pi(1, 0) - \Pi(0, 0)$.

This definition implies that adding an activity while the other activity is already being performed has a higher incremental effect on performance (Π) than adding the same activity in isolation. For the purposes of this study, the performance measure we focus upon is sales growth. If innovation and exports are complementary, then this implies that the contribution of innovation to organizational growth is higher for firms that are contemporaneously exporting, and vice versa.

THE COMPLEMENTARITY BETWEEN INNOVATION AND EXPORTS

There are compelling reasons to expect a positive interdependence between exports and innovation.

We proceed by first discussing how engaging in one growth strategy reinforces the benefits achievable through the other, and then highlighting how the adoption of a strategic activity can make the adoption of the other less costly.

Firms consider export markets a fundamental channel to boost their sales. This is increasingly true for both established and young or small enterprises (Shrader, Oviatt, & McDougall, 2000). The actual contribution to sales growth of entering export markets,[1] however, depends both on the increase in the quantity sold abroad and on the price charged in export markets. There is in fact ample evidence that the "law of one price" – that is, that identical products sell for the same common-currency price in different countries – does not hold. Furthermore, it is clear that the documented deviations in the law of one price are not an artifact of non-identical goods (see Goldberg and Knetter, 1997, for a review). More specifically, foreign markets frequently generate lower mark-ups compared with domestic markets (e.g., Bughin, 1996). Competition and costs related to exporting are among the most frequently suggested drivers of the observed lower mark-ups.

Yet much of the heterogeneity in the difference between export and domestic pricing is due to differences in prices across firms in the same product markets, and differences across markets are relatively unimportant. This within-market variation reflects differences in product attributes and quality (Aw, Chen, & Roberts, 2001), and differences in quality are explained by investments in innovation. *Inter alia*, Braymen et al. (2010), analyzing a sample of newly founded US firms, show how investments in R&D enable firms to produce a better variety of goods for which there is global demand. Investments in innovation enable firms to achieve greater capability to meet the demands of their domestic and international markets (Zahra & Covin, 1994), as they can shift the demand curve upward, or move along the demand curve itself (Mowery & Rosenberg, 1979). Coherently, McGuinness and Little (1981) find that the "relative improvement" of products, such as unique features and differentiation from existing products, increases export performance.

In addition, investments in innovation for exports can bring about positive spillovers in the domestic market, too. Iacovone and Javorcik (2009) show that producers that export a particular product variety might be able to obtain a price premium for their domestic sales of the same variety, and this result is associated with an increase in investment activity when this new variety is introduced.

To summarize, exporting firms that also innovate can further increase their sales growth selling better products in export markets – and thus either obtain a higher mark-up or sell a higher quantity of the same variety – and at the same time they can also witness positive spillovers for the products sold in domestic markets, which will be of improved quality.

Yet the benefits achievable through innovation depend on firms' learning abilities, which will influence the quality of innovations themselves. And firms' learning abilities may increase precisely through exports. Recent studies have argued that exports might serve as a vehicle to get access to novel information and technological knowledge not available in the home market, and which can further be used in the firm's innovation process, leading to the phenomenon labeled "learning by exporting" (e.g., Alvarez & Robertson, 2004; Salomon & Shaver, 2005a). In line with learning by exporting, Aw and Batra (1998) provide evidence of substantial inflows of knowledge to exporting Taiwanese firms, which come through the constant adaptations of their production methods to the specifications provided by foreign purchasers. Clerides et al. (1998) argue that foreign buyers might suggest useful ways to improve the manufacturing process and products, also by deliberately offering new product designs and technical assistance. With respect to innovation performance, Alvarez and Robertson (2004) find a positive relationship between exporting and the probability of innovating, and this holds for various dimensions of innovative activities, such as investments in improving the design, production processes, or product quality, the presence of R&D activities, and purchases of foreign technical licenses. Consistently, Salomon and Shaver (2005a) find that a firm's export activity is positively associated with an increase in its number of product innovations and its number of patent applications.

These arguments suggest that innovating firms that enter foreign markets, and in doing so have the opportunity to learn by exporting and produce higher-quality innovations, will be able to gain an even higher market power through innovation in both domestic and foreign markets, and as a consequence further increase their sales.

We therefore hypothesize the following:

Hypothesis 1: Innovation and exports are complementary activities for firms' sales growth. That

is, let us define G firms' rate of sales growth. Then the following inequality holds: $G(I, E)-G(0, E) \geqslant G(I, 0)-G(0, 0)$, where I indicates innovation and E indicates exports.

Cassiman and Veugelers (2006) and Arora and Gambardella (1990) argue that the (conditional) joint adoption of two activities is a necessary (though not sufficient) condition for their complementarity. Is this the case for innovation and exports?

Clearly, while innovation and exports might foster firms' sales growth, they are not costless activities. Nonetheless, engaging in one activity may diminish the cost of engaging in the other. Specifically, innovation can decrease the cost of exports. Exporting entails some sunk costs, primarily at the start of the activity, but also as the activity unfolds (Bernard & Jensen, 1999). Such sunk costs may include the cost of packaging, upgrading product quality, establishing marketing channels, and accumulating information on demand sources (e.g., Roberts & Tybout, 1999). In addition, firms that sell their products in a foreign country might be at a disadvantage as compared with domestic firms, in that they usually have to bear additional transportation and administrative costs. Consistently, prior literature has highlighted that firms that start exporting are more productive than firms that do not export, and are therefore able to bear the additional costs that exporting entails (e.g., Bernard & Jensen, 1999). Several studies have highlighted that R&D and innovation constitute an important source of the observed productivity differences among firms, and have documented the positive and significant association between innovation and firms' productivity and productivity growth (e.g., Griffith, Huergo, Mairesse, & Peeters, 2006; Huergo & Jaumandreu, 2004). More specifically, Cassiman and Golovko (2010) have shown that innovation may actually be at the roots of superior productivity and self-selection of more productive firms into exports. Hence, by improving productivity, innovation may reduce the burden of export-related costs.

