Cross-border e-commerce and comparative advantages in digital markets

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Abstract

The digital transformation of the past years affected also international trade. The share of exchanges across borders conveyed by digital tools is growing rapidly in many important markets, both advanced and emerging, and the growth of online sales during the Covid-19 crisis, in spite of declining trade volumes indicates that the use of e-commerce can accelerate economic integration between countries.

The existing evidence suggests that access to the digital channel to export is not an automatic extension of traditional exports, and it requires to carry out organizational, logistical and skills adaptations by firms, requiring investments. This paper investigates which are the main factors yielding a comparative advantage in cross-border e-commerce through an analysis of the available European data.

Keywords: digitalization, international trade

JEL Codes: F14, F19

1. Introduction

With the rapid growth of the Internet since the mid-1990s, the digital landscape has expanded and changed the way many markets operate. After over twenty years of experience and development, digital technologies adopted by firms influence the organization of production processes, exchanges between companies, and transactions with consumers. For consumers, the possibilities of choice and comparison between goods have greatly expanded, and their expectations have also increased. With the spread of information and telecommunications technologies, access to the network, now almost universal in advanced countries and in many emerging countries, and the advancement in logistics, e-commerce has become a mass phenomenon and the its growth in many countries has been very rapid.¹ According to UNCTAD estimates (UNCTAD, 2021), the value of e-commerce reached \$ 26.6 trillion globally in 2019, equivalent to around 30% of world GDP in the same year. (Table 1). Measuring the impact of the digital economy today is essential for understanding the economy as a whole given the growing dependence of businesses and consumers on digital for products and services.

International trade has also been deeply influenced by these transformations and in the last decade, as also exchanges across national borders have undergone greater digitization. Digital trade involves digitally enabled or digitally ordered cross-border transactions in goods and services which can be digitally or physically delivered (Lopez-Gonzalez and Jouanjean, 2017). UNCTAD estimates that 1.45 billion people, or a quarter of the world's population aged 15 and over, shopped online in 2018, up 9% from 2017. Although most online shoppers mainly buy from domestic suppliers, interest in purchasing from overseas suppliers continued to expand. The percentage of cross-border online shoppers relative to all online shoppers increased from 17% in 2016 to 23% in 2018.

Such rapid growth is due to unprecedented reductions in the costs of engaging in international trade thanks to the digital transformation. But the change is not only quantitative. According to many studies, the use of digital technology is changing both how and what countries trade and contributing to growing competitiveness (Lopez-Gonzalez and Jouanjean, 2017 and WTO, 2018). Similarly to the way that reductions in transport and coordination costs enabled the growth of trade in the past decades and the creation of global value chains (GVCs), declining costs of transmitting and sharing information are helping reduce barriers to engaging in digital international trade. This is leading to more traditional trade because of lower trade costs across most sectors, but especially to more digitally delivered trade, including new services (e.g. intermediation or cloud computing services) and smaller value services (such as apps) often delivered through new tech (platforms). This new type of trade is transforming the features of a growing share of trade flows: more digitally

¹ While there is no single recognized and accepted definition of digital commerce, there is a growing consensus that it encompasses digitally enabled business transactions to goods and services that can be digitally or physically delivered and that involve consumers, businesses and governments (see for example

<u>https://www.oecd.org/trade/topics/digital-trade/</u>). So while all forms of digital commerce are enabled by digital technologies, not all digital commerce is delivered digitally. For example, digital commerce also involves exchanges of digitally enabled but physically delivered goods and services, such as buying a book through an online marketplace or booking a stay in an apartment through a corresponding application.

ordered parcels crossing borders, making trade more accessible, with implications for SMEs, individuals and customs and related authorities; more bundled or 'smart' products combining the characteristics of goods and services and constantly connected; more cross-border data flows, which underpin all digital trade transactions but raise new issues such as privacy, national security, intellectual property protection, cybersecurity, industrial policy.

The above examples indicate that the digital transformation has also made trade become more complex, requiring firms employing specific organizational skills, and how and which measures affect trade has also changed (Lopez-Gonzalez and Ferencz, 2018; Ferencz and Gonzales, 2019). Border barriers have different effects in the digital era where more small parcels cross international borders, and new issues such as cross-border data flows can raise new issues when referring to "domestic protection". In today's rapidly evolving digital environment, governments are facing growing regulatory challenges in ensuring that the opportunities and benefits from digital trade, for both individuals and for businesses, can be realized and shared.

