A multi-dimensional analysis on how different types of innovations impact SMEs business performance

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February 2019

Working Papers in Applied Economics

WPAE-2019-02

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Abstract.

This paper examines the impact of innovation decisions on business performance for small and medium-sized enterprises based on a multi-dimensional analytical approach. With this aim, the impact of the firm's innovation decisions (in terms of the introduction of product, process, and/or organisational innovation) on four alternative performance indicators (two financial indicators: sales increase and cost reduction; and two operational indicators: increase of productive capacity and improvement in quality) is analysed. Additionally, an array of potential moderating determinants (such as firm and entrepreneur characteristics) are controlled for. Our findings highlight the existence of positive impacts of innovation decisions on both dimensions of business performance (financial and operational), but these impacts significantly differ depending on the type of innovation and the performance indicator considered. Thus, in order to study the multi-faceted effects of innovation decisions made by the firm, results point out that the relationship between innovation (product, process, or organisational) and business performance should be analysed from a multi-dimensional approach. These findings imply significant implications for the design and implementation of innovation strategies in SMEs, since these should be tailored according to the business performance sought by the firm.

Keywords: innovation, business performance, SMEs, Spain.
JEL Classifications: M21, L25, O30.

1. Introduction.

SMEs are commonly defined as reactive, flexible and risky organisations (Terzioski 2010), as well as more innovative than their larger counterparts (Tonge et al. 2000), which reflects the widespread assumption that in order to be successful, entrepreneurs or small business managers need to possess an innovative edge to compete successfully against bigger, well-established incumbents (Rosenbusch et al. 2011). Further, SMEs are able to obtain profits from a quicker and more flexible adjustment to environmental changes due to their simplified hierarchies and quick decision-making (Nootebomm 1994; Vossen 1998). In this sense, the introduction of innovative products, processes, and/or new organisational business models may represent an additional opportunity for SMEs to stand out from the competition and improve their performance to remain competitive, both in the short- and medium-term (Porter 1980; Keizer et al. 2002; Máñez et al. 2010 and 2015).

In contrast to the extensive literature asserting the positive aspects of innovation on business performance (see Añón Higón et al. 2015; Freel 2000; Freel and Robson 2004; Hervas-Oliver et al. 2014; Máñez et al. 2015; Van Auken et al. 2008; Zahra and George 2002; among others), other studies have reported mixed and inconclusive findings for SMEs (Vermeulen et al. 2005; Terzioski 2010). A number of explanations to these results come from the fact that innovation requires a large amount of resources (e.g. financial, technological, and human capital), which might constitute a significant constraint for SMEs (Acs and Audretsch 1988; Vossen 1998). Moreover, success in introducing innovation may require special organisational capabilities in order to better appropriate its performance benefits (Howell et al. 2005; Thornhill 2006) and/or may imply an increase in uncertainty and risks (Nieto and Santamaría 2010). Therefore, further research in this topic might be essential since there still remains a lack of empirical evidence on the relationship between innovation and the performance of SMEs (OECD 2010; Rosenbusch et al. 2011).

This paper aims to fill this gap by providing new empirical evidence on the relationship between innovation and SMEs business performance using a multi-dimensional analytical approach. This approach is based on the postulation that different types of innovations introduced by the firm exert a distinctive impact on the various dimensions of business performance. Specifically, we check whether the strength of the innovation-performance relationship depends on the type of innovation and on the

performance dimension considered. Following the definition of innovation by OCDE (2010), three different types of innovations are analysed: product, process, and organisational (or managerial) innovations. Regarding performance dimensions, each one is measured by two alternative indicators: sales increase and cost reduction, on the financial dimension, and increase of productive capacity and quality improvement, on the operational dimension. Therefore, this study aims to extend previous research studies, such as Rosenbusch et al. (2011), Van Auken et al. (2008), and Freel and Robson (2004), among others, with the objective to answer following general questions: Does empirical evidence support the positive relationship between innovation and SME business performance in both, financial and operational dimensions? Is innovation indeed always a positive strategy for the improvement of business performance regardless of the performance measure and the type of innovation considered?