At the same time, exporting can influence the costs of innovation. Investments in innovation involve the commitment of financial resources in the short run on the expectation of future positive returns. If capital markets were fully efficient, and if information was freely available to all parties, then firms should be able to find external sources to finance any profitable investment opportunities. However, if these conditions do not hold, external financing might become unavailable or costly, and firms' ability to make capital investments becomes constrained by internal sources of cash. Firms with variable cash flows may thus be particularly inhibited from making investments in innovation, which can be particularly uncertain. This is particularly true for SMEs, as size advantages exist in the capital market (Ross, Westerfield, & Jaffe, 1999). Exporting firms can stabilize their cash flows, since business cycles are not perfectly correlated across national markets (e.g., Salomon & Shaver, 2005b). A stable cash flow may in turn allow access to larger internal financial resources for investments in innovation activities. Furthermore, exporting firms can also have cheaper access to external financing, in that exporting can provide greater assurances to external sources of funds that the firm will be better able to service its obligations because of mitigated liquidity constraints (Shaver, 2011).

If engaging in one activity decreases the costs of engaging in another activity, and if one activity increases the benefits from the other, we expect these strategies to be positively correlated: that is, firms that are exporting are more likely to engage in innovation, and vice versa. We thus hypothesize the following:

Hypothesis 2: The adoption of one growth strategy – that is, exports or innovation – will be positively associated with the adoption of the other.

DATA AND METHODS

The Sample

The data we use in this study come from a survey of Spanish manufacturing firms during 1990–1999. The project was conducted by Fundación Empresa Pública with financial support from the Spanish Ministry of Science and Technology. The survey is administered to the population of Spanish manufacturing firms with 200 or more employees, and to a stratified sample of small and medium firms, representative of the population of manufacturing firms with more than 10 but fewer than 200 employees. The sample intends to maintain the representativeness of the manufacturing sector over time. Every year new firms are included in the sample from the population of new firms. Firms that exited the original sample during the sampling period are replaced by firms with similar characteristics drawn from the population.[2]

The initial sample is an unbalanced panel, with 2188 firms in 1990 and 3195 firms in 1999 coming from 20 distinct industries. Following the ESEE definition, we consider small and medium enterprises those firms that had 200 or fewer employees in 1990. The original sample of SMEs thus includes 1475 responding firms in 1990 and 1235 responding firms in 1999, which leads to 12,359 firm-year observations in total. Because of missing values and lagging of the independent variables, the final sample is reduced to 8802 firm-year observations.

Table 1 summarizes the export and innovation status of the firms in the final sample. Approximately 40% of the SMEs are exporters, with the proportion of exporting firms increasing from 30% in 1990 to 49% in 1999. About 35% of firms in the sample report innovation activities, ranging from 18% in 1990 to 39% in 1999.

The ESEE dataset provides an appropriate setting to test the relationship between exports, innovation, and growth that we aim to examine. First, the data allow tracing the firms and their export and innovation decisions over a time period of 10 years. In their influential review, Weinzimmer et al. (1998) argue that inconsistencies in the literature on the drivers of firms' growth may also derive from the fact that prior studies rarely explored the dynamic path of firms' behavior, in that they relied upon data with a short time span, or just considered the first-year and last-year sizes over the period of reference. Second, exporting firms constitute a large proportion in the sample, and show considerable variation in their exporting behavior over time. Third, our data cover a timeframe characterized by the opening of the Spanish economy to international markets. This makes our sample particularly well suited for examining the decision to internationalize. Fourth, there are very few firms (less than 0.3% of the sample) with foreign direct investment. In this way, we are able to focus on exports, without confounding effects from other internationalization strategies. Furthermore, the sample contains detailed information on the firms' innovation behavior, and displays substantial variation across firms and over time. Finally, during 1990–1999 Spain has gone through an entire business cycle. In 1990 there was growth in the economy, followed by a recession in 1993, and a recovery during the last years of the sample period (Shaver, 2011). Such variance can be usefully exploited to examine the growth dynamics during 1990–1999. Previous research has used the same dataset, as it is representative of the Spanish manufacturing industry over this period (e.g., Campa, 2004; Cassiman & Martinez-Ros, 2007; Salomon & Jin, 2008; Salomon & Shaver, 2005a, b).

Key Variables

In this study we are interested in gaining a better understanding of the drivers of SMEs' organizational growth. Our data contain manufacturing firms coming from different industries: hence, following Weinzimmer et al. (1998), we measure organizational size growth in terms of sales. As Delmar et al. (2003) argue, "there seems to be an emerging consensus that if only one indicator is to be chosen as a measure of firm growth, the most preferred measure should be sales." We use real sales, using the producer price index as a deflator.[3]

We are specifically interested in assessing whether innovation and export are complementary activities for firms' growth. For each firm, and for every year, we know whether a firm innovated and/or whether it exported (for a full definition of the variables see the Appendix). Building upon Cassiman and Veugelers (2006), we then create for each firm-year observation four exclusive dummy variables indicating firm strategy with respect to its export and innovation activities. These dummies distinguish the following mutually exclusive and collectively exhausting cases:

(1) firms that both export and innovate (*Innovate&Export*);
(2) firms that only export (*OnlyExport*);
(3) firms that only innovate (*OnlyInnovate*);
(4) firms that neither export nor innovate (*NoInnovate&NoExport*).

One initial concern may be that firms do not display enough variation in their export and innovation behavior over time, the choice being driven mainly by time-invariant differences across

Table 1 Export and innovation status (expressed in percent) during the sample period, 1990–1999

	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*Total*
Exporters	30.8	31.2	32.7	33.9	36.5	41.8	43.5	48.0	50.3	49.3	39.6
Innovators	18.3	36.4	35.8	35.7	35.9	36.2	36.5	40.3	40.0	39.1	35.0

Table 2 Transition probabilities (in percent)

	NoInnovate&NoExport	*OnlyExport*	*OnlyInnovate*	*Innovate&Export*
NoInnovate&NoExport	77.31	5.04	15.73	1.92
OnlyExport	7.58	65.38	2.94	24.10
OnlyInnovate	38.74	3.37	50.25	7.65
Innovate&Export	3.18	24.17	3.49	69.16

firms, and thus not allowing for econometric identification. In Table 2 we present a transition probability matrix, which shows the probability that a firm will follow a given strategy in a specific year, given the strategy it was following in the previous year. It is evident that although export and innovation strategies tend to be persistent, they do show substantial variation over time, making our sample a suitable setting to test the proposed relationship.

