

# **ICT as facilitator of internationalisation in small and medium-sized firms**

Eva Hagsten  
Stockholm University

Patricia Kotnik  
University of Ljubljana

December 2014

## **Abstract**

Based on harmonised and uniquely linked firm-level datasets for a large group of European countries, this study investigates the role of different ICT capacities in the internationalisation of small and medium-sized firms. Both the decision to export and the export intensity are explored in this respect. The different ICT capacities are captured by online presence, proportion of employees with broadband internet, use of online transactions and by ICT schooled employees. A small and medium-sized firm is defined as having 10 to 249 employees. This group comprises virtually the whole population of firms in most countries while their exporting activities are far smaller than proportionate. The results show a positive relationship between the ICT capacities and the engagement in exporting activities, although the capacity most efficient seems to vary across countries. In countries where the ICT intensity of firms is less developed, more basic capacities such as online presence are of importance for the decision to export. There are also indications that an expansion of international sales benefits from more advanced ICTs than the pure decision to export.

## **Keywords**

ICT, exports, SMEs, firm behaviour

## **Introduction**

In recent years there have been a number of studies investigating the internationalisation of small and medium-sized firms (SMEs). Size, labour productivity, innovation activities, skills, new investments and foreign ownership are regarded as key determinants of export participation and export performance of these firms. Typically, the importance of ICT in trade has seldom been explored, despite its obvious prospect of simplifying international activities, especially for smaller firms and exports of services. The few exceptions to this arise in management, marketing or entrepreneurship literature with studies based on qualitative or non-representative data, showing that ICT is relevant in the internationalisation process.

This study contributes to existing research by empirically investigating the role of different ICT capacities in the internationalisation of small and medium-sized firms. A strength of the study is the use of uniquely linked, harmonised and representative firm-level datasets for 12 European countries, including both services and manufacturing firms. Unlike most other studies, information is available on both goods and services exports for a majority of the countries. To the best of the author's knowledge this approach has not been employed before. The results indicate a positive relationship between ICT capacities and exporting behaviour of small and medium-sized firms. However, what ICT capacity is most efficient for exports seems to vary across Europe. There are also indications that an expansion of international sales benefits more from advanced ICT capacities than the pure decision to export.

According to Martens (2013), cross-border e-commerce is gaining in importance. However, it is not only online sales that contribute to exports through the use of ICT; internet technology has also been increasingly integrated into marketing activities. The internet may be used to establish direct customer contacts instead of traditional market intermediaries (Lohrke et al 2006) as well as to strengthen customer service and support. Additionally, the internet may facilitate information gathering on competitors, specific markets and above all on customers (Borges et al 2009). Furthermore, the internet simplifies the build-up of valuable customer-related information (for example by web-based market surveys, customer

satisfaction measurements and by data-mining techniques applied to website visits and transactions). Internet-related sources can also be used to adjust the marketing mix, as in the example of Amazon, who systematically use customer profiles for this (Prasad et al 2001). Lendle et al (2012) show that online markets may build trust and reduce information frictions.

Reuber and Fischer (2011) propose that a successful exporting firm needs both back-end integration and front-end functionality of its online technology. The former implies that web applications are linked with back-office databases and that better analysis of data gives the firm an advantage in discovering international opportunities. Front-end functionality refers to online product information, transaction processing and the ability to customise the online experience for specific markets. Thus, ICT can be used for relationship building, information search and provision, and as an online sales channel. The use of the internet may reduce entry costs to foreign markets as well as per-unit cost of exporting once presence on the market is established.

Empirical evidence on the role of ICT in trade is scarce and is mainly based on aggregate rather than on firm-level data. By using aggregate data on bilateral trade from 1995-1999, Freund and Weinhold (2004) found that increases of websites in a country help to explain export growth in the following year. Portugal-Perez and Wilson (2012) studied the impact of various types of infrastructure on the export performance of developing countries and demonstrate that ICT is relevant and that its impact on exports seems to be increasingly important the richer a country becomes.

Firm-level studies on the impact of ICT use on exports can mostly be found in international marketing literature. Results of these studies imply that online activities affect export sales (Bennett, 1997), with an emphasis on how the internet technology is used (Morgan-Thomas and Bridgewater, 2004) and that ICT in combination with offline strategies drives export performance (Sinkovics et al 2013). Ashurst et al

(2012) add to this discussion by pointing out that the firm is also dependent on its capacity to operate the ICT at hand.

When distinguishing between different types of online capabilities, Morgan-Thomas (2009) shows that the key benefit from internationalising lies in supporting customer relationships, rather than in online sales. A study by Mathews and Bianchi (2010) reveals that websites and e-sales are significantly related to the export growth in a group of Australian firms. Bianchi and Mathews (2013) report that internet has indirect effects on a group of Chilean firms, through improved information flows and business relationships. Still, these firm-level studies use data from relatively small samples of export performance in single countries. Some newer studies based on more representative data include an exploration of factors affecting growth in international sales, once the foreign market is entered by the SME. The results tell that firms with fast growing exports rely heavily on ICT (Morgan-Thomas and Jones, 2009). Further, a study of the use of eBay sales data from five countries shows how this platform has opened up export markets to SMEs at lower costs (Martens, 2013). A study of SMEs in the United Kingdom indicates that ICT users are some 15 percent more likely to export, *ceteris paribus* (Higon and Driffield, 2011).