A sizeable sample of Spanish SMEs is employed from industrial, construction, commercial and services sectors, all collected in 2012, but with retrospective information on the three previous years for innovation activities. Our results indicate that while product innovation impacts positively on sales increase, and organisational innovation reveals a positive effect on cost reduction, all innovation types (product, process and organisational) show significantly positive effects on both operational performance indicators (productive capacity increase and quality improvement). In this regard, our results provide a better understanding of the importance and the role of innovation in improving certain performance dimensions/indicators of SMEs, in that they are relevant for those decision-makers related to innovation, entrepreneurship and business performance.

The rest of the paper is organised as follows. The second section reviews the main literature on the relationship between the innovation decisions and business performance of SMEs and presents our research hypotheses. The subsequent section presents information on the sample and on the methodology applied in the analysis of the data. The last two sections discuss the analytical results and present the conclusions of the study.

2. Literature review and hypotheses.

Regarding the relationship between innovation and the business performance of SMEs, an array of studies have shown positive effects of innovation activities on business

performance. Nevertheless, these studies have focused on specific dimensions of business performance of SMEs, avoiding a multidimensional analytical approach. Moreover, most of the existing studies have principally analysed the effects of technological innovations (such as product innovation and, to a lesser extent, process innovation) on SME business performance (Foreman-Peck 2013; Hervas-Oliver et al. 2014). Thus, there remains a significant knowledge gap regarding the impacts of non-technological innovation (such as organisational innovation) (Aragón-Sánchez and Sánchez-Marín 2005; Lin and Chen 2007).

On focusing on the financial dimension of business performance, studies such as Calvo (2006) and Pérez et al. (2004), show that innovation increases the financial performance of a firm and the survival rates among SMEs. In this respect, Geroski and Machin (1992), Zahra et al. (2000) and Máñez et al. (2015) find robust evidence concerning the larger margins obtained by innovative firms, which indicates that innovation may foster sales growth and internal efficiency, thereby significantly reducing production costs due to the gains obtained from the increase in labour productivity. Hall et al. (2009), among others, highlight this aspect and, using a sample of European countries, including Spain, argue that product and process innovations exert a positive impact on SME productivity.

In addition to the positive effects on the financial performance of SMEs, further benefits of innovation include learning economies, economies of scale and scope, and the ability to set quality standards (Shepherd and Shanley 1998). These benefits usually arise from a better capability to identify, assimilate, and apply knowledge more easily throughout the company due to innovation (Cohen and Levinthal 1990). In this regard, evidence shows that the spread of innovation to processes and managerial aspects in multiple business areas of the company increases its productive potential and leads to a continuous improvement in quality, which together represent a medium-term competitive advantage that guarantees a positive operational performance (Zahra and George 2002).

In very competitive markets, the survival of SMEs is related to their ability to offer differentiate high-quality products and services (Edquist 2001). Specifically, process and organisational innovations may play a significant role in the improvement of product (and service) quality as a result of the introduction of new forms of management that enhance quality in certain areas or in the company as a whole (i.e. total quality management as evidenced by Prajogo and Sohal 2003). Moreover, the spread of the innovation process

to all areas of the firm may exert a positive impact on its medium-term performance through an increase of its productive potential and the achievement of continuous improvement in quality (Zahra and George 2002).

The increase of productive capacity as an operational performance measure might be understood as a pure indicator of business growth, though growth can be measured in various ways (Westhead and Birley 1995; Dobbs and Hamilton 2007). In this respect, existing literature shows that innovation tends to foster business growth in small firms (Storey 1994; Heunks 1998; Freel and Robson 2004). Further, growth in terms of employment generation has received special attention over alternative measures (Curran 2000; Gibb 2000), especially in countries, such as Spain, that suffer from persistent unemployment problems (Triguero et al. 2014). This latter work states that process innovation shows a positive effect on employment for Spanish SMEs, while that of product innovation remains insignificant. Nevertheless, this study considers the augmentation of productive capacity as a global operational outcome, given that more production necessarily implies an increase of productive capacity through a greater use of physical and human factors (Freel 2000).