Statistical Approach

Growth regression. To test for the complementary relationship between exporting and innovation activities we follow several steps. We begin by reproducing the results of extant literature for our sample, and identifying the positive association between export and innovation activities and the firms' growth. To do so, we estimate the following model:

$$Growth_{it} = f(Export_{it-1}, Innovate_{it-1}, X1_{it-1}, X2_{it-1}, \ldots, Xn_{it-1}; \gamma, \beta) \quad (1)$$

where:

- $Growth_{it}$ represents firm i's sales growth rate at time t (with respect to time $t1$). We assume an exponential growth trend as in Evans (1987) and Ang (2008):

$$Growth(t) = \log[sales(t)/sales(t-1)] \quad (2)$$

- *Export* and *Innovate* are (1-year lagged) dummy variables, which are equal to 1 if the firm exported/innovated in the previous year, and zero otherwise;
- ($X1_{it-1}$, $X2_{it-1}$, …, Xn_{it-1}) is a set of control variables that might have an influence on firm organizational growth;
- γ and β are vectors of parameters to be estimated.

We control for a number of relevant variables. We include the logarithm of sales (*Size*) to account for the link between firm size and growth (e.g., Evans, 1987; Lu & Beamish, 2006). Foreign capital in the ownership structure may be responsible for differences between domestic and foreign firms in terms of growth and export behavior; we control for that through the *percentage of foreign capital*. A merger dummy variable (*Merger*) controls for a possible increase in sales growth following a merger event that took place at time $t1$, to distinguish between organic growth and growth through M&A. Finally, we include the vector of year dummies to control for macroeconomic effects, as we expect sales growth to vary across time.

Next, we start testing for the complementarity effect of export and innovation for firm growth (Hypothesis 1) by estimating a model that links our organizational growth measure with the four exclusive dummies for exporting/innovation activities. We estimate the following model:

$$Growth_{it} = f(D_{it-1}, X1_{it-1}, X2_{it-1}, \ldots, Xn_{it-1}; \gamma, \beta) \quad (3)$$

In this specification, rather than using simple export and innovation dummies, we use a vector of exclusive dummy variables D for the choice of the combination of the export and innovation activities in year $t1$:

- D={(*NoInnovate&NoExport*), (*OnlyInnovate*), (*OnlyExport*), (*Innovate&Export*)};
- ($X1_{it-1}$, $X2_{it-1}$, …, Xn_{it-1}) is a vector of control variables, described above;
- γ and β are vectors of parameters for the innovation and export behavior variables and the control variables to be estimated.

If innovation and export are *complementary*, we expect the parameter estimate of the strategy that combines innovation and export (*Innovate&Export*) to be *positive and significant*. Moreover, we expect Milgrom and Roberts' (1990) complementarity test[4]

to *be significant*:

$$Growth(Innovate\,\&\,Export) - Growth(OnlyInnovate) \geqslant Growth(OnlyExport) - Growth(NoInnovate\,\&\,NoExport) \quad (4)$$

To estimate Eqs. (1) and (3) properly, we need to account for the possible endogeneity of export and innovation decisions and performance measure in our model (Hamilton & Nickerson, 2003; Shaver, 1998). We follow several steps to deal with this problem. First, we take advantage of the panel structure of our data and use a fixed-effects model, which allows to control for time-invariant unobserved firm heterogeneity. We choose the fixed-effects over random-effects specification to handle the unobserved factors, because the fixed-effects model allows the unobserved firm characteristics to be correlated with the strategy choice and performance variables. Individual-specific effects are usually interpreted as firm-specific characteristics that are constant over time, such as organizational structure or managerial capabilities. It is reasonable to assume that such firm-specific effects are related to the strategic decisions the firms take (export and innovation decisions, in our case).

Next, to account for the presence of the serial correlation in the model, which in particular may arise if the independent variables are serially correlated (this is likely to be the case, as innovation and export variables show some persistence over time), we use a fixed effects model with an AR(1) process for the errors. In addition, we estimate an alternative model for the growth rate using a dynamic Arellano–Bond estimator, which includes lagged values of the dependent variable (i.e., growth rate) as a covariate. Including a lagged dependent variable allows us to account for the potential serial correlation of the errors, as well as for the dynamic component in the firm-specific characteristics. Moreover, it provides additional control for endogeneity to the extent that lagged values of the dependent variable are associated with export and innovation adoption (Salomon & Jin, 2008).

Finally, drawing upon Cassiman and Veugelers (2006), we employ a multinomial probit regression as a first stage, estimating the probability of adopting different combinations of export and innovation strategies.[5] We then use these predicted probabilities for the firm's export and innovation decisions in the growth regression. The multinomial probit regression models the choice among the four possible outcomes j=(0(*NoInnovate &NoExport*); 1(*OnlyExport*); 2(*OnlyInnovate*); 3(*Innovate&Export*)). Thus our dependent variable is a non-orderable, categorical variable measured at time t, while the explanatory variables are measured at time $t-1$.

The explanatory variables include R&D investments as an input in innovative effort that can foster technological innovation (Salomon & Shaver, 2005b). Specifically, we expect R&D expenditure normalized on firm sales (*R&D intensity*) to positively affect the innovation output. The international trade literature shows that exchange rate fluctuations can significantly affect the export behavior of firms (Basile, 2001; Campa, 2004). Home currency devaluation is expected to result in more firms entering the export market as well as increased export sales of already exporting firms. We therefore use *Exchange rate index* as a variable that can positively influence the decision of a firm to export.[6] Further, we include the 1-year lagged values of innovation (*Innovate*) and export (*Export*) to control for the possible persistence in the innovation and exporting activities. Firms' size (*Size*), measured as the logarithm of sales, stands as an important control variable that may affect both export and innovation decisions. Larger firms may have access to more resources to invest in innovation. On the other hand, smaller firms are usually associated with less bureaucracy, and thus may be more efficient in innovating (e.g., Acs & Audretsch, 1987). With respect to exports, prior literature posits a non-linear relationship between size and exporting, showing the positive effect of the size up to a certain threshold (Bernard & Jensen, 1999; Sterlacchini, 1999). As our focus is on SMEs, we expect a positive effect of size on both export and innovation decisions. Being a part of a foreign company might facilitate the process of becoming an exporter (Basile, 2001): thus we include a percentage of foreign capital that controls for the foreign ownership of the firm (*percent of foreign capital*). We include advertising intensity and capital intensity as proxies for complementary assets (Teece, 1986). These typically include firms' capabilities (e.g., manufacturing capabilities or sales expertise) as well as firms' tangible and intangible assets (e.g., brand name, customer relationships, and distribution channels). The presence of complementary assets may foster the adoption of both export and innovation activities, as they can be effectively used to bring a new product/process innovation to the market and exploit it commercially. We measure

capital investments as a share of spending on capital goods in total sales (*Capital intensity*). *Advertising intensity* is a share of spending on advertising and public relations in firm total sales. Finally, the vectors of industry and year dummies are inserted to control for the industry heterogeneity and macroeconomic conditions common to all firms.

