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Digital Reorganization as a Driver of the Export Growth of Italian Manufacturing Small and Medium Sized Enterprises[57]

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Abstract:

In this paper, we argue that digital reorganization, encompassing the introduction of digital technologies that require changes in business processes and improvement in internal digital skills, is significantly related to the international activities of SMEs and is therefore an important driver of export growth. We apply binary probit models to microdata gathered from a survey carried out in 2015 on a representative sample of 426 exporting Italian manufacturing SMEs in Italy. Our results show that the likelihood of increasing exports is correlated with more advanced digital technologies becoming embedded within organizational innovations of firms, thereby gaining a competitive edge.

Keywords: digitalization; innovation; export; competitiveness; manufacturing; SMEs

JEL Classification: L23; O33

Introduction

An increasing number of studies have investigated the advantages of digitalization on the economic system (Spiezia 2012, OECD 2016, Evangelista *et al.* 2014). The adoption of digital technologies and their integration into industrial processes has broadened firms' competitive advantage in global markets (Hagsten and Kotnik 2017, Diaz-Chao *et al.* 2015).

By providing new channels of marketing and sales information and reducing distance and entry-related costs, internet-based technologies may help to overcome the constraints of some SMEs when moving into foreign markets by also supporting the integration into the global value chains (GVCs) (De Marchi *et al.* 2018). Bell *et al.* (2001) introduced the term internetization to indicate the increasing adoption and diffusion of internet-based technologies that progressively act as the "back bone of internationalization" (Etemad *et al.* 2010).

Despite existing research on the internationalization of SMEs, the extent to which different digital technologies (DTs) help firms in exporting into international markets is still unclear (Liao *et al.* 2009, Mostafa *et al.* 2005, Reuber and Fischer 2011). In fact, digitalization is a very complex phenomenon, which is substantially changing the nature of products, services, and organizations (Yoo *et al.* 2012). For instance, Hagsten and Kotnik (2017) and Pickernell *et al.* (2016) observed that website usage by firms is main determinant SMEs decisions while online sales are insignificant. On the other hand, for Hagsten (2015) online sales are significant.

Bianchi and Mathews (2016) and Bianchi *et al.* (2017) pointed out that internet technologies may affect export growth only indirectly, while Mathews (2011) found a direct relationship. The impact on competitiveness is only due to which forms of DT are adopted, but also how they are used. Galandary (2013) found that ICTs become

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a determinant of international market performance only in terms of seeking information and increasing long-term relationships, rather than supporting online sales.

Many scholars have also underlined that DTs foster a firm's performance when they are embedded within organizational changes (Powel and Dent-Micallef 1997, Booth and Philip 1998, Barney 2001, Li and Ye 1999, Tippins and Sohi 2003, OECD 2016). Improving digital organization internally may be the right way to integrate digital technologies into a firm's strategy and skills development. Indeed, firms today cannot ignore the incumbent digital paradigm, and thus have to adapt their strategies to new scenarios and transformations due to global challenges, including digital contents and human skills. Consequently, the individual skills employed must be converted into collective skills that enable firms to operate and compete in wider markets. Thus, the improvement of digital organization should be embedded within internal processes in which skills, innovation, and organizational culture grow simultaneously.

In this paper, we focus on the role of organizational changes related to the adoption of advanced DTs in affecting the international market performance of firms. More specifically, we empirically investigate whether the likelihood of export growth is related to the organizational innovations resulting from the implementation of software tools that enable firms to share information with their suppliers, customers, and business partners along the supply chain (such as Enterprise Resource Planning - ERP - and Supply Chain Management - SCM – applications, cloud computing and e-business services). These technologies have received comparatively less attention from scholars even though they are perceived to be particularly suitable for the internationalization strategies of small firms. We use binary probit models and compute marginal effects. Also, we test the impact of several variables that explain the role of organizational innovation of firms and firm's investment in digital skills. Finally, we control for size, location and sector of activity. Our results show that the likelihood of increasing export is correlated with the embedding processes of DTs within the organizational innovations of firms, which exploit the potential of DTs to increase their competitiveness.

The structure of this paper is as follows. In Section 2 we review the related literature. Section 3 outlines the methodology adopted and summary statistics. Section 4 presents the results and discussion. Section 5 concludes the paper.