In the light of the literature review, this paper aims to highlight the impacts of different types of innovation (i.e. product, process and organisational) from a multidimensional approach, thus considering different dimensions of the SMEs' business performance. Thus, our first general hypothesis is:

Hypothesis 1: *The introduction of innovation (product, process and organisational) by the firm may impact on both dimensions of SME performance (financial and operational). Nevertheless, these impacts may differ depending on the performance dimension (and indicator) considered.*

It should be borne in mind that although both dimensions of business performance may be positively influenced by innovation, these impacts may vary significantly between the two business-performance dimensions (financial and operational) and/or the type of innovation introduced by the firm (product, process and/or organisational). Despite confirmation of this fact by the existing literature, most attention has been given to the study of the effects of innovations of a technological nature (such as product innovation

and, to a lesser extent, process innovation) on the business performance of SMEs (Hervas-Oliver et al. 2014). Hence, there is still a significant lack of knowledge regarding the impacts of non-technological innovation types (such as organisational innovation) on business performance (Aragón-Sánchez and Sánchez-Marín 2005). In this sense, Damanpour et al. (1989) state that innovation is a multi-faceted phenomenon with different types of benefits for SME performance that depend on the type of innovation introduced by the firm. In this study, we aim to identify how these impacts on business performance of SMEs may differ from one type of innovation to another. Consequently, our second and complementary research hypothesis is:

Hypothesis 2: The type of innovation implemented by the firm will determine which of the business performance indicators is influenced and to what extent. Therefore, any type of innovation might not always be suitable for influencing all dimensions and/or indicators of SME business performance.

The relationship between innovation and business performance may also be moderated by other determinants, both internal and external to the firm. In this sense, Rosenbush et al. (2011) argue that the global impact of innovation on SME performance should be described by an aggregation of positive and negative mediating effects, which are moderated by contextual factors, both internal and external. Among these moderating factors, characteristics of the firm, such as size and age (Henderson 1999; Hall et al. 2009), characteristics of the entrepreneur, such as educational level acquired and managerial experience (Entrialgo 2002; Dobbs and Hamilton 2007), and entrepreneurial and strategy determinants (Veugelers 1997) have been revealed as relevant. R&D cooperation strategies (both with market partners and with public agents) among SMEs have also played a significant role in developing new products and processes (Spithoven et al. 2013). Additionally, governance environmental (national or regional) and sectoral characteristics have attracted scholars' attention as moderating factors in the innovation-performance relationship (Yang 2016). On the basis of these arguments, our analysis controls for a wide group of these internal and external. A more detailed description of the variables used in our analysis is given in the following section, as well as in the Appendix.

3. Data.

The research analysis proposed is constructed on the general hypothesis that innovations (i.e. product/service, process, and organisational innovations) introduced by the firm in previous years might have a significant effect on the various dimensions of business performance for SMEs in subsequent years. The business performance and innovation variables used in this study are described below. Moreover, a full description of all variables employed is also provided in the Appendix.

Data comes from a survey carried out in 2012 on the competitiveness of Spanish SMEs. This data forms part of the project "*Analysing the qualitative aspects shaping the quality of entrepreneurs and SMEs: implications for the economic development of the Spanish Regions*", promoted by the Regional Government of Andalusia (P09-SEJ-4857). The firms included in the sample have fewer than 250 employees and annual sales below 50 million Euros. The survey was conducted across six Spanish regions: Andalusia, Extremadura, Madrid, Murcia, Navarre, and the Basque Country, representing southern, central and northern regions of the country.