Although the empirical evidence is scarce on how ICT influences exports at the firm level, the essence of the literature discussed above indicates that a window for marketing and sales (website), an infrastructure (broadband) and possibly also the right skills would be beneficial. Thus, to capture ICT capacities that might be associated with the exporting behaviour of small and medium sized firms, the following ICT variables will be studied:

- i) Online presence (having a website), enables a firm to share information and communicate with customers.
- ii) Online transactions (e-sales), facilitates economic exchange between buyers and sellers, like customer ordering and payment.

- iii) Proportion of employees with access to fast internet, encompassing complementary ICT and human resources beneficial for exporting activities.
- iv) ICT-intensive human capital (proportion of ICT schooled employees) reflecting highly specialised employees.

Intuition suggests that entering a new market could be related to visibility and simpler tools, like having a website, maybe in combination with the right skills. An expansion of international sales, on the other hand, might require more advanced ICT capacities, such as online transactions and employees with fast internet access.

The remainder of the paper is organised as follows: The next section deals with the conceptual model and estimation methods. Then the datasets used are presented, including some descriptive statistics. The penultimate section summarises and discusses the results, ensued by concluding remarks including policy implications.

### **Conceptual model and estimation method**

To examine ICT as a determinant of export behaviour this study builds on the recent stream of literature on firm heterogeneity and international trade based on work by Melitz (2003) and others. Theoretical studies and empirical work that follow this seminal paper have paid special attention to the interaction of sunk costs of entering export markets and firm productivity. The decision to go international will be determined by this interaction and merely productive firms will self-select into export markets. In several empirical studies these original findings have been extended by factors such as human capital, capital intensity, size, age and foreign ownership, resulting in many, if not all, of these variables turning out to be strongly connected to export market entry (Greenaway and Kneller, 2007).

In a study on the export decision of manufacturing firms in the United States, Bernard and Jensen (2004) show that, besides favourable exchange rate shocks, size, productivity, labour quality, ownership

structure, introduction of product innovations and past successes in export markets, are factors that increase the probability to export. Studies of determinants of the export behaviour of SMEs have revealed similar results. Hollenstein (2005) concludes that the most important drivers of the internationalisation of SMEs are the advantages arising from the availability of human, knowledge and physical capital as well as some firm-specific assets in fields like marketing, organisation and finance. A firm-level study focusing on SMEs in transition economies also finds that both human capital and technology-related factors are important sources of international competitiveness, as well as industry linkages, firm size, foreign capital share, sector of activity, availability of external finance, and membership in business associations (Gashi, Hashi, & Pugh, 2014). Schott (2004), adds further evidence of the importance of highly skilled employees in determining the export activities of a firm.

Taking into account the findings of previous research on international trade, the exports behaviour will be modelled by a set of variables that indicate the productive resources and characteristics of the firm, augmented by the group of variables capturing ICT capacities. To answer the question of whether a relationship exists between ICT and the exports behaviour, we start by estimating the following Probit model:

$$XD_{it}^* = \beta_0 + \beta_1 EX_{it-1} + \beta_2 R_{it-1} + \beta_3 C_{it} + \beta_4 ICT_{it-1} + \beta_5 HK_{it-1} + \beta_6 EX_{Spill_{it-1}} + \beta_7 S_{it} + \varepsilon_{it} \quad (1)$$

where  $XD_{it}^*$  represents the probability to export and the observed variable  $XD_{it}$  takes on the value of 1 if the firm is an exporter, otherwise 0.

$$XD_{it} = \begin{cases} 1 & \text{if } XD_{it}^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

Prior exporting experience is described by  $EX_{it-1}$ , whose coefficient is usually interpreted as evidence of sunk costs while  $R_{it-1}$  indicates the productive resources (labour productivity, capital-labour ratio and

firm size) and  $C_{it}$  relates to other characteristics of the firm (age and foreign ownership). Additionally,  $ICT_{it-1}$  reflects the set of ICT indicators and  $HK_{it-1}$  illustrates the proportion of highly skilled human capital in firms (also including  $HKIT$ , the employees with technology schooling). Spillovers from other export activities within the same industry are captured by  $EX_{spill_{it-1}}$  and  $S_{it}$  is a vector of industry and year dummies (see Table 1 for a description of the variables). The error term  $\varepsilon$  is assumed to be independent and identically distributed. Pooled data from the early 2000s to 2010 will be used for the estimations. Each country will be estimated separately and the simultaneity issue alleviated by the use of one year lagged variables.

$$XI_{it} = \beta_0 + \beta_1 R_{it-1} + \beta_2 C_{it} + \beta_3 ICT_{it-1} + \beta_4 HK_{it-1} + \beta_5 S_{it} + \varepsilon_{it} \quad (2)$$

In a second step, the determinants of export intensity ( $XI$ ) are estimated, as illustrated in equation 2. This model resembles the specification for the export decision, with the exception of the lagged exports measure, the capital/labour ratio and the export spillovers, and will be estimated on the pooled sample including both exporters and non-exporters, by the use of the Ordinary Least Squares (OLS) technique. The explanatory variables are lagged one-year and the industry and time effects held fixed.