1. Literature review

The relationship between information technologies and productivity, industrial performance, innovation and export growth of national and regional economic systems has been the subject of many studies (Freund and Weinhold 2004, Spiezia 2012, Portugal-Perez and Wilson 2012, Evangelista *et al*. 2014, OECD 2016). The Internet, online activities and ICT usage have been found to positively affect foreign sales (Prasad *et al.* 2001, Aspelund and Moen 2004, Morgan-Thomas and Bridgewater 2004, Clarke 2008, Bianchi and Mathews 2013, Hagsten 2015, Bennett 1997, Bianchi and Mathews 2016).

Among the drivers affecting a firm's performance, DTs are increasingly becoming a determinant of export growth (Bianchi and Mathews 2016, Bianchi *et al.* 2017, Galandary 2013). DTs facilitate access to international markets, increase the rate and speed of internationalization process by reducing distance and entry-related costs through a greater integration between business partners, suppliers and customers (Liu *et al.* 2016) as well as increasing knowledge of foreign markets (Bianchi and Mathews 2013, Freund and Weinhold 2004).

More specifically, DTs reduce the transactional costs (Lohrke *et al*. 2006, Kontinen and Ojala 2010) related to environmental uncertainties and to communication (Samie 1998, Dandridge and Levenburg 2000, Daniel *et al.* 2002, Bell and Loane 2010, Sinkovics *et al.* 2013). Indeed, DTs improve the efficiency of the information exchange (Gabrielsson and Kirpalani 2004, Loane *et al.* 2004, Mathews and Healy 2008) with international customers, suppliers and partners (Hamill 1997) as well as providing further and faster information on competitors (Petersen *et al.* 2002, Loane *et al.* 2004, Borges *et al*. 2009). They also increase knowledge regarding the varieties of goods and their related characteristics (Bianchi and Mathews 2016, Loane and Bell 2006, Mathews and Healy 2008, Borges *et al.* 2009). The higher quality of knowledge information supports firms in their decision-making process (Samie 1998, Teo and Choo 2001).

DTs facilitate the development of both the internal and external relations of firms (White and Daniel 2004), produce new international business networks (Petersen *et al.* 2002) and increase trade relationships with customers and suppliers (Samie 1998, Teo and Choo 2001, Morgan-Thomas 2009), thus fostering integration in the GVCs (De Marchi *et al.* 2018). DTs allow small firms to increase export activities through lower investments, thus overcoming their traditional burdens linked to size issues (Overby and Min 2001, Arnott and Bridgewater 2002, Houghton and Winklhofer 2004, Simpson and Docherty 2004, Saban and Rau 2005, Fillis and Wagner 2005,

Maranto-Vargas and Gómez-Tagle-Rangel 2007, Mathews and Healy 2008, Tseng and Johnsen 2011, Consoli 2012, Tarutė and Gatautis 2014).

Regarding the role of DTs on export activity and performance, the literature has focused both on mature ones, such as websites and e-commerce (Hagsten and Kotnik 2017, Pickernell *et al.* 2016, Bianchi and Mathews 2013, Daniel *et al.* 2002, Morgan-Thomas 2016, Saban and Rau 2005), and more advanced ones, such as enterprise resource planning (ERP) and customer relationship management (CRM) (Oviatt and McDougall 2005, Reuber and Fischer 2011, Ross and Blumenstein 2015, Tseng and Johnsen 2011). ERP and CRM are useful for improving internal organizational processes and for facilitating the relationships with supply chain partners (Porter 2001).

Nevertheless, investments in DTs may not lead to increasing competitiveness level when considered alone (Li and Ye 1999, Trainor *et al.* 2010). The Internet generates a competitive advantage and positively affects a firm's performance when it is embedded within organizational practices or processes (Powel and Dent-Micallef 1997, Booth and Philip 1998, Barney 2001, Li and Ye 1999, Tippins and Sohi 2003, OECD 2016). Introducing DTs may involve organizational changes, such as re-engineering business processes and the adoption of new marketing methods (Spiezia 2012), including production planning, inventory management, order scheduling and CRM (Jean 2007, Sanders 2005, Marinagi *et al.* 2014).