The questionnaire was designed to include questions on the innovative activities of each business and on the subjective perceptions of the entrepreneur regarding the impact of innovations, introduced by the firm during the three years previous to the year of the survey (period 2009-2011), on different dimensions of its current business performance. Data on the characteristics of the firm and entrepreneur and on business strategies was also gathered. All types of SMEs were included in the study with the exception of self-employed entrepreneurs without employees. The survey was addressed to the person with the role of entrepreneur in the firm, which is defined as the person who performs principal managerial functions within the business. In this regard, several studies have provided empirical evidence that SME managers are the most important decision-makers within their organisations (Van Gills 2005; Hall et al., 2009) and their managerial perceptions shape the firm's strategic behaviour to a significant degree (O'Regan and Sims 2008). Additionally, several recent studies have confirmed that self-reported information by managers constitute an adequate approach to measure business performance and other strategy variables, such as innovation (Foreman-Peck 2013; Madrid-Guijarro et al. 2013).

The sampling procedure for this dataset was designed to represent the structure of the regions following the stratified sampling principles in finite populations. The population of firms was segmented by size, sector and location in order to ensure wide coverage. The number of firms in each stratum was calculated with reference to information contained in the Central Directory of Firms that had been collated by the Spanish National Statistical Institute. The stratified sample, with quotas for business-size groups and sectors, was representative of the business population of every region included in the study, with an error of ±6.0% at a confidence level of 95.5 per cent. A response rate of 20.8 per cent was obtained in the fieldwork. The final dataset, after correcting for missing data, was made up of 1,424 observations. No bias was detected between respondents and non-respondents.

The questionnaire asked managers the following question: *"Is your firm perceiving a significant beneficial impact on its business performance due to innovations introduced in the last three years?"*, for which the possible answer is either "yes" or "no". Additionally, the questionnaire distinguished between four alternative indicators regarding business performance gains: two indicators on a financial dimension (increase in sales and cost reduction) and another two on the operational dimension (increase in productive capacity and improvement in the quality of products/services provided by the firm).

As regards innovation variables, the survey provides information on three types: product (or service) innovation, process innovation, and organisational innovation. Product innovation and process innovation, are related to technological innovation, since technological changes generate new (or transformed) products/services and processes (Freeman 1974). However, managerial or organisational innovation is based on changes introduced into the organisational and administrative structure of the company and are more closely related to management than to the company's main activities.

In relation to the questions on innovation, which constitute our main determinants for business performance, the questionnaire asked managers the following question: *"Has your firm introduced any new or significantly improved innovation during the last three years?"*, where innovation is classified as product/service innovation, process innovation, or organisational innovation. If the firm had introduced any type of the innovations mentioned, then the answer to the question was yes, and no otherwise. Several studies have found that manager perceptions regarding innovations introduced by the firm are

highly correlated with objective measures of innovation, such as patents and R&D expenses (Frishammar and Hörte 2005; Kalantaridis and Pheby 1999; Zahra and Covin 1993).

A number of control variables that have shown explanatory relevance are also considered in our empirical analysis. Following the literature, we group these variables into four categories: characteristics of the firm; business strategies; entrepreneurial characteristics; and, determinants of the business environment. The introduction of these moderating variables is justified by an extensive literature (see Dobbs and Hamilton 2007; Entrialgo 2002; Love and Roper 2015; O'Regan et al. 2005; Vahter et al. 2013; Zahra et al. 2000; among others). A complete description is offered in the Appendix.

Descriptive statistics for the main variables of interest are shown in Tables 1 and 2. Table 1 presents the proportion and number of innovators and the frequency distribution for the type of innovations introduced by firms in our sample. It can be observed that 62.60% of the firms in the sample introduce at least one innovation in the period 2009-2011.

[Table 1 about here]

Table 2 provides further information on the composition of the sample regarding firm characteristics and strategic variables. Moreover, our average entrepreneur is 46 years old, male (69% of the sample), with a university degree or higher level of qualifications (49.5% of the sample) and 16 years of managerial experience.