Adoption regression. We proceed by testing Hypothesis 2, on the positive link between the adoption decisions of export and innovation activities. As suggested by Arora and Gambardella (1990), if two strategies are complementary (i.e., if export raises the marginal value of innovation, and vice versa), we expect to observe that firms that are engaged in exporting also tend to adopt innovation strategy. In other words, if two strategies are complementary, one would expect them to be positively correlated. However, the relationship between these strategies may depend on other characteristics of the firm and its environment. It is possible that strategies A and B are positively correlated because they are both strongly correlated to a particular firm or market characteristic (Arora & Gambardella, 1990). So the observed correlation between A and B may be spurious, which implies that one has to control for such factors.[7]

We estimate a seemingly unrelated bivariate probit model to test the direct effect of the decision to export on the innovation decision, and vice versa. The bivariate probit model explicitly takes into account the correlation between export and innovation decisions. The dependent variables are two dummy variables that measure the export and innovation status of a firm at time *t*. We include the explanatory variables used in the multinomial probit model measured at time *t*1 to explain the decisions to innovate and export previously described.

RESULTS

Table 3 presents summary statistics and product moment correlations for our sample. Generally, the correlations are as expected. With respect to the dependent and main independent variables, export and innovation indicators show positive and significant correlation with sales growth rates (r=0.04, $p<0.001$ and r=0.06, $p<0.001$, respectively), consistent with prior research. Additionally, export and innovation decisions are highly correlated (r=0.21, $p<0.001$), which is in line with our hypothesis on the positive interdependence of export and innovation activities.

We proceed by documenting in our sample the relationship between exports and growth and innovation and growth suggested by prior research. The results of the estimation are reported in Table 4 (Model 1).

In line with prior literature, both innovation and export have a positive effect on firm's future growth rates. The coefficients of *Export* and *Innovate* are positive and significant at the 5% and 10% significance levels, respectively. With respect to the control variables, firm *size* has a negative and significant ($p<0.01$) impact on growth, consistent with prior research that finds that firms' rate of growth is not size independent (e.g., Becchetti & Trovato, 2002; Lu & Beamish, 2001). The *merger* dummy coefficient shows the expected sign (positive), but is statistically insignificant, whereas if a

Table 3 Descriptive statistics and product moment correlations

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Export	1								
2. Innovate	0.21	1							
3. Total sales, growth rate	0.04	0.06	1						
4. R&D intensity	0.13	0.18	0.01	1					
5. Advertising	0.15	0.07	0.04	0.09	1				
6. Capital intensity	0.01	0.15	0.07	0.04	0.003	1			
7. Merger	0.03	0.01	0.02	0.01	0.02	0.03	1		
8. Foreign capital	0.22	0.08	0.06	0.02	0.04	0.04	0.07	1	
9. Exchange rate index	0.13	0.05	0.10	0.01	0.03	0.001	0.02	0.10	1
Mean	0.38	0.34	0.03	0.38	0.96	3.67	0.005	5.78	140.84
Standard deviation	0.48	0.47	0.31	1.78	2.68	7.50	0.07	21.73	12.56
Min	0	0	2.83	0	0	0	0	0	101.93
Max	1	1	3.47	41.86	48	79.61	1	100	167.49

Table 4 Growth regression

	Model 1 *Fixed effects with AR(1)*	*Model 2* *Fixed effects with AR(1)*	*Model 3* *Arellano–Bond regression*	*Model 4* *Fixed effects with AR(1) and predicted values from multinomial probit model*	*Model 5* *Arellano–Bond regression with predicted values from multinomial probit model*
Export	0.03** (0.01)				
Innovate	0.02* (0.01)				
Growth (*t*1)			0.005 (0.03)		0.01 (0.02)
Innovate&Export		0.05*** (0.01)	0.03*** (0.01)	0.09*** (0.02)	0.04** (0.02)
OnlyInnovate		0.001 (0.01)	0.003 (0.01)	0.04 (0.03)	0.02 (0.03)
OnlyExport		0.02 (0.01)	0.01 (0.01)	0.01 (0.02)	0.01 (0.02)
Size	0.76*** (0.01)	0.76*** (0.01)	1.09*** (0.04)	0.76*** (0.01)	1.10*** (0.04)
Merger	0.05 (0.04)	0.05 (0.04)	0.06** (0.02)	0.05 (0.04)	0.06** (0.02)
% of foreign capital	0.001*** (0.000)	0.001*** (0.000)	0.001* (0.0003)	0.001*** (0.000)	0.001** (0.000)
Intercept	0.21*** (0.05)	0.21*** (0.05)	Included	0.25*** (0.04)	Included
Year fixed effects	Included	Included	Included	Included	Included
Number of observations	7253	7253	5671	7087	5360
		Complementarity test: *Innov&Export− OnlyInnovate> OnlyExport− NoInnovate& NoExport* $F(1, 5554)=6.80$ Prob > F=0.009 two-sided	Complementarity test: *Innov&Export− OnlyInnovate> OnlyExport− NoInnovate& NoExport* $\chi^2(1)=4.43$ Prob > F=0.035 two-sided	Complementarity test: *Innov&Export− OnlyInnovate> OnlyExport− NoInnovate& NoExport* $F(1, 5400)=6.89$ Prob > F=0.008 two-sided	Complementarity test: *Innov&Export− OnlyInnovate> OnlyExport− NoInnovate& NoExport* $\chi^2(1)=3.39$ Prob > F=0.065 two-sided

*, **, *** are significantly different from zero at the 10%, 5%, or 1% level respectively.