### **Build-up and description of the dataset**

For the purpose of the analysis the nationally linked ESSLait firm-level datasets and the meso-aggregated Micro Moments Database have been used.<sup>1</sup> These datasets have been built up by the aid of the Distributed Microdata Approach (Bartelsman, 2004), a method to access and analyse otherwise classified information. In each participating country, firm-level information from business (BR), trade and education registers as well as from surveys on production (PS), ICT usage (EC) in firms has been

---

<sup>1</sup> The ESSLait project was funded by Eurostat, Grant Agreement 50721.2013.001-2013.082.

harmonised and then merged.<sup>2</sup> In the case of the United Kingdom, information on educational achievement is drawn from the Community innovation survey (IS).

**Table 1. Variable description and sources**

	<b>Variable</b>	<b>Description and source</b>
<b><i>XD</i></b>	Export decision	Exporter = 1, otherwise 0 (Trade, VAT)
<b><i>EX</i></b>	Export value	Nominal exports services and manufacturing (Trade, VAT)
<b><i>XI</i></b>	Export intensity	Nominal exports over gross production (Trade, VAT, PS)
<b><i>R</i></b>	Labour productivity (LPQ) Capital-labour ratio (K/L) Firm size (E)	Nominal sales per employee (PS) Capital stock or book value per employee (PS) Number of full time employees or head counts (BR or PS)
<b><i>C</i></b>	Age (AGE) Foreign ownership (FOWN)	Firm age in years (BR) Foreign ownership = 1(BR or PS)
<b><i>ICT</i></b>	Online presence (WEB) Online transactions (e-sales, AESELL) Complementary ICT and human resources (BROADpct)	Having website = 1 (EC) Having e-sales = 1 (EC) Proportion of broadband internet-enabled employees (EC)
<b><i>HK</i></b>	Schooled human capital: 1. ICT-intensive human capital (HKITpct) and Non-ICT intensive human capital (HKNITpct) or 2. Human capital (HKpct) or 3. Wages (W)	Either: Proportion of post upper secondary ICT educated employees (Education Register, Occupation register or IS, ISCED: maths, physics, engineering or ICT) and Proportion of post upper secondary generally educated employees or Proportion of employees with post upper secondary education, or Total wage bill per employee (PS) - if educational achievement not available
<b><i>EXspill</i></b>	Export spillovers	Ratio of exporters to total number of firms in an industry (2-digit NACE); (Trade statistics, VAT)
<b><i>S</i></b>	Time fixed effects Industry fixed effects	Year (BR, PS, EC) Industry 2-digit code (BR)

Note: BR=business register, PS=production survey, Structural business Statistics or similar, EC=E-commerce survey (ICT usage in firms) and IS=Innovation survey (Community innovation survey). Data on exports originate from either the value added tax register (VAT) or from the trade statistics.

All variables used in the estimations are described in Table 1, which also includes data sources. The datasets consists of manufacturing and services firms (NACE rev. 1.1. industries 15-37 and 50-99),

<sup>2</sup>More information about the methodology for accessing the microdata and build-up of the meso-aggregated dataset is available in Eurostat (2008), Gaganan (2012), Denisova (2013), Bartelsman et al (2013) and Iancu et al (2013).

exclusive of energy, water and construction (industries 40-45). Industries 75 to 99 are partially covered. In Austria, Italy, the Netherlands and Norway, only trade in goods were possible to retrieve. The deficit of service trade data has two main causes: Either these statistics are held by some other authority than the statistical office (the national bank, for instance), increasing the legal barriers for linking of microdata, or the services trade statistics are based on information from a sample survey, which renders too few overlaps in the merged datasets.

**Table 2. Features of small and medium-sized firms in 2010**

Country	AT <sup>G</sup>	DK	FR	IE	IT <sup>G</sup>	LU	NL <sup>G</sup>	NO <sup>G</sup>	PL	SE	SI	UK
Export intensity, XI (pct)	13	27	19	95	11	55	25	11	23	35	56	12
SME export/total export (pct)	38	38	19	21	41	32	58	40	27	36	72	15
WEB (pct)	89	91	71	73	62	76	88	83	74	94	80	88
BROADpct	44	32	44	43	38	61	59	66	38	65	51	59
AESELL (pct)	24	26	21	27	6	17	27	41	14	35	20	29
HKITpct		5	4					4		7		6
Average wage Euro (000)	39	48	52	34	31	46	57	46	35	51	22	43
Average firm size (employees)	25	27	45	53	33	29	42	23	39	23	27	55
Labour productivity Euro (000)												
E>250	54	63	77	236	63	53	87	56	113	74	32	82
50≤E≤249	67	58	61	89	54	73	92	56	86	63	30	82
10≤E≤49	50	61	72	56	38	52	71	46	76	59	25	63
Observations PS	39687	14513	19060	1322	162600	2897	26116	24643	51935	34769	9479	13201
Observations PSEC	1986	2906	4917	2188	11547	1682	5329	2884	9996	2047	1167	3242
Proportion SME (pct)	98	97	85	92	99	97	95	98	95	98	98	74
Data available from	2001	2004	2006	2002	2001	2003	2006	2001	2003	2001	2003	2001

Note: A <sup>(G)</sup> means exports of goods only. The values for Italy refer to 2009. A firm is considered small or medium-sized when the number of employees amounts to between 10 and 249.

Source: ESSLait Micro Moments Database.

For the regressions, nominal values are deflated by EUKLEMS or WIOD 2-digit price series where needed.<sup>3</sup> The change in industry classification is overbridged by a probability procedure that converts the series back to NACE rev. 1.1. The estimations are performed on the small and medium-sized

<sup>3</sup> [www.euklems.net](http://www.euklems.net) and [www.wiod.org](http://www.wiod.org).