[Table 2 about here]

4. Method.

To test the hypotheses described above, binary outcome (probit) models are used. Specifically, these models let us to analyse whether the previous introduction of innovation (of any type) by the firm results in a higher predicted probability of a current positive performance (i.e. sales increase), under a ceteris paribus assumption. In our specific case, three innovation variables (product, process and managerial innovation) and a set of control variables (such as business environment, the firm and entrepreneur

characteristics and other variables related to firm's strategy) are considered as explanatory variables of SMEs' business performance. Consequently, the specification of our model to test can be expressed by:

$$Performance_i = \beta_0 + \beta_1 [Innovation]_i + \beta_2 [Firm\ Characteristics\ \&\ Strategy]_i +$$

$$\beta_3 [Entrepreneur\ Characteristics]_i + \beta_4 [Business\ Environment]_i + \varepsilon_i$$

where the variable *Performance* represents the binary outcome (one out of our four performance indicators), taking a value equal to 0 if the firm has observed no significant improvement in this performance indicator or a value equal to 1 if it has improved its performance due to innovation introduced by the firm. The error term is assumed to be iid~$N(0; \sigma_\varepsilon)$.

As the estimated β parameters are not directly interpretable (apart from the sign), marginal effects of the regressors at mean values are estimated. As these alternative parameters are fully interpretable in sign and value, they show how much the (conditional) probability of the outcome variable changes when you change the value of a specific regressor under a *ceteris paribus* assumption. In order to test our four alternative performance measures, this model specification is run separately for each of them. Both estimated β parameters and marginal effects are shown in Tables 3 and 4.

5. Results.

Before discussing the results, it is important to note that regression models that include various dimensions of innovation might be subject to multi-collinearity. A collinearity test has been applied in all our models. The resulting variance inflation factors range from 1.02 to 2.06 for the explanatory variables in our tested models. Since all scores are far below the cut-off point of 10, multi-collinearity is ruled out (Neter et al. 1990).

Estimates results are shown in Tables 3 and 4. With regards to the financial dimension, Table 3 shows the estimated β parameters and its associated marginal effects (margins) as defined above. Robust standard errors are given in parenthesis.

Results show a significant positive impact of product innovation on sales increase. Thus, as indicated by the marginal effect, the introduction of this type of innovation in previous years results in a higher predicted probability of sales increase of 12.8% (under a *ceteris paribus* assumption). No significant impacts are detected in the case of process innovation. Regarding the introduction of managerial innovation, this significantly increases the predicted probability of cost reduction in a percentage of 8.2%.

From an operational point of view, Table 4 shows that all types of innovation (product, process and managerial innovations) reveal to assert a significant impact on both indicators (an increase in productive capacity and quality improvement), as shown by the statistically significant marginal effects. With respect to an increase of productive capacity, the highest impact is observed for process innovation (10.7%), followed by product (8.6%) and organisational innovation (7.3%). Regarding the improvement in quality of products and services provided by the firm, product innovation asserts the highest impact (9.3%), followed by process and organisational innovation. These findings would confirm that innovation (of any type) positively impact on the operational dimension of business performance, fostering SME's competitive advantage in the market in the long-term (as also argued by Zahra and George 2002).

[Table 3 about here]

[Table 4 about here]

In summary, findings support the hypothesis that innovation increases the probability of achieving better performance outcomes in SMEs. Moreover, these results not only confirm the positive impact of innovation on business performance for SMEs but, conversely to Heunks (1998) who found that "innovation of any kind fosters growth of small firms" (p. 270), the type of innovation introduced by the firm seems to make a difference regarding its positive impact depending on the performance indicator considered. Thus, the benefits of innovation for a SME would depend on the type of innovation developed, as argued by Damanpour et al. (2011) and confirmed by our findings. These findings would support our research hypotheses, since innovation would clearly assert positive effects on business performance. Nevertheless, these effects, both

in terms of sign and extent, would differ depending the type of innovation and the performance dimension/indicator considered.

Regarding the control variables, firm characteristics such as firm size and age are not major determinants of business outperformance. Only medium-sized firms seem to enjoy a higher probability of better performance in operational measures, being a 27% higher in the case of productive capacity increase and a 12% for quality improvement. These results suggest that bigger SMEs would be in a better position to internalize positive effects of innovation than smaller companies. Similarly, potential effects of entrepreneur characteristics turned to have low impacts at moderating the relationship between innovation and business performance. Gender shows a positive effect on the cost reduction and quality improvement indicators; meanwhile entrepreneur's age registers a negative impact on both operational performance indicators. These findings would suggest that the positive relationship between innovation and performance in SMEs is stronger as entrepreneurs (and thus, their business projects) are younger (Máñez Castillejo et al. 2010; Rosenbusch et al. 2011). The level of qualification reached by the entrepreneur does not seem to be significantly important in determining business performance.