Table 5 Multinomial probit model

	OnlyExport(t)	*OnlyInnovate(t)*	*Innovate&Export(t)*
Export(*t*1)	3.10*** (0.08)	0.24*** (0.08)	3.04*** (0.08)
Innovate(*t*1)	0.01 (0.07)	1.32*** (0.06)	1.48*** (0.07)
Size (ln of sales)	0.35*** (0.03)	0.13*** (0.02)	0.45*** (0.03)
R&D intensity	0.07*** (0.03)	0.08*** (0.02)	0.11*** (0.02)
Advertising intensity	0.75 (1.67)	0.55 (1.55)	3.62** (1.63)
Capital intensity	0.85* (0.47)	1.41*** (0.32)	1.14** (0.45)
% of foreign capital	0.002 (0.001)	0.002 (0.002)	0.002 (0.001)
Exchange rate index	0.005 (0.003)	0.003 (.004)	0.000 (0.003)
Intercept	6.67*** (0.74)	2.80*** (0.71)	7.87*** (0.72)
Year and industry fixed effects	Yes	Yes	Yes

Number of observations=8802.
Prob > χ^2=0.000.
*, **, *** are significantly different from zero at the 10%, 5%, or 1% level respectively.
Standard errors adjusted for intragroup (firm) correlation.

firm has a foreign capital it exhibits a higher growth rate ($p<0.01$).

Next we estimate the models that test for the complementarity of exports and innovation strategies (Hypothesis 1). We regress the growth rate on the exclusive combinations of exporting and innovation activities, together with the control variables that might influence growth. The lagged choices of innovation and export distinguish three cases: firms that both exported and innovated (*Innovate&Export*), firms that only exported (*Only Export*), and firms that only innovated (*OnlyInnovate*). The omitted or base case is a firm that did not do any of these activities. Table 4 (Models 2–3) presents the results of the fixed effects and Arellano–Bond[8] regressions. The results of Models 2 and 3 are aligned: indeed, coupling innovation and export activities has a significant and positive effect on growth. Consistent with complementarity, the coefficient at *Innovate&Export* is positive and highly significant. Moreover, the results of the one-sided Wald test for the difference of the parameters reveal that the test for complementarity holds at the 1% significance level for the fixed effects model and at the 5% significance level for the Arellano–Bond model. This indicates that the return from innovation increases as firms export, and vice versa. The coefficients of *OnlyInnovate* and *OnlyExport* are not significantly different from zero, suggesting that it is really the combination of both activities that matters in explaining the growth of SMEs in our sample. The parameter estimate of the lagged value of growth is not significant. This might not be surprising: the organizational growth process is often associated with random walks (e.g., Geroski, 1999, 2005).

To account for the endogeneity of the export and innovation decisions, we further estimate a two-stage model. Table 5 lists the results of the multinomial probit that models the choices to innovate and export (first stage).

The results are broadly consistent with those of prior studies. They are used primarily to generate the predicted probabilities for each of the strategy choices for use in the second-stage regression, so we do not discuss them in detail here. Yet we would like to mention a particularly interesting finding on advertising intensity, which constitutes the sole driver of the joint adoption of export and innovation strategies. The coefficient of *Advertising intensity* is positive and significant at the 5% significance level for the combination *Export&Innovate*, and only for this combination. We will go back to this finding in the Discussion and Conclusion section.

The results of the second stage are reported in Table 4 (Models 4–5). The coefficient on the *Innovate&Export* choice is positive and significant ($p<0.05$), with the magnitude amplified, compared with Models 2–3. The coefficients on the *OnlyExport* and *OnlyInnovate* variables become negative, but are not statistically different from 0, as in Model 2. The test for complementarity still holds, that is, (*Innovate&Export*−*OnlyInnovate*⩾*OnlyExport*−*No Innovate&NoExport*) is accepted at the 1% significance level for the fixed-effects model and the 10% significance level for the Arellano–Bond model.

We then proceed by estimating the bivariate probit model that relates the decisions to export and innovate (Hypothesis 2). The results for the bivariate probit model on the adoption of export and innovation strategies are reported in Table 6.

Table 6 Adoption regression: Seemingly unrelated bivariate probit model

	Export(t)	*Innovate(t)*
Export(*t*1)		0.36*** (0.08)
Innovate(*t*1)	0.39*** (0.05)	
R&D intensity		0.09*** (0.02)
Size (ln of sales)	0.53*** (0.03)	0.13*** (0.02)
Advertising intensity	5.71*** (1.63)	1.74** (0.76)
Capital intensity	0.47* (0.24)	1.76*** (0.21)
% of foreign capital	0.004*** (0.001)	0.001 (0.001)
Exchange rate index	0.003 (0.003)	
Intercept	6.60*** (0.51)	2.14*** (0.29)
Year and industry fixed effects	Yes	

Number of observations=8802.
Prob > χ^2=0.000.
*, **, *** are significantly different from zero at the 10%, 5%, or 1% level respectively.
Standard errors adjusted for intragroup (firm) correlation.

The table shows the significant positive effect of the decision to export on the decision to innovate, and vice versa: the decision to innovate positively and significantly affects the decision to engage into exports. The findings emphasize that the adoption of one activity is positively and significantly related to the adoption of the other, consistent with the existence of complementarity between exporting and innovation. With respect to the control variables, the results are in line with prior literature. *Size* has a positive and significant effect on the decisions both to innovate and to export. *Advertising intensity* positively affects the adoption of innovating and exporting activities. *Capital intensity* has a significant and positive influence on the decision to innovate, but is negatively related to the decision to export. The *percentage of foreign capital* is positively and significantly related to the decision to start exports.

Overall, the results support both Hypothesis 1 and Hypothesis 2, showing that firms that invested in both export and innovation are characterized by higher growth rates than those that do only one of the activities or none of them, and that the return from one activity increases as the level of the other increases.

ADDITIONAL ANALYSES

We proceed by conducting several additional analyses to provide further evidence consistent with the complementary relationship between exports and innovation.