In this paper, we want to assess some characteristics of cross-border e-commerce to understand whether indeed e-commerce reduced international trade costs, and there is a positive relationship between digitalization and exports (Freund and Weinhold, 2004). In today's global markets, the digital channel can bring firms and customers closer together, but at the same time it requires some specific technology and organizational changes for firms. Therefore, we try to understand which factors enhance the diffusion of e-commerce and foster international digital trade, with a specific focus on European countries.

We try to answer these questions through the consolidated international trade model considering heterogeneous firms, and assessing how the digital channel affects both the fix entry costs and the accessibility to foreign markets. The analysis suggests that, to the extent that the use of the digital channel allows companies to improve their productivity and price competitiveness, it can actually be an important lever for increasing the volume of exports, the number of exporters and the margins achieved international market. But the same model also indicates that internationalization operates a decisive process of selection among companies because of high entry costs, often country-specific. Therefore, it is not obvious that the choice of digital export is the most suitable for everyone. Also for e-commerce, trade costs and barriers to digital trade, as well as comparative advantages and disadvantages should be taken into account.

The work is organized as follows: section 2 presents the overall picture of European e-commerce and use of the digital channel to export, in section 3 we describe the interpretative model of the possible determinants of comparative advantages and trade frictions in digital exports, in section 4 the potential factors of competitiveness in digital markets are presented, section 5 analyzes the empirical evidence of the impact of such factors and section 6 concludes.

2. E-commerce in Europe

E-Commerce concerns the purchase or sale of goods and services between individuals, companies, or organizations of various kinds, carried out by a digital terminal (such as a computer or smartphone) via the Internet or other telecommunications networks. In order to talk about e-commerce, orders must necessarily be transferred through a digital network, usually via a sales interface. E-commerce is commonly divided, according to the parties involved in the exchanges, into business-to-consumer e-commerce (B2C), in the case where the buyers are the final consumers, or in business-to-business e-Commerce (B2B) in the case of transactions between enterprises. In addition, it is also possible that the telematic purchase takes place between private individuals, usually through specific intermediation platforms, in which case we have consumer to consumer e-Commerce (C2C). We speak instead of B2G, in the case in which the purchaser is the Public Administration, or B2B2C, in the case in which there is an intermediate passage between enterprises before the final consumer. It is important to classify the different types of e-commerce, because the characteristics of the parties involved are relevant for market access.

Even if many digital markets are still mostly domestic, cross-border e-commerce (or transnational) is growing rapidly and is proving to be the key growth engine for B2C, thanks mainly to giant marketplaces like Amazon and eBay, with an annual growth rate estimated to be close to 30 % from 2014 to 2020. Among the few estimates available, the most recent indicate the value of B2C cross border e-commerce in \$189 billion in 2015 - 7% of the total B2C e-commerce - for a total of about 380 million consumers involved in international purchases (UNCTAD, 2017). According to some researchers, by 2022 transnational purchases are expected to account for 20% of worldwide e-commerce, with a turnover of 627 billion dollars (Palese and Usai, 2018).

Also in cross-border e-commerce, like in traditional exports, the main markets in terms of absolute values are the United States and China. The European Union members are generally active in e-commerce and cross-border e-commerce, even if there are relevant differences across the EU, as highlighted already in early analysis (Guerrieri and Bentivegna, 2011). The high level of openness and integration of the European market and the strong export vocation of a significant share of European firms suggest cross-border e-commerce to be widespread among European countries, but with high heterogeneity in the use of e-commerce across Europe. For example, in Bulgaria less than 10% of businesses have revenues from online sales, while in Ireland this percentage exceeds 35%. What unites the EU is the tendency of consumers to buy products mainly from their own country or, at least, from other Member States. Contrary to what could be expected, the digital single market appears less integrated and homogeneous than other traditional markets. Market segmentation can be due to many reasons, first of all the ongoing evolution and adaptation of digital markets, and the high impact of heterogeneous and incomplete regulations in digital markets. But also, the factors that allow a country and a firm to be a successful exporter in traditional markets do not automatically apply to e-commerce.