With respect to the firm's strategy variables, results show that export activity and the firm's venturing orientation appear to be significant factors in explaining business performance. In this regard, exporting SMEs show significantly better performance in terms of sales increase, cost reduction and productive capacity augmentation. These results support the existence of a positive relationship between exporting and business performance, as argued by Golovko and Valentini (2011) and OECD (1997), among other studies. Additionally, SMEs with a clear venturing orientation (and low levels of risk aversion) increase significantly the predicted probability of outperforming between 2% and 3.6%, depending on the selected performance indicator. These findings are in line with those of Rosenbusch et al. (2011), who show positive effects of firm's innovative edge on business growth. Finally, all models incorporate environmental control variables, such as sectoral and regional variables. Nevertheless, estimated parameters are not shown due to its non-statistical significance.

Based on the above findings, our hypotheses can be further discussed. Firstly, empirical results for the case of Spanish SMEs have shown that innovations introduced by the firm in previous years play a significant role in explaining current business

performance, leaving innovation decisions as a key determinant for business success and survival. Although these findings are in line with the reviewed literature, our specific analysis shows how the introduction of different types of innovation by the firm (of a technological nature, i.e. product and process innovation, and/or of a non-technological nature, i.e. organisational innovation) exert a distinctive impact on alternative performance dimensions and indicators. Furthermore, our findings confirm that the impact of innovation decisions should be analysed from a multi-dimensional approach, as also suggested by Edwards et al. (2005) and Damanpour et al. (2011). Moreover, these results not only confirm the positive impact of innovations on business performance for SMEs but, the type of innovation introduced by the firm also seems to make a difference regarding its positive impact depending on the performance indicator considered.

5. Conclusions.

Most of the attention given by scholars to the effects of innovation focus on the relationship between technological innovation (i.e. product innovation) and business growth measures (i.e. sales, employment) for SMEs, while other performance dimensions of business and non-technological innovations (i.e. organisational innovation) have traditionally been overlooked. Findings show that the introduction of innovation of any type (product, process, and/or organisational) has significant and positive effects on SME business performance dimensions, both financial and operational. Specifically, while product innovation has a significant impact on sales increase, and organisational innovation increases the probability that a cost reduction occurs, all innovation types show positive and significant effects on SME operational performance indicators (i.e. increase in productive capacity and quality improvement).

Innovation decisions can therefore be characterised as a multi-faceted factor, showing different types of potential performance benefits for a firm depending on the type of innovation introduced and the dimension of business performance considered. This study does not only contribute to the empirical knowledge on the relationship between innovation decisions and business performance in Spanish SMEs, but it incorporates a multi-dimensional approach in order to assess the impacts of innovation decisions (of either a technological or non-technological nature) on alternative business performance dimensions and indicators. Therefore, findings hold significant implications for policymakers and all agents involved in innovation decisions within SMEs, since the

design of innovation strategies should depend on the previously specified business performance objectives.

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Table 1. Number of observations and frequency by innovation type.

	N	%
Innovators	892	62.60
Innovators by type		
Product innovation	790	55.44
Process innovation	404	28.35
Organisational innovation	464	32.56

Table 2. Frequency distribution of certain categorical variables.

Sector	
Industry	10.81%
Real Estate & Construction	14.88%
Commercial	25.61%
Services	48.70%
Size	
Micro (1-9 employees)	87.93%
Small (10-49 employees)	10.46%
Medium (more than 49 employees)	1.61%
Firm Strategy	
Exporting	19.30%
Importing	25.26%
Attending fairs	73.12%
Market cooperation	23.79%
Institutional cooperation	15.09%

Table 3. Financial performance.