The potential of DTs also depends on internal skills for managing such technologies appropriately (Brynjolfsson and Hitt 2000, Díaz-Chao *et al.* 2015, Jones *et al.* 2014, Moen *et al.* 2008, Bianchi and Mathews 2016, Jean 2007, Liu *et al.* 2016, Sanders 2005) and for converting specific competences absorbed from the outside into new human resources for the firm (Cohen and Levinthal 1990, Li 2009).

The empirical literature has only recently started to investigate the relationship between digital technologies and export behaviour in more depth (Hagsten 2015, Hagsten and Kotnik 2017, Ghalandari 2013, Love and Roper 2015, Pickernell *et al.* 2016, Bianchi and Mathews 2016, Bianchi *et al.* 2017, Sinkovics *et al.* 2013, Rangriz 2012, Olejnik and Swoboda 2012). Some scholars (Cassetta *et al.* 2016, Pickernell *et al.* 2016, Hagsten and Kotnik 2017) have analyzed the effects of internet-based technologies on the presence of firms on foreign markets, whereas others (Morgan-Thomas and Bridgewater 2004, Murphy and Bruce 2003, Morgan-Thomas 2009, Toften and Hammervoll 2011, Bell and Loane 2010, Mostafa *et al.* 2005) have focused on the impact of the Internet on market performance. Morgan-Thomas and Jones (2009) found that SMEs that invest in ICT are more likely to be larger and register a more rapid growth in their sales abroad. Moon and Jain (2007) found internet marketing abilities (internet marketing research, support services, and promotional activities) are positively related with profit, sales and market share.

Focusing on export growth in Chilean firms, Bianchi and Mathews (2016) found that internet marketing capabilities (online sales, advertising and research) positively affect export market growth only indirectly by improving business network relationships, which in turn foster international performance. This finding is confirmed by Bianchi *et al.* (2017) using slightly different indicators to measure internet capabilities (investments in technology, IT operation capabilities, e-commerce activities). A direct relationship between DTs and international market growth was found for Australian firms by Mathews (2011) and Bianchi and Mathews (2010); here internet usage (including websites) and internet marketing intensity (including e-commerce) positively influence foreign sales. Focusing on Iranian firms, Galandary (2013) found that using ICT for information searches and long-term communicational development and interaction, positively affect international market performance.

2. Methodology

2.1. Data and variables

Our data source was a survey carried out by the Italian Union of Chambers of Commerce (Unioncamere-Si.Camera) in 2015 on a representative sample of 426 exporting manufacturing SMEs in Italy, with at least four employees. Data collected include information on firms' structural characteristics such as size, geographical location at a macro-territorial level (north-west, north-east, centre-south and islands) and industrial sector. The survey also includes a wide range of different data on digitalization, such as website use and e-commerce activities, digital organization, and employment of people with high-digital skills. The dataset also includes issues regarding internationalization, particularly on export performance and drivers of competitiveness.

Zucchella *et al.* (2007) observed three dimensions of export, based on:

- geographic scope (number of exporting countries);
- precocity (early start of international activities) and speed of foreign sales;
- export intensity (percentage of export of total sales).

Leonidou *et al.* (2002) pointed out that export intensity can be measured through indicators, such as export sales growth, export profit, export sales volume or export profit contribution.

Research carried out in Italy (Basile 2001, Majocchi *et al.* 2005, D'Angelo 2012) has mainly adopted the ratio between export sales and total sales as a proxy of export intensity. Bianchi and Mathews (2016) analysed the international performance of SMEs using variables such as the growth of new customers in new or existing export markets.