The diffusion of e-commerce does not appear to be linearly correlated to income per capita, and some EU members are lagging behind with respect some emerging countries. The European Union has put in place a program to enhance the process of digitalization and to foster e-commerce (see

https://digital-strategy.ec.europa.eu/en/activities/digital-programme), based on the view that a stronger diffusion of these technologies can promote economic growth and prosperity, as well as integration across Europe. Still, openness and integration in e-commerce are often lower than openness in traditional markets. If we consider cross-border e-commerce not only in absolute value, but also as a percentage of total e-commerce, this ratio provides us with a measure of international openness to digital trade, an interesting indicator, particularly relevant to many traditionally open countries. Figure 3 shows that the ranking of openness in digital markets is quite different from the one in traditional export propensity. Italy, although characterized by a relatively small share of firms involved in e-commerce (Fig. 2) and a small B2C e-commerce market (amounting to 17 billion in 2015, the lowest among the top 10 countries by size of the entire e-commerce market) is a country in which cross-border transactions display a remarkable weight on total e-commerce. In particular, Italy, Canada and Germany emerge as very open, even if to a smaller extent than in traditional trade, while large markets such as the United States and China, also because of their size, are more closed to the rest of the world. We want to investigate the reasons behind these differences, and in particular if there are specific factors that allow countries to develop a comparative advantage in ecommerce.

3. The link between digitalization, exports and productivity

Is there a link between the diffusion of digital technologies and the export pattern of a country? International trade models based on technological differences (à la Ricardo, and even more Eton and Kortum (2002)) can provide insights on how varied technological distributions can help to explain the different relevance of e-commerce across countries. In this type of trade, trade costs and trade barriers are directly related to the technological advancement and the diffusion of information and communication technologies (ICT). Regulatory barriers also play a key role in this area, as market access can become much more costly or much less profitable in presence of specific regulations on data treatment and diffusion, on consumers' protection, on transparency. For this reason in the empirical analysis we focus on European Union countries, so to have a common regulatory framework and exploit other types of differences as sources of comparative advantage in exports.

In this context, the distribution of productivities cannot be taken as exogenous. In fact, a potential channel connecting exports and use of digital technologies can be productivity: through the enhancement of productivity in specific sectors and firms, digitalization can affect the comparative advantages of a country. Furthermore, digitalization can affect productivity especially at the firm level, and therefore affect exports through a differentiated impact on individual firms. More generally, there can be some countries' characteristics that facilitate the adoption of digital technologies and the development of domestic and export e-commerce markets.

The link between the digital revolution and productivity has been studied for some time now.² This link is generally assumed to be positive, but as general official national accounting statistics find very small effects of the digital revolution on productivity in most countries, also in the case of international trade the empirical evidence of a positive link with the use of the digital channel is not straightforward. This difficulty in highlighting a link between export performance and e-commerce, between the use of digital technologies, international trade and the export capacity of firms, may be partly due to statistical reasons, similar to those that apply to the national accounts of countries, and to the objective difficulty of correctly measuring these phenomena.

Still, some studies found a positive correlation between digitalization and international trade. Freund and Weinhold (2004) propose a model where the Internet stimulates trade by reducing market-specific fixed costs, and their empirical analysis confirms the model predictions. More recently, using a larger set of countries and more accurate measures of Internet diffusion, Lin (2015) also confirms this evidence. According to OECD data, countries with a higher degree of internet penetration have a greater degree of trade openness and sell more products to more markets. Indeed, on aggregate, a 10% increase in 'bilateral digital connectivity' raises goods trade by nearly 2% and trade in services by over 3% (López González and Ferencz, 2018). Digitalisation is important for all sectors, including agriculture, natural resources and textiles, but it is most important for exports in more sophisticated manufactures and digitally deliverable services. Digitalisation is also associated with countries drawing greater benefits from regional trade agreements (RTAs). When combined with an RTA, a 10% increase in digital connectivity gives rise to an additional 2.3% growth in goods exports (Lopez-Gonzalez and Ferencz, 2018). The benefits of digital trade were already apparent before the COVID-19 pandemic, but the crisis has further accelerated the shift towards a digital economy and underscored the need for governments to enable digital trade as a means to mitigate the economic slowdown and speed up recovery (OECD, 2020).