	Sales increase		Cost reduction	
	β	Margins	*β*	Margins
Innovation				
Product	0.3530	0.1280***	0.0693	0.0261
	(0.0728)	(0.0257)	(0.0730)	(0.0274)
Process	0.1146	0.0415	0.1174	0.0442
	(0.0851)	(0.0308)	(0.0834)	(0.0313)
Organisational	0.1144	0.0415	0.2185	0.0822***
	(0.0780)	(0.0282)	(0.0758)	(0.0282)
Firm characteristics				
Size 2	0.1575	0.0568	0.1877	0.0715
	(0.1200)	(0.0428)	(0.1178)	(0.0451)
Size 3	0.1484	0.0535	0.4173	0.1584
	(0.2992)	(0.1066)	(0.2960)	(0.1102)
Age	0.0047	0.0017	0.0032	0.0012
	(0.0071)	(0.0025)	(0.0071)	(0.0026)
Business strategy				
Export	0.1728	0.0627*	0.1960	0.0737**
	(0.0950)	(0.0343)	(0.0919)	(0.0344)
Import	0.0418	0.0151	-0.1690	-0.0636*
	(0.0906)	(0.0329)	(0.0878)	(0.0329)
Fair	0.1425	0.0517*	-0.0655	-0.0246
	(0.0804)	(0.0290)	(0.0796)	(0.0299)
Market Cooperation	-0.0704	-0.0255	0.2222	0.0836**
	(0.0922)	(0.0334)	(0.0909)	(0.0340)
Institutional cooperation	0.1291	0.0468	-0.0695	-0.0261
	(0.1110)	(0.0402)	(0.1066)	(0.0400)
Venturing orientation	0.0995	0.0361***	0.0542	0.0204**
	(0.0191)	(0.0067)	(0.0187)	(0.0069)
Entrepreneur characteristics				
Gender	0.0988	0.0358	0.1652	0.0621**
	(0.0776)	(0.0281)	(0.0769)	(0.0288)
Age	-0.0063	-0.0023	-0.0076	-0.0028
	(0.0047)	(0.0027)	(0.0047)	(0.0017)
Managerial experience	-0.0194	-0.0070*	-0.0039	-0.0014
	(0.0112)	(0.0040)	(0.0113)	(0.0042)
Level of studies =2	-0.3093	-0.1098	-0.5309	-0.2001
	(0.3688)	(0.1262)	(0.3709)	(0.1369)
=3	-0.3171	-0.1126	-0.4641	-0.1753
	(0.3660)	(0.1251)	(0.3680)	(0.1359)

=4	-0.2620 (0.3670)	-0.0925 (0.1254)	-0.4405 (0.3699)	-0.1664 (0.1366)
=5	-0.2545 (0.3642)	-0.0898 (0.1242)	-0.3601 (0.3663)	-0.1360 (0.1352)
Observations	1424		1424	
Wald Chi^2	145.66***.		83.09***	
Pseudo R^2	0.077		0.045	
Correctly classified	63.13%		61.24%	

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Robust standard errors given in parentheses.

Table 4. Operational performance.