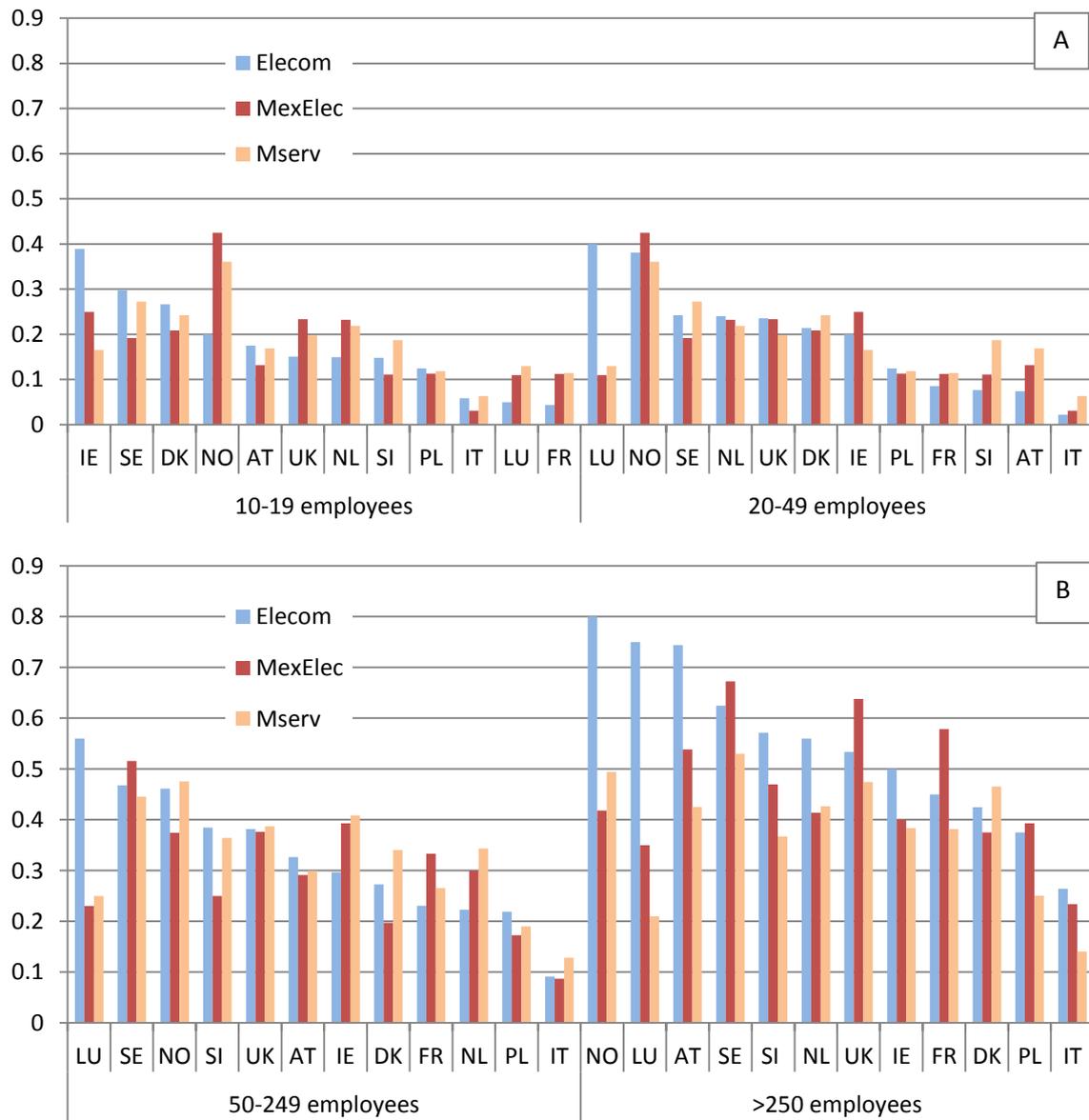
manufacturing and services firms in the PSEC datasets (which is short for the merger of BR, PS and EC as described above and in Table 1). A firm is considered small or medium-sized when the number of employees amounts to between 10 and 249. In Table 2 some general descriptive statistics on the main variables of these firms are presented.

The export intensity of SMEs varies across the countries studied. In general, dependency on international trade is higher for a small open economy than for a large country. This is clearly visible from Table 2, where just about a tenth of the total production by SMEs in the United Kingdom sample is shipped abroad, meanwhile more than half of the Slovenian and approximately a third of the Swedish production is exported. In Austria, Italy, the Netherlands and Norway, only exports of goods have been available for linking at the firm-level, implying that the measure of export intensity is underestimated in these countries. The very high value for Ireland is explained by the degree of merchanting, that is, when a good or service is produced in one country, sold in another and accounted for in a third.

The representation of small and medium-sized firms in exporting activities is smaller than their proportion of the total population of firms, the latter amounting to far more than 90 per cent in most countries except in France and the United Kingdom. Thus, this means that the majority of international sales are undertaken by large firms. A small or medium-sized firm has on average 23 to 55 employees (Norway and Sweden - the United Kingdom). This indicates a pattern with more sizeable firms in the larger of the economies studied here, although Ireland seems to be an exception to this, possibly related to the extent of multinational firms.