In the case of exports, the difficulty in finding a clear relationship emerges especially if considering aggregate data. In fact, the overall data on digital exports can mix different effects: for some companies, the use of the digital channel can actually increase competitiveness and export capacity to new markets, for others there are too many costs and obstacles to effectively exploit this tool. Therefore, the positive link between digitalization, e-commerce and exports exists, but only under certain conditions.

To understand this diversity of effects, it is useful to refer to the international trade model with heterogeneous companies for the analysis of e-commerce. This model shows that in general relatively few firms in a country export, even if foreign markets are potentially profitable. This occurs because the choice to export involves an initial cost, generally non-recoverable, of a non-negligible amount to change the production organization or find suitable distribution channels, for example. Not all companies are able to bear this cost, and the fixed cost is amortized only by the relatively more productive and competitive companies, which are therefore able to win enough sales volumes to amortize the costs of entering foreign markets. Therefore, in the model of international trade with heterogeneous firms (i.e. with different levels of productivity), only the relatively more

² See for example Brynjolfsson and Hitt (2003),; Cardona et al. (2013; Choi and Hoon Yi (2009); Corrado and van Ark (2016).

productive firms export profitably. The correlation between exports and productivity is positive, with the causal link going from productivity to the choice to export.³ Therefore, as long as digitalization enhances productivity, it could indeed be positively correlated with exports. It is also important to recall that the positive link is associated with a selection effect, which means that many companies do not export or suffer losses if they try to enter foreign markets.

This reasoning can also be applied to the case of exports via digital channel, in an even more marked way. In fact, the initial costs to activate a digital sales channel in a foreign market are often high, and require specific skills and investments, knowledge of the foreign market and its online sales platforms, electronic payment systems, investments to reorganize logistics, and so on. The digital market is also extremely competitive, with the presence of a very large number of companies, potentially from all over the world, trying to win a share of local consumer spending. Consequently, gaining visibility and a digital market niche is often complex. Those who are successful, however, can have very high profits also thanks to the global dimension of the market in front of it. Furthermore, the use of the internet and digital technologies once adopted can significantly reduce the transaction costs and the cost of obtaining information on a given market and supplying customers.

Figure 7 summarizes this reasoning, representing the relationship between profits and productivity in different types of markets. Figure 7 shows the trend in profits of companies that sell on the domestic market (solid line), on the foreign market by exporting through traditional channels (dotted line) and on the foreign market through the digital channel (dashed line). For a company that operates in more than one of these markets and channels, the profits add up. By hypothesis, the fixed costs of entry into the various markets are represented by the negative amounts D, X and E, lower on the domestic market and higher for e-commerce abroad. For simplicity, the growth of profits as a function of productivity is assumed to be the same on the traditional domestic and foreign market (same variable costs and same marginality), therefore the continuous line and the dotted line have the same inclination. Instead, e-commerce profits are assumed to grow faster due to organizational benefits and lower transaction cost, as many e-commerce models suggest. It should be noted that due to the specific hypothesized combination of initial fixed costs and variable costs, the minimum productivity threshold to have positive profits on the digital market is equal to e, higher than in the other cases. Domestic sales require a relatively lower cost of entry (level D in Figure 7), and therefore even firms with low productivity manage to remain on the domestic market profitably. Selling abroad requires a higher initial cost (represented by level X in the Figure), but for companies above a certain productivity threshold, exporting generates additional positive profits compared to those on the domestic market.

The transition to e-commerce requires even greater initial investments (equal to E) but can also generate greater profits, for companies above a certain productivity threshold, thanks to a decrease in a series of operating costs (hence, the greater slope of the profit function represented in Figure for digital exports). Obviously, the representative scheme shown in Figure 7 is based on a series of

³ The positive correlation between firm productivity level and internationalization and the selection effect have been confirmed by various empirical studies carried out in many countries in recent years. See for example Mayer and Ottaviano (2008).

hypotheses, and can be adapted to different situations (for example by changing the relative inclination of the profit functions represented). But it is useful to underline that in the presence of companies with heterogeneous characteristics and different levels of productivity, the effect of digital technology can be very different: the competitiveness in online export and the profitability of this channel require a series of preconditions, and the productivity threshold for making profits in this market depends on the level of initial costs of entry.