	Productive capacity		Quality improvement	
	β	Margins	β	Margins
Innovation				
Product	0.2433 (0.0742)	0.0857*** (0.0258)	0.3540 (0.0802)	0.0934*** (0.0208)
Process	0.3040 (0.0867)	0.1071*** (0.0301)	0.2663 (0.1003)	0.0703*** (0.0262)
Organisational	0.2093 (0.0791)	0.0737*** (0.0277)	0.1817 (0.0899)	0.0479** (0.0236)
Firm characteristics				
Size 2	0.0204 (0.1214)	0.0072 (0.0429)	-0.1051 (0.1387)	-0.0287 (0.0390)
Size 3	0.9379 (0.3966)	0.2724*** (0.0819)	0.6799 (0.4431)	0.1333** (0.0591)
Age	-0.0056 (0.0071)	-0.0019 (0.0025)	0.0021 (0.0081)	0.0005 (0.0021)
Business strategy				
Export	0.1973 (0.0976)	0.0695** (0.0342)	0.1579 (0.1109)	0.0416 (0.0292)
Import	-0.0626 (0.0912)	-0.0220 (0.0321)	-0.0702 (0.1018)	-0.0185 (0.0269)
Fair	0.0857 (0.0815)	0.0302 (0.0286)	0.1396 (0.0874)	0.0368 (0.0230)
Market Cooperation	0.1471 (0.0943)	0.0518 (0.0331)	0.1626 (0.1106)	0.0429 (0.0291)
Institutional cooperation	-0.0574 (0.1118)	-0.0202 (0.0393)	0.1582 (0.1366)	0.0417 (0.0359)
Venturing orientation	0.0972 (0.0195)	0.0342*** (0.0066)	0.0770 (0.0225)	0.0203*** (0.0058)
Entrepreneur characteristics				
Gender	0.1041 (0.0782)	0.0366 (0.0275)	0.1436 (0.0865)	0.0379* (0.0228)
Age	-0.0173 (0.0048)	-0.0061*** (0.0016)	-0.0111 (0.0053)	-0.0029** (0.0013)
Managerial experience	0.0025 (0.0115)	0.0009 (0.0040)	0.0086 (0.0128)	0.0022 (0.0033)
Level of studies =2	-0.0305 (0.3655)	-0.0103 (0.1233)	0.2167 (0.3861)	0.0565 (0.1074)
=3	-0.2096 (0.3615)	-0.0727 (0.1221)	0.1808 (0.3807)	0.0478 (0.1065)

=4	-0.1139 (0.3630)	-0.0390 (0.1225)	0.0677 (0.3818)	0.0186 (0.1071)
=5	-0.1987 (0.3596)	-0.0689 (0.1213)	0.0381 (0.3774)	0.0105 (0.1061)
Observations	1424		1424	
Wald Chi^2	154.72***.		108.51***	
Pseudo R^2	0.086		0.085	
Correctly classified	66.15%		79.21%	

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Robust standard errors given in parentheses.

APPENDIX. Definitions of the Variables.

Variable	Definition
Business Performance	
Sales increase	Whether the business has increased sales due to innovation introduced within the last three years (coded 1).
Cost reduction	Whether the business has reduced costs due to innovation introduced within the last three years (coded 1).
Productive capacity	Whether the business has increased productive capacity due to innovation introduced within the last three years (coded 1).
Quality improvement	Whether the business has increased quality due to innovation introduced within the last three years (coded 1).
Innovation	
Product innovation	Whether the business had introduced any new or significantly improved product/service innovation within the last three years (coded 1).
Process innovation	Whether the business had introduced any new or significantly improved process innovation within the last three years (coded 1).
Managerial innovation	Whether the business had introduced any new or significantly improved managerial innovation within the last three years (coded 1).
Firm Characteristics	
Size	Dummy variable is coded 1 if the business belongs to size-bands: Micro (1 to 10 workers), Small (11 to 50 workers), or Medium-sized (50 to 249 workers).
Age	Years since the business was founded.
Business Strategy	
Export	Dummy coded 1 if the business exports abroad.
Import	Dummy coded 1 if the business imports from abroad.
Fair	Dummy coded 1 if the business participates in business fairs.
Market Coop.	Dummy coded 1 if the business cooperates actively with business partners in R&D.
Institutional Coop.	Dummy coded 1 if the business cooperates actively with public institutions in R&D.
Venturing orientation	Variable measuring the venturing orientation of the firm (=1 for highest risk aversion to enrolling in risky business projects, and =7 for lowest risk aversion).
Entrepreneur Characteristics	
Gender	Dummy coded 1 if the entrepreneur is male (=0 if female).
Age	Age of the entrepreneur.

Experience	Years of managerial experience of the entrepreneur in the business.
Qualification	Dummy coded 1 if the entrepreneur attained a certain level of studies (=1 unqualified, =2 primary schooling; =3 secondary school qualifications; =4 vocational training; =5 university degree or higher).

Business Environment	
Region	Dummy coded 1 if the business is located in a particular region.
Sector	Dummy coded 1 if the business operates in a particular sector.