Information on ICT schooled human capital can be extracted for five of the countries studied. This proportion is low everywhere. As expected, having a website is the ICT capacity most often in use among SMEs. This also comes close to saturation, led by SMEs in Sweden and Denmark. Frequent broadband internet access for employees can be found in the Northern countries, particularly in Norway and Sweden.

**Diagrams 1A and B. Proportion of e-sales across firm size, country and industry**



Note: Elecom is the ICT producing industries, MexElec manufacturing exclusive of ICT and MServ is market services without ICT services.  
 Source: ESSLait Micro Moments Database

However, this access is not as widespread as having a website. While broadband employee access and having a website do not vary much across firm size within industries, e-sales shows a less homogeneous pattern, including also apparent differences across countries, as highlighted in Diagrams 1A and B.

Firms with 49 employees or fewer are clearly less active with online transaction than firms with more than 50 employees. The large firms, with at least 250 employees, engage most extensively in online transaction, and particularly so in the ICT producing sector (Elecom). Services firms are the most frequent online sellers in the size group 20-249 employees.

The merged datasets used for this study suffer from a high attrition of firms, especially smaller ones, following the commonly established practice across European statistics producers to reduce the form-filling burden. These limitations restrict further mergers of the dataset, implying that the empirical model does not include information about R&D or innovation output, variables commonly considered in export specifications. Hypothetically, this could mean that some of these effects are instead captured by the industry dummies or by the different ICT capacities. A high attrition in the dataset also hampers the use of panel data methods and dynamic models.

## **Results and discussion**

As expected, ICT is found to be positively related to the exporting activities of small and medium-sized firms in most of the countries investigated, although the specific ICT capacity that matters the most seems to vary across countries. It appears that a basic tool like having a website is important for export decisions in a majority of countries while the e-sales variable remains insignificant. When instead export intensity is investigated, a slight shift from basic to more advanced ICT tools is revealed, but ICT schooled human capital is still of importance for the behaviour of exports.

**Table 3. Determinants of exports decision**  
*Probit estimations, pooled samples over time of SMEs*

Dependent variable:	AT <sup>G</sup>	DK	FR	IE	IT <sup>G</sup>	LU	NL <sup>G</sup>	NO <sup>G</sup>	PL	SE	SI	UK
Probability to export (XD*)												
<b>Firm has website (WEB)</b>			+	***	***	**		***	***	***	**	
<b>Employee broadband access (BROADpct)</b>			+		***			***		***		**
<b>Online transactions (AESELL)</b>												
<b>ICT-intensive human capital (HKITpct)</b>	n.a.	***		n.a.	n.a.	n.a.	n.a.	**	n.a.	**	n.a.	**
Non-ICT intensive human capital (HKNITpct)	n.a.		***	n.a.	n.a.	n.a.	n.a.	***	n.a.	***	n.a.	
Human capital (HKpct)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.	n.a.		n.a.
Log wages (W)		n.a.	n.a.	+	***	*	n.a.	n.a.	***	n.a.	n.a.	n.a.
Prior exports (EX)	***	***	***	***	***	***	***	***	***	***	***	**
Log labour productivity (LPQ)			**				***	***	***	**	***	
Log employment (E)	***	***	***	***	***	**	***	***	***	***	***	
Capital/labour ratio (K/L)		***						***				
Age				**		***		***	***			
Foreign ownership (FOWN)			***					***	***	***	**	
Export spillovers ( <i>EXspill</i> )	***				***	**	***	***	+			***
Observations	800	5897	6486	5385	34802	4479	4923	6476	18690	9068	912	333
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: All explanatory variables (except age and ownership) are lagged one year. A <sup>(G)</sup> means information only available for exports of goods. Empty cell implies insignificant estimate while \*\*\*, \*\* and \* denotes significance at the 1, 5 and 10 per cent levels. Source: ESSLait PSEC dataset and own calculations

In nine out of 12 countries there is a positive relationship between the online presence of an SME and its decision to export. This is reported in Table 3, including sign and significance of each individual coefficient. Having a website increases the probability that a small or medium-sized firm exports in France, Ireland, Italy, Luxembourg, Norway, Poland, Sweden and Slovenia. This indicates that even simpler ICT tools such as a website may facilitate for firms to carry out a range of activities from a distance that would otherwise be more difficult and costly to achieve. Through a website the firm becomes visible and can establish direct contact with customers, strengthen its customer service and build up a customer-related information system. A website may also support international advertising and

makes it possible for firms to fit the online experience to customers from specific markets. The findings are in line with the conclusions of Lendle et al (2012), who found that online markets potentially build trust and reduce information frictions and with Freund and Weinhold (2004) who found that websites are positively related to exporting activities.

In France, Italy, Norway, Sweden and the United Kingdom the degree of broadband internet-enabled employees is positively correlated with exports behaviour, even after controlling for human capital of the firm. This result may indicate that SME employees in these countries manage to use the internet as a resource in activities connected to exploiting opportunities on international markets, as suggested by Portugal-Perez and Wilson (2012).

Access to online transactions, or e-sales, is the third ICT variable in the empirical model presented here. Contrary to the expectations there is no clear evidence of a relationship between e-sales and the export decision. The insignificant coefficients may indicate that a system for online sales is not enough to support the exporting activities of SMEs. Instead there could be a further underlying factor involved, connected to the lack of trust for online purchases. Alternatively, investments in proper and secure systems for online sales may require resources that are out of reach for certain SMEs, while this would be a lesser concern for larger firms, something that results by Eurostat (2012) indicates.