4. Enabling factors for cross-border e-commerce

Based on the theoretical framework presented and on the existing studies, we want to estimate the role of different factors which might enable digitalization and e-commerce, by stimulating the development of the e-commerce markets, and the role of different types of costs that can affect the position and the slope of the profit line depicted in Fig. 7. Through this analysis we also aim to understand the observed differences between EU member countries in terms of participation to e-commerce and cross-border e-commerce.

4.1 Technology level and digitalization

The possibility for consumers and businesses to benefit from the opportunities offered by ecommerce depends primarily on the degree of digitalization of the country and, in particular, the way in which individuals' access and use the network and the presence of appropriate infrastructure so that undertakings can offer the relevant services (Giuffrida, Mangiaracina, Marvasi and Tajoli, 2018). According to Lawrence and Tar (2010), the poor state of telecommunications infrastructure in most developing countries is the main barrier to the adoption of e-commerce. The lack of telephone lines, low quality, low speed and high cost of bandwidth must be addressed before users and firms in many countries can think about participating in e-commerce.

The other enabling factor taken into account is the use of digital technologies other than ecommerce. Some of these technologies are purely functional to the implementation of an ecommerce activity, others can contribute indirectly, for example by increasing the efficiency of business processes that precede or follow the online sale. Indeed, companies that have digital technologies other than e-commerce have a significantly higher propensity to adopt a digital export strategy than those that do not have such technologies (Tajoli, 2020).

According to a research conducted by OECD (2020) Big Data analytics and Artificial Intelligence are technologies that can foster the diffusion of the e-commerce between the population due the fact that can improve matching between buyers and sellers, or even matching consumers and content. Also Cloud Computing technology has stimulated e-commerce business models, in particular those on subscription, enabling individuals and organizations to access resources through an online interface. Such resources include software applications, storage capacity and network, and computing power.

In general, at the country level, higher technology is associated with higher levels of development and higher income per capita. Looking at European data, at first sight the correlation between income per capita and e-commerce does not seem so strong (Fig. 2 and 4), but we check also for this correlation.

4.2 Educational level and skills

Many studies confirm that the propensity to use digital technologies and therefore e-commerce is moderated by the level of education and skills of individuals. The higher the level of education, the greater the propensity to use digital services.

This finding hold across countries with different characteristics and development levels. Farhoomand et al. (2000), studying companies in Finland and Hong Kong with the aim of identifying the main barriers affecting the acceptance of e-commerce across borders, found that among the main inhibitors of the spread of e-commerce is " lack of education on the potential of global e-commerce". Lawrence and Tar (2010) confirm this result for a set of developing countries, showing that the lack of adequate computer training is restricting the use of computers and the Internet as a means of participating in e-commerce.

More generally, the lack of ICT skills is a widespread obstacle to the effective adoption of ecommerce. A survey carried out by the Observatory of the Politecnico di Milano on companies producing consumer goods suggests that the real enabling factor in the case of digital export is the quality of human resources that a company employs (Elia et al., 2021). Indeed, while smaller firms might find a number of organizational constraints in expanding to digital markets, the size of the company becomes less relevant when companies have adequate human resources and technologies to implement a digital export strategy. With reference to human resources, companies that have a "traditional" export manager, that is, a person with internationalization skills, but not digital skills, have a lower propensity to use e-commerce to export; on the contrary, companies that have an ecommerce manager, that is, a person with digital skills, but not skills for internationalization, have a greater propensity to undertake a digital export strategy (Tajoli, 2020).

In the empirical analysis, we also check if the availability of technological skills affects the diffusion of e-commerce.

4.3 Regulatory systems, policies and security

For an efficient digital market to develop it is important that governments ensure that the telecommunications market is open and competitive so as to offer a range of interoperable technological options and network services (in particular broadband) of adequate quality and price, so that users can choose between various technologies and services for high-speed internet access.

According to Miyazaki and Fernandez (2001), for both experienced and inexperienced users of Internet technologies the perception of risk regarding Internet security has a decisive role in the use of such technologies, including that of digital trade. Rose et al. (1999) identifies hackers as an obvious security threat to e-commerce. The meeting point between hackers and e-commerce users is data. Digital trade naturally results in the exchange of information which is stored in databases

that may be subjected to cyber-attacks. The overall data security, privacy regulations and data access and storage are important elements is the diffusion of e-commerce, and even more for cross-border e-commerce.