According to the proposed mechanism that explains the virtuous circle between exports and innovation, exporting firms that also perform innovation activities can increase their sales volume by selling better products in export markets, and therefore either pricing higher or selling higher quantities of the same products. Moreover, better products can also enhance domestic sales. On the other hand, innovating firms when entering export markets have a chance to benefit from learning by exporting, and therefore produce better innovations. As a consequence, these firms will be able to increase their sales in both domestic and foreign markets, again either pricing higher or benefiting from higher demand, or both. We therefore expect to observe changes in firms' sales related to the change in the adopted growth strategies (export or innovation).

In particular, we focus on those firms that were only exporting but at some moment in time switched to being both exporting and innovating, and compare the *foreign* sales volumes (coming from exporting) of these switching firms to those of similar firms that continued to be *only exporters*. By the same token, we compare the variation in *domestic* sales of the firms that were only innovating with those that switched to being both exporting and innovating. An increase in *export sales* after the adoption of innovation for formerly *only exporting* firms, and an increase in *domestic sales* after the adoption of exports for formerly *only innovating* firms, would be consistent with our arguments.

To make the comparison we use a matching estimator (Abadie & Imbens, 2002),[9] which allows us to properly trace the changes in sales volumes (export or domestic) at the moment of and after switching. As relevant matching covariates we include: firm size, measured as the logarithm of the number of employees; export intensity (for only exporting and innovating and exporting firms); R&D intensity (for only innovating and innovating and exporting firms); and year and sector dummies. The results of the estimation are reported in Table 7A and 7B.

Overall, the results are consistent with the proposed mechanism. Firms that *innovate and export* show a significant increase in export sales (Table 7A) compared with *only exporting* firms already 1 year after engaging in innovation. Similarly, *Innovators&Exporters* increase their domestic sales in about 2 years after the switch compared with *only innovating* firms.

Table 7 Matching estimator

	Year of switching	*1 year after switching*	*2 years after switching*
A. Differences in export sales between matched exporting-only and innovating and exporting firms			
Logarithm of export sales	0.11 (0.10)	0.20** (0.09)	0.19** (0.09)
Number of observations	659	700	512
B. Differences in domestic sales between matched innovating-only and innovating and exporting firms			
Logarithm of domestic sales	0.15 (0.09)	0.12 (0.10)	0.25* (0.13)
Number of observations	431	276	147

Standard errors are given in parentheses.
*, **, *** are significantly different from zero at the 10%, 5%, or 1% level respectively.

Table 8 Evolution of the percentage price change before and after switching

	2 years before	*1 year before*	*Year of switch*	*1 year after*	*2 years after*
A. Exporting-only firms that switched to being both innovating and exporting					
% of price change	1.28 (4.24)	1.65 (4.09)	1.49 (3.58)	0.72 (4.25)	1.42 (5.39)
Accumulated average % of price change			4.65 (7.47) 2 years before−year of switch		5.17 (8.48) Year of switch−2 years after
t-test on the equality of means in accumulated percentage of price change: 2 years before vs 2 years after	H_0: % of price change(after switch) > % of price change (before switch) *t*=0.79 p-value=0.21 *N*=250				
B. Innovating-only firms that switched to being both innovating and exporting					
% of price change	1.83 (3.70)	1.51 (3.43)	1.23 (5.10)	2.64 (3.06)	1.35 (2.34)
Accumulated average % of price change			4.28 (7.04) 2 years before−year of switch		6.64 (5.99) Year of switch−2 years after
t-test on the equality of means in accumulated percentage of price change: 2 years before vs 2 years after	H_0: % of price change(after switch) > % of price change (before switch) *t*=1.38 p-value=0.08 *N*=56				

Standard errors are given in parentheses.
*, **, *** are significantly different from zero at the 10%, 5%, or 1% level respectively.
H_0 stands for null hypothesis.

Searching for a deeper understanding of the phenomenon, the next analysis examines the change in prices for the firms that switched from being only exporting to innovating and exporting, and from being only innovating to innovating and exporting. The ESEE survey provides information on prices at the firm level; more specifically, firms report the average price increase in percentage across their markets compared with the previous year. As we do not observe the absolute values of prices, the comparison of the price increases between the groups of firms might be misleading. Hence, we look at the temporal evolution of the percentage of price increase only for switching firms.[10] Tables 8A and 8B report the results regarding price changes.

Though these results might only be indicative, the *t*-test on the equality of means of the cumulated price increase over the two timeframes – from 2 years before switch to year of switch, and from year of switch to 2 years after switch – shows that the increase in prices is higher in the post-switch period (insignificantly for exporting-only firms, and significantly at the 10% significance level for the

innovating-only firms) than in the pre-switching period. Again, the observed patterns are in line with the proposed reinforcing mechanism between exports and innovation.

DISCUSSION AND CONCLUSION

In this study, we have analyzed the effect of innovation and exports on SMEs' organizational growth. Specifically, we have argued that innovation and exports are *complementary* activities that reinforce each other, and whose individual marginal contribution to SMEs' sales growth is higher if the other activity is also in place. Our empirical analyses provided evidence consistent with our arguments. Even though our findings are robust to a number of different specifications and additional checks, they should still be carefully interpreted because of some limitations that may warrant attention. In particular, while the use of exclusive dummy variables for describing innovation and export strategies has the nice property of not imposing any specific functional form in the "productivity" regression, more fine-grained data on innovation and export (e.g., measures of export and innovation intensity) could also be profitably exploited. In addition, we do not control for where the export activity is directed to, making the implicit assumption that export may be equally beneficial, independent of the export market, whereas Salomon (2006) shows that there are additional benefits in terms of incoming knowledge spillovers when exporting to developed foreign markets. We thus expect the complementarity relationship to be even stronger for firms that export to more developed markets. We also have to acknowledge that we rely on data from a single country, and hence we cannot assess the effect of differences in institutional, financial and governance regimes – factors that might actually matter for the link between strategic choices and growth (e.g., Sapienza et al., 2006). Relatedly, the results of this study may not strictly apply to other countries. For instance, it has been shown that the relationship between exporting and productivity might depend on countries' economic development, with specific different results in low-income countries (Bernard, Jensen, Redding, & Scott, 2007).