Another potential resource is ICT schooled employees. Highly skilled employees are important in determining the export activities of a firm according to Schott (2004) and Ashurst (2012) emphasises the importance of being able to operate the ICT at hand in the firm. Specific ICT skills are expected to complement other capacities of the firm. The results confirm a positive relationship between ICT schooled employees and the export status in four out of the five countries (Denmark, Norway, Sweden and the United Kingdom) where data on educational achievement is available.

Interesting to note is that in Norway, Sweden and the United Kingdom, the positive relationship between the degree of broadband internet-enabled employees and export status is valid even when the proportion of ICT schooled employees is controlled for. That is, if two SMEs with a similar proportion of ICT-educated employees would be compared, the probability of exporting would be higher for the firm where a larger proportion of employees has fast internet access. This result suggests that internet use creates benefits even when used by employees who are not ICT schooled.

The control variables behave as expected. Past exporting experiences, capturing sunk costs connected to entering foreign markets, clearly increase the probability to export. Generally, larger as well as foreign-owned firms are more likely to export. Export spillovers appear to be relevant in several countries and firms that belong to industries with a higher proportion of exporters are more prone to export. The level of labour productivity is related to exports behaviour of firms in several but not all countries, a variation that might be explained by different time lags, related for instance to institutional efficiency in a country. It also turns out that not only ICT schooled employees are significant for the decision to export, but in fact all kinds of schooled employees.

Turning to the second specification, where the exports behaviour of small and medium-sized firms is estimated by export intensity as the dependent variable (Table 4), verifies the link to ICT capacities, although the pattern is somewhat changed. A majority of countries is still affected in its exports behaviour by at least one ICT tool. However, having a website is now somewhat less urgent while the importance of having broadband internet-enabled employees and online sales is more pronounced, although the significance of broadband employees has been lost for the United Kingdom and Norwegian firms, already on a higher level of employee connectivity. Nonetheless, the United Kingdom results have to be interpreted with care due to the small number of observations in the merged sample.

**Table 4. Determinants of export intensity**  
*OLS estimations, pooled samples over time of SMEs*

Dependent variable:	AT <sup>G</sup>	DK	FR	IE	LU	NO <sup>G</sup>	PL	SE	SI	UK
Export intensity (XI)										
<b>Firm has website (WEB)</b>										
<i>Coefficient</i>	0.113*	-0.016	0.016***	0.046**	-0.015	-0.010	-0.017***	0.013	0.095***	-0.034
<i>t-value</i>	1.92	1.13	3.11	2.41	1.37	0.43	3.98	0.49	2.60	0.92
<b>Employee broadband access (BROADpct)</b>										
<i>Coefficient</i>	-0.095	0.008	0.014*	0.196***	0.030*	0.031	-0.027***	0.149***	0.016	0.038
<i>t-value</i>	1.47	0.84	1.91	4.35	1.95	1.28	4.29	5.93	0.32	0.93
<b>Online transactions (AESELL)</b>										
<i>Coefficient</i>	-0.033	0.000	-0.004	0.016	0.031**	-0.028*	-0.006	0.063***	-0.022	-0.002
<i>t-value</i>	0.88	0.01	0.68	0.81	2.48	1.85	1.10	3.55	0.52	0.05
<b>ICT-intensive human capital (HKITpct)</b>										
<i>Coefficient</i>	n.a	0.413***	0.043	n.a	n.a	0.155*	n.a	0.357***	n.a	0.195
<i>t-value</i>		12.26	1.43			1.92		4.37		1.59
<b>Non-ICT intensive human capital (HKNItpct)</b>										
<i>Coefficient</i>	n.a	0.102***	0.140***	n.a	n.a	0.187***	n.a	0.428***	n.a	-0.010
<i>t-value</i>		2.98	7.30			3.37		5.73		0.13
<b>Human capital (HKpct)</b>										
<i>Coefficient</i>	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0.228**	n.a
<i>t-value</i>									2.18	
<b>Log wages (W)</b>										
<i>Coefficient</i>	0.067	n.a	n.a	-0.018	-0.016	n.a	-0.001	n.a	n.a	n.a
<i>t-value</i>	1.08			0.77	1.13		0.19			
<b>Log labour productivity (LPQ)</b>										
<i>Coefficient</i>	0.000	0.000***	0.000***	0.000***	0.000***	0.000***	0.000	0.000*	0.001**	0.000
<i>t-value</i>	0.96	4.88	6.48	2.58	8.11	2.68	0.42	1.76	2.46	1.55
<b>Log employment (E)</b>										
<i>Coefficient</i>	-0.016	0.053***	0.021***	0.105***	0.009	0.019**	0.022***	0.022***	0.036**	0.038
<i>t-value</i>	0.58	10.61	7.31	10.13	1.51	2.13	11.47	2.75	2.31	1.59
<b>Age</b>										
<i>Coefficient</i>		-0.001**	0.000*	-0.001*	-0.004***	0.000	-0.001***	0.000	-0.004*	-0.001
<i>t-value</i>		2.41	1.97	1.84	8.34	0.14	5.49	0.49	1.88	0.43
<b>Foreign owned (FOWN)</b>										
<i>Coefficient</i>		0.020**	0.099***	0.451***		0.010	0.280***	0.190***	0.176***	-0.019
<i>t-value</i>		2.32	13.73	18.30		0.51	51.93	8.51	4.15	0.59
Observations	800	5897	6486	5385	4479	6476	18690	9068	912	333
R <sup>2</sup>	0.21	0.35	0.18	0.33	0.26	0.06	0.27	0.08	0.19	0.41
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: All explanatory variables (except age and ownership) are lagged one year. A <sup>(G)</sup> means information only available for exports of goods and \*\*\*, \*\* and \* denotes significance at the 1, 5 and 10 per cent levels. Data limitations exclude NL and IT from the estimations of the export intensity. The coefficients can be interpreted as marginal effects (for instance, in the case of France, firms having a website render a 1.6 percentage points higher export intensity), Source: ESSLait PSEC dataset and own calculations