Table 1. Variables definition

Variables	Type	Description
Dependent		
Export increase	Dummy	Whether the firm has registered export growth in 2015 (yes = 1. no = 0)
Independents		
Mature digital technologies	Dummy	Whether the firm uses website in at least one foreign language and carries out e-commerce activities (yes = 1. no = 0)
Digital organization	Dummy	Whether the firm during 2012-2014 has introduced organizational changes related to digital technologies (ERP, SCM, e-business services, web-marketing, *etc.*) (yes = 1. no = 0)
Digital skills	Dummy	Whether the firm during 2012-2014 has employed persons with high-digital skills (*e.g.* software development, engineering, database managers, *etc.*) (yes = 1. no = 0)
Product Innovation	Dummy	Whether the firm during 2012-2014 has introduced product innovation (yes = 1. no = 0)
Process innovation	Dummy	Whether the firm during 2012-2014 has introduced technological process innovation (yes = 1. no = 0)
Competitiveness quality	Dummy	Whether the firm bases mostly its international competitiveness strategy on the quality of goods produced rather than lower prices (yes = 1. no = 0)
Human capital	Continuous	Share of graduated employees
Control variables		
Micro	Dummy	Firms with 4-9 employees (yes = 1. no = 0)
Small	Dummy	Firms with 10-49 employees (yes = 1. no = 0)
Medium	Dummy	Firms with 50-249 employees (yes = 1. no = 0)
Technology sectors	Dummy	Whether the firm belongs to a medium-high/high technology intensive sector (yes = 1. no = 0)
Traditional sectors	Dummy	Whether the firm belongs to a medium-low/low technology intensive sector (yes = 1. no = 0)
North-West	Dummy	Whether the firm is located in the North-West (yes = 1. no = 0)
North-East	Dummy	Whether the firm is located in the North-East (yes = 1. no = 0)
Centre-South and Islands	Dummy	Whether the firm is located in the Center-South and Islands (yes= 1.no = 0)

Source: Authors' elaboration.

Ghalandari (2013) measured international performances through the degree of satisfaction of the management, taking into account some indicators including sales growth. Bianchi *et al.* (2017) used indicators related to improving international market share, growth and profitability.

In our empirical analysis, we use export growth: the variable is 1 if the firm registered an export increase in 2015, and 0 otherwise.

Digitalization is a very complex phenomenon, since different technologies produce heterogeneous effects on a firm's performance (Garicano and Rossi-Hansberg 2006, Bloom *et al.* 2014). In line with Bianchi and Mathews (2010), Mathews (2011), Hagsten and Kotnik (2017) and Bianchi and Mathews (2016), we tested website and e-commerce usage (mature digital technologies): our variable is 1 if the firm has a website not only in Italian but also in a foreign language and carries out e-commerce activities.

According to Bianchi and Mathews (2016) and OECD (2016), we measured the relationship between the international sales growth and the organizational changes involving the adoption of digital technologies. To capture this linkage, we included a dummy variable accounting for whether the firm is innovative in terms of digital organization (such as supply-chain management, business re-engineering, enterprise resource planning, *etc.*). Then, to account for the effect of digital skills, we included a binary variable: 1 if the firm has employed people with high-digital skills, 0 otherwise. Finally, we included a proxy of human capital, calculated as the proportion of employees with a university degree.

To evaluate the relationship between international performance and innovation (Basile 2001, Ozcelik and Taymar 2004, Lopez Rodriguez and Garcia Rodriguez 2005, Love and Roper 2015, Nassimbeni 2001, Higón and Driffield 2011) we introduced two dummy variables: if the firm has realized product innovation, and if the firm has realized process innovation. To overcome the potential causal effect between export and innovation, innovation variables were lagged by one year (Lopez Rodriguez and Garcia Rodriguez 2005, Spanos *et al.* 2004, D'Angelo 2012).

To capture the impact of the quality of production on performance in the foreign markets we computed a dummy variable: 1 if the firm has oriented its international competitiveness on production quality, 0 otherwise.

To control for the characteristics of firms, we included size (Lopez Rodriguez and Garcia Rodriguez 2005, Cavusgil and Zou 1994). Also, we controlled for the macro-territorial areas (north-west; north-east; and centre-south and islands), to take into account the different geographical locations (Del Monte and Papagni 2003). Then, to test the impact of technological intensity on export growth (Zou and Stan 1998, Cavusgil and Zou 1994) we used a dummy variable accounting for whether a company works in a technology (medium-high and high intensity) sector.

2.2. The econometric model

To empirically test the effects of digitalization on export growth, we included a binary dependent variable (increase/no increase in exports) and several predictors. Each of them is a dummy variable with two possible values (0, 1). Only human capital is a continuous variable and accounts for the proportion of employees with a university degree.