The aforementioned limitations notwithstanding, this study makes several contributions to the literature. To begin with, we present novel evidence on the drivers of SMEs' growth. Prior research has explored the effect of these strategic activities in isolation, showing that each of the activities contributes positively to SMEs' growth rates (e.g., Becchetti & Trovato, 2002; Lu & Beamish, 2001; Yasuda, 2005). In this study, we go one step further and discuss the positive *interaction* between the two activities in shaping SMEs' performance. In particular, we describe and test the mechanism that may underlie the reinforcing circle between exports and innovation, and provide empirical evidence for the existence of the claimed complementarity effect. Our study is akin to Filatotchev and Piesse (2009: 1272), who argue that "R&D and export orientation seem to be mutually reinforcing in terms of their combined effect of growth." This study complements their study both theoretically and empirically. Theoretically, we unearth the mechanism behind complementarity of innovation and exports, which is not the focus of their paper. Empirically, we follow the rigorous test of complementarity suggested by Cassiman and Veugelers (2006) and consider a wider and representative sample of SMEs, whereas they adopt a specific and different empirical context, based on a sample of newly listed firms.

Second, this study sheds some new light on the mechanisms through which exports can enhance firms' performance. While export is the most widely used strategy for international expansion, the determinants of firms' export behavior have received more attention than its consequences and, more broadly, the effect of exports on firm performance has not received nearly the attention devoted to macro-level issues (Salomon & Shaver, 2005b).

At a more general level, our study adds also to the strategic management literature. The idea that the activities of a firm's strategy and their effects on performance are not independent is actually a key notion in strategy (e.g., Porter, 1996; Rivkin, 2000). Yet searching for interactions might still provide an insufficient understanding of the role of activities for firms' competitive advantage. Porter and Siggelkow (2007) have highlighted that the nature of interaction between a firm's strategic activities may not simply be an inherent property of the activities themselves, but also a function of the other decisions made by a firm. In other words, whether and how two activities interact – for instance whether they are complements and reinforce each other, or whether they are substitutes – may also depend on *other* activity choices made by a firm. Hence, they argue, researchers should also try to discuss and identify the possible drivers of the interaction between activities.

What promotes the complementarity relationship between innovation and exports that we have documented? Cassiman and Veugelers (2006) have suggested an empirical methodology to identify the possible drivers of a complementary relationship between two activities. First, a multinomial choice model having the exclusive strategic activities combination as dependent variables is to be estimated. Second, the exclusive drivers of the *joint decision* – that is, with specific reference to the case of this study, the variables whose parameter estimate is significant in the multinomial model *only* for the *Innovate&Export* option, and *not* significant for other combinations – can explain the observed correlation of activities, and therefore highlight the contextual variables that affect complementarity within a heterogeneous firm population. As the results of the multinomial probit reported in Table 5 show, for the purposes of this study this variable – the "exclusive driver" – is advertising intensity.

Arguably, two conditions are to be met for the functioning of the virtuous circle at the basis of the complementarity between innovation and exports. First, firms need to be able to recognize and absorb the valuable external knowledge available in export markets. In accordance with the well-known "absorptive capacity" argument (Cohen & Levinthal, 1990), Aw et al. (2007) have shown that firms' ability to learn from export is positively associated to their internal R&D activities. Second, the knowledge absorbed in foreign markets needs to be effectively used and embodied in innovations, and the value of these innovations should be recognized and valued in both domestic and foreign markets. Being an effective innovator requires more than just developing innovations; it requires appropriating the value they create. Knight and Cavusgil (2004), *inter alia*, have highlighted the critical role of marketing activities as a fundamental driver of performance in international markets for young firms. Advertising can help firms to offer products whose value buyers perceive to exceed the expected value of alternative offerings, and can thus provide a means through which firms can interact with foreign and domestic markets to herald the value of their innovative products. Advertising promotes information dissemination, product differentiation, and brand building, and can hence boost firm sales by stimulating demand (i.e., increasing volume), allowing firms to charge more per unit, or both. Our results therefore complement prior literature that has highlighted the role of advertising in shaping export sales (e.g., Salomon & Shaver, 2005b) by suggesting that investments in advertising are a key contextual variable that influences the extent to which combining innovation and exports increases SMEs' rate of growth.[11]

Our results also carry some important implications for practice. We show that although exports and innovation may be perceived as substitute strategies (e.g., Roper & Love, 2002), which compete for finite internal resources and need prioritizing over time, the potential of combining the two strategies should not be ignored by managers. Adopting both activities provides more benefits than the sum of the benefits of the two activities in isolation, suggesting that performance improvements do not necessarily come from optimizing each of these strategies on its own, but also from the positive interaction between them. Yet we do not suggest that the complementarities are readily realized for *all* firms, and we do acknowledge that the positive interaction of export and innovation strategies might be contingent on a number of factors. Moreover, our findings are relevant from a public policy perspective, too. Economic policies aimed at export promotion have been widely supported by the idea that exposing firms to an international environment leads to increasing productivity. Nevertheless, the practice shows that these efforts may not work as effectively as thought if not accompanied by innovation efforts by the firms. For instance, despite large investments made by the Spanish government in export promotions during the 1990s, the country's productivity growth has been one of the lowest among the EU nations. Our findings directly suggest that combining innovation and export activities may lead to synergies positively affecting growth. Then policies aimed at both innovation and export promotions might be a valuable option. However, we should also acknowledge that to properly compare different policy alternatives we should account for a number of additional factors, and in particular for the costs of these policies.

There are several avenues for future research suggested by our findings. We discussed the interaction between the innovation strategy and the export strategy of firms. We touched upon the factors that could drive the complementary relationship between these activities, and found advertising intensity to matter. Further research could address the question of context variables that promote complementarity in more depth. Moreover, additional interactions within a firm's strategy, and in

particular international strategy, could be profitably explored in future studies, since such interdependences present relevant insights not only for the creation, but also for the sustainability of competitive advantage (Rivkin, 2000). At a more general level, our analysis points out the need to integrate international entrepreneurship research with a strategic perspective. Salomon and Shaver (2005b) have stressed that firms' internationalization choices are not driven solely by environmental factors, such as exchange rate changes and market growth, which are outside the control of managers, and that a firm's export strategy should be a strategic decision that involves more than simply scanning for and responding to changes in the macroeconomic environment. Our findings have shown that a strategic approach to export should not ignore the interaction among a firm's activities in place, or which could be developed.