Poland is the only country with a negative relationship between increases of ICT capacities and export intensity. This clearly contradicts the results from the estimation of the export decision. In Norway, Sweden and Luxembourg, a system for online sales is significant for the proportion of exports, though in Norway the relationship is negative. The slight shift in emphasis on ICT capacity seems reasonable enough. A more basic ICT tool might be needed for the first international step in combination with an extra input of skills. Once on the international market, a gearing up of ICT usage might be the most powerful tool. The results clearly coincide with those found by Mathews and Bianchi (2010), who found significant relationships between export market growth on the one hand and websites and e-sales on the other.

The control variables reveal that improvements in labour productivity is positively related to export intensity, as is the size of the firm and most often also foreign ownership. Somewhat surprisingly, the age variable indicates that the younger the firm the larger the exports, while generally schooled human capital, not only those with ICT orientation, is of importance too. The value of the R-squared uncovers that only between six and 41 per cent of export intensity can be explained by the model. This is not entirely unanticipated given the nature of cross-section data and the considerable number of non-exporters in the dataset. Unreported results for the export intensity equation including exporters only show no major differences in the parameter estimates.

Several robustness checks have been undertaken. It is likely that the importance of ICT capacities differ between manufacturing and services firm. Unreported results show no clear pattern in the estimates across the two industry groups, except for the presence of a website, which is more often related to the exports decision in services than in manufacturing firms. However, it needs to be kept in mind that consecutive splits of linked datasets lead to smaller samples, and general conclusions become difficult to draw. A similar analysis by Eurostat (2012), based on a dataset including a high proportion of large firms, renders

fewer significant estimates for the relationship between having a website and exports decision, while the link to online sales is pronounced. This suggests that size of firm might be more crucial than sector for the decision to export.

The decision to export and the export intensity have also been estimated by use of the Heckman sample selection model with lagged exports, export spillovers and the capital/labour ratio as identifying variables. Two out of these three identifying variables are significant at the 5 percent level in the majority of cases. More importantly, the results of the key parameters in the export intensity estimation are similar but not identical to those of the single equation methods, including significant but small estimates for the inverse Mill's ratio. However, doubts can be raised about the adequacy of the Heckman model when there is no sample selection or censoring (zero exporters are known).

## **Conclusions**

This study has contributed new empirical evidence on the role of different ICT capacities in the internationalisation of small and medium-sized firms in twelve European countries. As opposed to the other studies, the approach is novel in the sense that it is based on large, harmonised and representative firm-level datasets and provides insights from a broader spectrum of ICT capacities.

In a majority of the countries investigated, specific ICT capacities are of importance for the export decision. As expected, the ICT tool most efficient for small and medium-sized firms varies, possibly but not exclusively related to diverse levels of ICT usage throughout Europe. Institutional settings in the countries might be vital too. Employees schooled in ICT is also a factor that that is associated with the probability to export. Additionally, the results indicate that once on the international market, ICT capacities are still important for export behaviour, but the weight among them changes from simpler to more advanced ones, especially for firms in countries already high in ICT usage. This might indicate that

after entrance, a firm needs to advance its technology to survive on the international market. The results supports those of for instance Freund and Weinhold (2004), Mathews and Bianchi (2010), Portugal-Perez and Wilson (2012) and Bennett (1997) in that websites may be positively related to exports growth, an ICT infrastructure impacts exports (broadband-enabled employees) and that online capacities are related to exports sales.

Besides the ICT variables, the outcome also confirms that the export decision is positively dependent on past international experience, labour productivity, firm size, schooled human capital, age and foreign ownership. Similarly, export intensity is also positively related to labour productivity, size, ownership and schooled employees. With the exception of having a website, which is more often important for the export decision in a services firm, no specific ICT patterns across industries have been traced.

The lack of homogeneous features across countries of the ICT capacity most efficient for the internationalisation of small and medium-sized firms suggests that an overall EU-level support strategy may miss its target. However, continuing efforts to support fast internet supply, which is indeed one of the key areas of the Digital Agenda for Europe, may still be a plausible solution at least for countries with a lower intensity in their ICT usage. This would enable small and medium-sized firms to take the first digital step into a new market by establishing a website with core information on products and services. A natural next step would then be to advance the activities on the website, for instance by allowing online transactions. However, difficulties in finding significant links between export behaviour and online sales might be related to firms still being resistant or unaccustomed to these kinds of transactions, or they simply cannot afford a website with proper sales functions. The results may also indicate that the aspects of trust and security could be relevant. Considering the aims of the Digital Agenda, to support a digital single market through guaranteeing consumer rights and by fostering a secure and trustworthy internet environment, a feasible interpretation of the results is that this aim is not yet within reach.