In order to model such a limited dependent variable, we used a probit regression model. Since the probit model is nonlinear, it models the conditional probability of a "successful" outcome, that is, $Y_i = 1$, *i.e.* whether the firm has increased exports during the period in question. In other words, depending on the regressors, the probability that the outcome variable Y_i is 1, is a certain function of a linear combination of the regressors. We also tested the marginal effect of the specific predictor which is equal to the relevant slope coefficient and which measures how much the mean of the outcome variable changes when that predictor varies, while all the other predictors are held at some values. Unlike with a linear model, with a probit model the coefficients do not directly measure the marginal effects and therefore the marginal effects need to be calculated:

$$\frac{\partial P(Y_i = 1|X_{1i}, \dots, X_{Ki};\ \beta_0, \dots, \beta_K)}{\partial X_{ki}} = \beta_k \phi\left(\beta_0 + \sum_{k=1}^{K} \beta_k X_{ki}\right) \quad (1)$$

where: $\phi(\cdot)$ is the standard normal probability density function. As highlighted by the right hand side of the formula, this marginal effect depends not only on the regression coefficient β_k, but also on the values of all the other predictors, as well as the regression coefficients.

Depending on the choice of the other predictors used in this formula, various marginal effects were then calculated. The most common marginal effects reported are those where all the other predictors are set to their mean values. More specifically, the marginal effect of a covariate may be interpreted as the partial derivative of the event probability with respect to the independent variable that we are taking into account. Marginal effects xi in the probit model correspond to φ(x'b)bi, where φ(x'b) is the density function of the standard normal, x'b is the outcome of the vector of chosen values, and bi is the parameter estimate for xi.

2.3. Summary statistics

Table 2 shows the summary statistics. The variables are all qualitative except human capital. A total of 18.5% of firms considered have registered an export growth in 2015. The majority of the firms are small (10-49 employees) and represent 47.7% of the sampled SMEs, micro firms (4-9 employees) 27.7% and medium sized firms 24.6%. A total of 43.4% were located in the north-west, 29.8% in the north-east and 26.8% in the centre-south and islands. By using EUROSTAT taxonomy (http://ec.europa.eu/eurostat/cache/metadata/FR/htec_esms.htm) the proportion of high and medium-high technology firms was 35.9% of the total, and 9% of the employees have a degree.

Focusing on digitalization, 72.5% of the sample have a website in a foreign language[61] and use e-commerce (mature digital technologies), whereas 29.8% have innovated in terms of digital organization; 24.6% have employed people with high-digital skills. Firms that have innovated their products and processes represent 22.5% and 27.5%

[61] We took into account the foreign language to link above all the digitalization factor (website use) to internationalization issues.

of the sample, respectively. Finally, around 40% of the total firms base their international competitiveness on production quality rather than low prices.

Table 3 displays the correlation matrix among variables. All correlation coefficients are positive and only one is slightly negative (-0.03); they also present values lower than 0.3. The only exception is the relationship between digital organization and process innovation (r = 0.42, p-value < 0.01).

Table 2. Summary statistics

Variables	Mean	95% CI		S.D.
Export increase	0.185 (0.019)	0.148	0.223	0.389
Mature digital technologies	0.725 (0.022)	0.683	0.768	0.447
Digital organization	0.298 (0.022)	0.255	0.342	0.458
Digital skills	0.246 (0.021)	0.205	0.288	0.431
Product innovation	0.225 (0.020)	0.186	0.265	0.418
Process innovation	0.275 (0.022)	0.232	0.317	0.447
Competitiveness quality	0.392 (0.024)	0.345	0.439	0.489
Human capital	8.948 (0.711)	7.551	10.345	14.670
Micro	0.277 (0.022)	0.234	0.320	0.448
Small	0.477 (0.024)	0.429	0.524	0.500
Medium	0.246 (0.021)	0.205	0.288	0.431
Technology sectors	0.359 (0.023)	0.313	0.405	0.480
Traditional sectors	0.641 (0.023)	0.595	0.687	0.480
North-West	0.434 (0.024)	0.387	0.482	0.496
North-East	0.298 (0.022)	0.255	0.342	0.458
Centre-South and Islands	0.268 (0.021)	0.225	0.310	0.443

Source: Authors' elaboration.

Table 3. Correlation matrix

Variables	1	2	3	4	5	6	7	8
1. Export increase	1.000							
2. Mature digital technologies	0.158*	1.000						
3. Digital organization	0.230*	0.125*	1.000					
4. Digital skills	0.274*	0.157*	0.270*	1.000				
5. Product innovation	0.162*	0.068	0.152*	0.070	1.000			
6. Process innovation	0.126*	0.108*	0.415*	0.234*	0.159*	1.000		
7. Competitiveness quality	0.149*	0.085	0.086*	0.177*	-0.030	0.077	1.000	
8. Human capital	0.088*	0.164*	0.035	0.052	0.108	0.098	0.640	1.000

Note * p-value < 0.01.