Some indicators on the openness and functionality of the digital markets have been developed by the European Commission and by OECD. We also test how the overall functioning of the digital markets is correlated to cross-border e-commerce.

4.4 Additional factors

E-Commerce relies on efficient logistic infrastructures within a country. Inefficiencies in essential services such as postal service along with delivery required in an international transaction can frustrate the success of the transaction itself. The distribution and delivery systems are key components to developing ecommerce. It is not sufficient to have a name and a product to adopt ecommerce successfully. It is also necessary for an enterprise to have in place the distribution and delivery channels capable of meeting customer expectations. Speed is one of the most important manifestations of ecommerce. Overnight delivery, just-in-time processing, 24/7 operations all are examples of how much faster and more precisely timed economic activities are in the ecommerce world (Lawrence & Tar, 2010).

In the case of cross-border e-commerce, where timely delivery can be more problematic, the availability of adequate logistic services can be even more important. In principle, the exporting firms can rely both on domestic and on foreign logistic services. On the one hand, the presence of good logistic services in a country can allow local firms to develop their local e-commerce market, and on the other hand, good logistics in the destination market is necessary to reach the final consumers. Therefore, while playing a very important role in e-commerce in many sectors, logistics needs not to be an advantage of the exporting country. Even if very important, to test the role of logistics in cross-border digital trade, we would need bilateral trade data for this type of trade, which unfortunately are not available.

Another crucial factor enabling e-commerce is the payment system. With regard to B2C ecommerce in particular, owning payment instruments suitable for online use facilitates the procedure, providing, depending on the chosen means, also greater security guarantees for the parties than traditional payments in cash or cheques. The most widely used online means of payment is definitely the credit card, the spread of which depends in part on the degree of general development of the country and its financial market in particular (Giuffrida, Mangiaracina, Marvasi and Tajoli, 2018).

5. Empirical Analysis of the key factors impacting e-commerce diffusion in the European Union

As discussed in the previous section, e-commerce trade has some specific characteristics and enabling factors, differentiating it from traditional international trade. This implies that comparative

advantages in traditional trade do not automatically translate in comparative advantages also in ecommerce (as suggested by Deardorff, 2017). In the empirical analysis we want to understand which are the most important variables at the country level and at the firm level that are positively associated with cross-border e-commerce.

In the regressions, the dependent variable is the share of active firms (with more than 10 employees) engaged in e-commerce and cross-border e-commerce in European countries (Eurostat data). The regressions are run on a panel of 28 EU member countries over three years, 2015, 2017 and 2019, and they are run using year fixed effects.

As a first test, we check the correlation between the involvement of firms in e-commerce (domestic and cross-border) and the level of income per capita, to verify if the use of e-commerce by firms is associated to the level of development. The results are reported in Table 3. The correlation between the share of firms in e-commerce and GDP per capita is indeed positive, but it turns out not to be significant if controlling for specific factors measuring the diffusion of digital technologies and associated to the use of e-commerce, such as the share of firms having a website and the share of firms using fast digital broadband, also positively correlated to GDP per capita. Therefore, what appears to be significant is the diffusion of ICT technologies, more than the level of development *per se.* The countries' size, measured in terms of population, also appears to be significant and with a positive impact, as economies of scale are at play in these markets. The positive role of the year fixed effects shows the significant increase over time of e-commerce.

Moving to assess the propensity to export through digital channels, we tested the relation between the share of firms involved in e-commerce and the share of firms doing cross-border e-commerce across countries and years (Table 4). The correlation between the two variables appears to be very strong and significant, even when controlling for additional factors such as the countries' export propensity and the digital openness. Also, the value of the coefficient, very close to one, seems to confirm that once a firm has started to use the digital channel for its sales, it can easily expand abroad. Indeed, we can see that the share of firms selling digitally to foreign countries within the sample of firms active in e-commerce is very high (Figure 4b), much higher than the share of exporters on the total number of firms.