The nature of the dataset with a high attrition of firms makes it difficult to employ panel data methods.

This is a challenge for future research and policy to overcome.

### **Acknowledgments**

Eurostat Grant Agreement number 50721.2013.001-2013.082 and Framework service contract N°

ENTR/2009/033.

## References

- Ashurst C, Cragg P and Herring P (2012) The role of IT competences in gaining value from e-business: An SME case study. *International Small Business Journal* 2012 30(6):640-658.  
DOI:10.1177/0266242610375703.
- Bartelsman EJ (2004) The Analysis of Microdata from an International Perspective. STD/CSTAT (2004)12, OECD.
- Bartelsman EJ, Hagsten E and Polder M (2013) Cross-Country Analysis of ICT Impact Using Firm-level Data: Micro Moments Database and Research Infrastructure. Eurostat.
- Bennett R (1997) Export marketing and the internet: Experiences of web site use and perceptions of export barriers among UK businesses. *International Marketing Review* 14(5):324-344.
- Bernard AB and Jensen J B (2004) Why Some Firms Export. *The Review of Economics and Statistics* 86(2):561-569.
- Bianchi C and Mathews SW (2013) The role of the Internet on export market growth: an empirical study in Latin America. In: *Strategic Management in Latin America 2013*, Mexico city, Mexico.  
<http://eprints.qut.edu.au/56585/>
- Borges M Hoppen N and Luce FB (2009) Information technology impact on market orientation in e-business. *Journal of Business Research* 62(9):883-890.
- Denisova E (2013) *Final Report on ESSLait Metadata Repository*. Eurostat
- Eurostat (2008) *Final Report, Information Society: ICT impacts Assessment by Linking Data from Different Sources*. Eurostat.
- Eurostat (2012) *Final Report, ESSNet on Linking of Microdata on ICT Usage*.
- Freund CL and Weinhold D (2004) The effect of the Internet on international trade. *Journal of International Economics* 62(1):171-189.
- Gaganan A (2012) Metadata Review. In: Eurostat *Final Report, ESSnet on Linking of Microdata on ICT Impact*:25-30.

- Gashi P, Hashi I and Pugh G (2014) Export behaviour of SMEs in transition countries. *Small Business Economics* 42(2):407-435.
- Greenaway D and Kneller R (2007) Firm heterogeneity, exporting and foreign direct investment. *The Economic Journal* 117(517):134–161.
- Higon DA and Driffield N (2011) Exporting and innovation performance: Analysis of the annual Small Business Survey in the UK. *International Small Business Journal* 29(1):4-24.
- Hollenstein H (2005) Determinants of international activities: are SMEs different?. *Small Business Economics* 24(5):431-450.
- Iancu D, Hagsten E and Kotnik P (2013) Quality of Linked Firm-Level and Micro-Aggregated Datasets: The Example of the ESSLait Micro Moments Database. Eurostat.
- Lendle A, Olarreaga M, Schropp S and Vezina PL (2012) There goes gravity: how eBay reduces trade costs. *CEPR discussion papers 9094*, London
- Lohrke FT, Franklin GM and Frownfelter-Lohrke C (2006) The Internet as an Information Conduit: A Transaction Cost Analysis Model of US SME Internet Use. *International Small Business Journal* 24(2):159-178.
- Mathews SW and Bianchi C (2010) The role of the Internet on international market growth of Australian firms: an exploratory study. In: *Proceedings of the Australia and New Zealand International Business Academy (ANZIBA) conference 2010*, 15-17 April 2010, Sydney, Australia.
- Martens B (2013) What does economic research tell us about cross-border e-commerce in the EU Digital Single Market? *JRC-IPTS Working Paper on the Digital Economy 2013-04*. Institute of Prospective Technological Studies, Joint Research Centre.
- Melitz MJ (2003) The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica* 71(6):1695-1725.

- Morgan-Thomas A (2009) Online activities and export performance of the smaller firm: a capability perspective. *European Journal of International Management* 3(3):266-285.
- Morgan-Thomas A and Jones MV (2009) Post-entry Internationalization Dynamics. *International Small Business Journal* 27(1): 71-97.
- Morgan-Thomas A and Bridgewater S (2004) Internet and exporting: determinants of success in virtual export channels. *International Marketing Review* 21(4/5):393-408.
- Portugal-Perez A and Wilson JS (2012) Export Performance and Trade Facilitation Reform: Hard and Soft Infrastructure. *World development* 40(7):1295-1307. DOI: <http://dx.doi.org/10.1016/j.worlddev.2011.12.002>.
- Prasad VK, Ramamurthy K and Naidu GM (2001) The Influence of Internet-Marketing Integration on Marketing Competencies and Export Performance. *Journal of International Marketing* 9(4):82-110.
- Reuber AR and Fischer E (2011) International entrepreneurship in internet-enabled markets. *Journal of Business Venturing* 26(6):660-679. DOI: 10.1016/j.jbusvent.2011.05.002.
- Schott PK (2004) Across-product versus within-product specialization in international trade. *The Quarterly Journal of Economics* 119(2): 647-678.
- Sinkovics N, Sinkovics RR and Jean RJB (2013) The internet as an alternative path to internationalization?. *International Marketing Review* 30(2):130-155.