Source: Authors' elaboration.

3. Results and discussion

Table 4 shows the results from binary probit models and marginal effects. In the first specification (Model 1) we measured the impact of mature digital technologies on the export growth. Then, we included digital organization (Model 2); finally, we added digital skills (Model 3).

The adoption of mature technologies (website/e-commerce) has a positive and significant effect on export increase at the 5% (Model 1) whereas it loses significance moving from Model 1 to Model 3. When digital organization is included in the model its marginal effects are significant at p < 0.01, both in Model 2 and Model 3. When we tested mature technologies, digital organization and digital skills all together (Model 3), digital skills had the highest values. Product innovation is statistically significant and moves from 1% (Model 1) to 5% (Model 3). Conversely, process innovation does not show any significant effects. Also, our results show that competitiveness quality is statistically significant at 1% in all the specifications.

Concerning control variables, there was a slightly more positive relationship between medium firms and an increase in exports, compared to micro sized firms. Furthermore, no significant effect was found between low-tech intensity and the probability of increasing exports, compared to high-tech sectors. Finally, unlike other research focusing on Italy (D'Angelo 2012, Pini and Quirino 2016), geographical location did not show any significant effect.

The results support the idea that digital technologies have a positive impact on export growth. However, the literature is still unclear regarding the relationships between digitalization and international performance (Liao *et al.* 2009, Mostafa *et al.* 2005, Reuber and Fischer 2011). For instance, e-commerce is not significant for Hagsten and

Kotnik (2017) and Pickernell *et al.* (2016), in contrast to Hagsten (2015). Moreover, while Mathews (2011) underlined a direct effect of internet activities on export growth, Bianchi and Mathews (2016) and Bianchi *et al.* (2017) found an indirect effect. Ghalandari (2013) highlighted the importance of ICTs when used for seeking information and strengthening relationships rather than online sales activities.

Our results may also support the idea of the need of including digital technologies in the internal organization processes of a firm. Powel and Dent-Micallef 1997, Booth and Philip 1998, Barney 2001, Li and Ye 1999, Tippins and Sohi 2003, OECD 2016 observed that digital organization has a positive effect on firms' competitiveness. According to Giovannetti *et al*. (2014), firms with a tightly integrated supply chain exhibit better performance in international markets. This means that transformation is not about only technological innovations and related adoption or integration into business activities, it also concerns how these innovations are adopted. Indeed, technological innovation implies digital transformation not only of methods and tools but above all internal organization, as it involves competitive positioning at all levels including the whole supply chain.

Also, in line with Jean (2007), the importance of digital skills is also supported by the results of human capital: in fact, human capital does not seem to show any significant effect on export growth. This may be explained with the "digital gap paradigm", *i.e*. the need to recruit employees with specific digital skills should be a prerequisite for competing more into international markets.

The results concerning the positive impact of product innovation and the absence of significance of process innovation are in line with D'Angelo (2012), and Higón and Driffield (2011) who found a stronger relationship for product innovation than process innovation. This may be explained by the fact that products depend more on consumer demand than processes. However, process innovation is a very complex phenomenon with considerable differences across all the value chain supply. Process innovation can lower costs, especially in the initial stages of an entrepreneurial activity. Nevertheless, innovation processes could require more financial resources, and may represent a constraint to smaller firms that have fewer resources available. Firms need to focus on internal changes in their organization, which includes more flexibility and openness to outside.

Product quality is another key element for improving standards of firms' competitiveness, as it ensures faster processes in line with the increasing dynamics of global markets. By using digital technologies and digital marketing tools, firms may promote their quality and provide useful information about the variety and differentiation of the goods produced and supplied.

Finally, the literature does not provide any clear explanations on the effect of size on export performance (Zou and Stan 1998): for instance, while some scholars (Dharanaj and Beamish 2003, Majocchi *et al.* 2005, D'Angelo 2012) have found a positive relationship, others (Wolff and Pett 2000, Bonaccorsi 1992) have observed negative or no significant effects. Our results indicate that size matters. In fact, it is more likely that medium firms are positively related with higher export growth, compared to micro firms.