To conclude, we reiterate that in this study we have offered novel empirical evidence on the drivers of SMEs' growth, documenting the complementarity between innovation and exports, and opening the path for much needed further theoretical and empirical work on the interaction in firms' growth and international strategies.

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NOTES

[1]We assume no interaction with domestic sales, for the sake of simplicity.

[2]The average proportion of the firms in year t that continue in the survey in year $t+1$ is approximately 91.5% for the 1990–1999 sample period. About 8.5% of firms exited the sample during this time period. Among the firms that exited the sample, approximately 2.6% disappeared due to closure, change to non-manufacturing activities and absorption during merger or acquisition. Approximately 3.3% of the exiting firms stopped collaborating, and about 2.6% were without access due to temporary closure or non-localizability.

[3]The source for the producer price index defined at the two-digit NACE industry level is Instituto Nacional de Estadística (www.ine.es).

[4]The test for complementarity is based on the definition of complementarity by Milgrom and Roberts (1990). *Growth*(*Innovate&Export*), *Growth* (*OnlyInnovate*), *Growth*(*OnlyExport*), and *Growth* (*NoInnovate&NoExport)* are the estimated coefficients on the firm's choice of different combinations of export and innovation in the growth regression (3). If the inequality (4) is true, that is, the complementarity test holds, it would mean that adding an activity (e.g., export) while the other activity is already performed (e.g., innovation) will result in higher incremental growth rates than when adding this activity in isolation.

[5]To explain the adoption decisions of the different combinations of export and innovation choices we use a multinomial probit model, which, unlike multinomial logit, avoids the I.I.A. assumption and assumes that the errors can be correlated across choices. We use a cross-sectional model with the errors corrected for the intra-group (firm) correlation.

[6]Following Campa (2004), we calculate an exchange rate index that reflects the changes in the peseta (the Spanish national currency over the period of analysis) with respect to other foreign currencies during 1990–1999, with higher values of the index corresponding to peseta depreciation periods. This index is firm specific, that is, it accounts for the fact that different firms may export to different markets and thus be differently affected by the exchange rate changes. It is calculated as a weighted average of the bilateral exchange rates of each of the potential export markets. For exporting firms, the information on the export markets is provided in the ESEE survey. The survey data distinguish among three broad export markets: EU (European Union) countries, other OECD countries, and the rest of the world. The computation of the exchange rate index is complicated, as the survey reports the information on the markets once in four years, that is, we have these data for 1990, 1994, and 1998. We calculate individual exchange rates for firms that were exporters in 1990, 1994, and 1998 by taking their export market to be equal to the one in the previous period. That is, for 1991–1993 we use the data for 1990, for 1995–1997 we use the information available in 1994, and for 1999 we use market destinations in 1998. For the firms that did not export in 1990 (1994) but exported in 1994 (1990), we define their markets as their 1994 (1990) pattern. The same procedure is applied to other combinations of 1990, 1994, and 1998. For firms that did not export

during 1990–1999 we compute a weighted average of the EU, OECD, and other countries' shares for Spain in that particular year.

[7]Prior strategy research has used a similar approach to test the interrelationship between different strategic decisions. For instance, Salomon and Shaver (2005b) investigate the link between domestic and export sales by using simultaneous equation modeling and testing for the direct effect between these two variables.

[8]The results of the Hansen test for the validity of over-identifying restrictions and the quality of instruments and Arellano–Bond test for the second-order serial autocorrelation of residuals support the validity of the model specification (Hansen test of over-identifying restrictions: $\chi^2(27)=26.52$; $\text{Prob}>\chi^2=0.490$; Arellano–Bond test for AR(2) in first differences: $z=0.40$ $\Pr>z=0.689$).

[9]Instead of conducting the test for the equality of means, we use a matching technique, as it allows to take into account relevant matching characteristics, such as firm size, export and R&D intensity, industry and year in which we observe the compared firms. We use the matching estimator developed by Abadie and Imbens (e.g., Abadie, Drukker, Herr, & Imbens, 2001; Abadie & Imbens, 2002) and estimate a model using a STATA routine developed by Abadie et al. (2001).

[10]We used a CPI index (www.ine.es) to correct for the inflation during 1990–1999, and make the percentage of prices comparable over different time periods.

[11]Another possible explanation regarding the importance of advertising intensity for the adoption of both export and innovation activities considers the difference between OEM suppliers and own-brand manufacturers, which might have different needs for innovation when exporting to foreign countries. Clearly, in the case of own-brand manufacturers, innovation is of greater importance and requires promoting in the foreign markets as these firms start exporting. We thank an anonymous reviewer for suggesting this alternative explanation.

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APPENDIX

Table A1 Variable definitions

Variable	*Description*
Total sales growth rate	Firm organizational growth measure, calculated as log(sales(t)/sales(t1)), with total (domestic and export) sales deflated using producer price index
Innovate	Dummy variable, equals 1 if firm realizes either product or process innovation
Export	Dummy variable, equals 1 if firm exports
Innovate&Export	Dummy variable, equals 1 if firm both innovates and exports
OnlyInnovate	Dummy variable, equals 1 if firm innovates only
OnlyExport	Dummy variable, equals 1 if firm exports only
NoInnovate&NoExport	Dummy variable, equals 1 if firm neither innovates nor exports
Capital intensity, %	Share of office/technical equipment and construction spending on total sales
Advertising intensity, %	Share of advertising and public relations spending in total sales
R&D intensity, %	Share of R&D expenditures in total sales
Exchange rate index	Firm-specific exchange rate index
Size	Firm size measured as the logarithm of sales
Merger	Dummy variable, equals 1 if firm experiences a merger at time t
% of foreign capital	Percentage of foreign capital in the capital structure of a firm
Definitions of product and process innovation in the ESEE survey	*Product innovation*: whether a firm obtained product innovation in a given year – new products, or products with new features that are different from those that a firm produced in the previous years. If the answer is yes, the type of modification is asked: • incorporates new materials • incorporates new components or intermediate products • incorporates new design or presentation • the product performs new functions *Process innovation*: whether a firm introduced an important modification in the production process. If the answer is yes, the type of modification is asked: • introduction of new machinery • introduction of new methods of production organization • both

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