Table 4. Results from binary probit models and marginal effects at means

Variables	Model 1	dy/dx (1)	Model 2	dy/dx (2)	Model 3	dy/dx (3)
Mature digital technologies	0.462**	0.113**	0.449**	0.108**	0.370*	0.086*
	(0.194)	(0.047)	(0.198)	(0.047)	(0.202)	(0.047)
Digital organization			0.556***	0.133***	0.432***	0.101***
			(0.170)	(0.041)	(0.176)	(0.041)
Digital skills					0.637***	0.149***
					(0.170)	(0.040)
Product innovation	0.467***	0.114***	0.413**	0.099**	0.397**	0.093**
	(0.167)	(0.041)	(0.171)	(0.041)	(0.174)	(0.041)
Process innovation	0.219	0.054	-0.001	-0.000	-0.059	-0.014
	(0.162)	(0.040)	(0.178)	(0.043)	(0.180)	(0.042)
Competitiveness quality	0.447***	0.110***	0.412***	0.099***	0.344**	0.080**
	(0.150)	(0.037)	(0.152)	(0.036)	(0.156)	(0.036)
Human capital	0.003	0.001	0.003	0.001	0.003	0.001
	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)
Small *(Micro)*	0.281	0.062	0.270	0.059	0.285	0.059
	(0.195)	(0.041)	(0.197)	(0.041)	(0.200)	(0.039)
Medium	0.415**	0.099**	0.411*	0.096*	0.495**	0.115**
	(0.217)	(0.052)	(0.219)	(0.051)	(0.224)	(0.052)
Traditional sectors *(Technology sectors)*	0.107	0.026	0.122	0.029	0.106	0.025
	(0.160)	(0.039)	(0.163)	(0.039)	(0.166)	(0.039)
North-West	0.048	0.012	0.001	0.000	0.037	0.009

Variables	Model 1	dy/dx (1)	Model 2	dy/dx (2)	Model 3	dy/dx (3)
(Center-South and Islands)	(0.191)	(0.046)	(0.193)	(0.046)	(0.196)	(0.046)
North-East	0.082 (0.201)	0.020 (0.049)	-0.009 (0.206)	-0.002 (0.049)	-0.006 (0.210)	-0.001 (0.048)
Constant	-2.035*** (0.292)		-2.092*** (0.298)		-2.166*** (0.304)	
Observations	426	426	426	426	426	426
LR chi^2	37.18		47.87		61.82	
Log likelihood	-185.701		-180.354		-173.380	
Prob > chi^2	0.000		0.000		0.000	
Pseudo R^2	0.091		0.117		0.151	

Note: Standard error in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. In the fist column reference category is shown in parentheses.

Source: Authors' elaboration.

On the other hand, we found no significant results in relation to business sectors of activity and location of the firm. This probably means that other factors may account for export growth. In fact, issues such as internal organization processes may be the key element for improving competitive advantages. These results require further investigation in a multilevel framework, as the interplay between micro and context variables may provide different impacts, regardless of the location and sector of activity.

Conclusions

The process of modernising a business and the use of new digital technologies is of great interest for both academics and policy makers. Although digital technologies have considerable advantages, many firms seem reluctant to use them. The lack or scarcity adoption and use of these technologies is due to several factors such as limited resources and the effectiveness in terms of return on investment that digital technologies can provide. Nevertheless, these constraints need to be overcome to ensure the survival of firms given the increasingly competitive global markets.

In such competitive markets, the need to create and improve a "digital culture" is key factor in explaining the digital transformation process. Embedding the digital culture in a firm is of primary importance for attracting skilled people and improving the way firms interact with other competitors. This entails companies reassessing their operating models by leveraging on new practices. In fact, digital organization means not only digital products, services, innovative products and processes, but also strengthening core operations with technology, which in turn increase the competitive advantage of a firm.

Today, whereas most internet users search for products online, many firms, organization are still uncertain about the importance of digital skills, and there is a digital skills gap across broad industrial sectors and services as well. The adoption of some forms of (both basic and advanced) technologies, as well as investments to improve digital skills is geographically uneven, thus affecting the available policy options. Future research should also further explore potential heterogeneity in digitalization paths among different industries, as well as in other countries.

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