Considering more specifically the determinants of cross-border e-commerce, in line with the framework presented in Fig. 7, we consider two types of explanatory variables that can affect the position of the threshold making cross-border e-commerce profitable. First of all, we include technological variables at the country-level that affect the entry cost in this market, such as infrastructure availability, or diffusion of websites as indicators of the technological level. But we also include additional characteristics of the domestic market, like the employment of ICT specialists, to assess the possibility of firms to use profitably digital technologies. We also control for the countries' export propensity and openness of the digital market. We consider overall e-commerce abroad, as well as the split between sales to other EU countries and to the rest of the world, to assess differences between the two types of markets. The description and source of the variables used in the regression is reported in the Appendix.

In Table 5, we see that also in cross-border e-commerce the most important role is played by technology, both when considering export to the rest of the EU and to the rest of the world. The variables measuring the technology diffusion and the availability of advanced infrastructures are significant also when lagged by one period (two years) as a robustness check, and this did not change the results. GDP per capita and, somewhat surprisingly, the country's openness are not significant in this case, confirming the peculiarity of digital exports compared with traditional exports. Instead, digital openness is strongly significant.

In the last set of regressions, reported in Table 6, rather than considering technology adoption, we look at the domestic country's factor endowment and potential demand for e-commerce. In the tradition of comparative advantage models, also factors' endowment in terms of availability of ICT skills in the population and in the employed labor force appear to play a positive role. Instead, potential demand size, supposedly relevant in a market that should benefit from economies of scale, is found to be insignificant.

6. Conclusions

The analysis performed confirms the existence of a number of differences between traditional trade and international e-commerce. In order to understand performance in digital exports, and more specifically the level of the entry threshold in this market in terms of the share of involved firms, it is necessary to consider specific factors facilitating e-commerce, foremost technological factors. In terms of policy implications, it appears that lowering the barriers to access to digital technology is the single most important factor to increase the share of firms involved in cross-border e-commerce.

At the same time, the relevance of the indicator of digital openness in all regressions highlights that it is crucial to take into account the existing barriers, especially regulatory barriers and which policies open up digital markets. Openness of countries and traditional export experience appear less relevant. The estimates have shown that there are some differences between the EU market and the rest of the world, implying that also in digital markets, globalization is far from complete.

References

Brynjolfsson E., Hitt L.M. (2003), Computing Productivity: Firm-level Evidence, *Review of Economics and Statistics*, 85 (4), pp. 793-808.

Cardona M., Kretschmer T., Strobel T. (2013), ICT and Productivity: Conclusions from the Empirical Literature, *Information Economics and Policy* 25, pp. 109-125.

Choi C., Hoon Yi M. (2009), The Effect of the Internet on Economic Growth: Evidence from Cross-Country Panel Data, *Economic Letters* 105, pp. 39-41.

Clarke George R.G. (2008), Has the Internet Increased Exports for Firms from Low and Middle-Income Countries?, Information Economics and Policy 20, pp. 16-37.

Corrado C., van Ark B. (2016), The Internet and Productivity, in *Handbook on the Economics of the Internet*, eds. Bauer J.M. and Latzer M. (Cheltenham, United Kingdom: Edward Elgar Publishing).

Deardorff A.V. (2017), Comparative advantage in digital trade, in S. Evenett (ed), Cloth for wine? The relevance of Ricardo's comparative advantage in the 21st century, CEPR e-book.

Eaton, Jonathan, and Samuel Kortum (2002). "Technology, Geography, and Trade." Econometrica 70, no. 5, 1741–79. http://www.jstor.org/stable/3082019.

Elia S., M. Giuffrida, R. Mangiaracina, L. Piscitello and L. Tajoli (2021), Export digitale, Covid ed emergenza: strategie per la ripartenza, report dell'Osservatorio Export Digitale del Politecnico di Milano, <u>https://www.osservatori.net/it/prodotti/formato/report/export-digitale-covid-emergenza-strategie-</u> <u>ripartenza-report</u>

Evangelista R., P. Guerrieri and V. Meliciani (2014), The economic impact of digital technologies in Europe, Economics of Innovation and New Technology, 23:8, 802-824, DOI: 10.1080/10438599.2014.918438

Farhoomand, A.F., Tuunainen, V.K. and Yee, L.W.,2000, "Barriers to Global Electronic Commerce: A Cross-Country Study of Hong Kong and Finland", Journal of Organizational Computing and Electronic Commerce, 10, 23-48.

Freund C.L., Weinhold D. (2004), The Effect of the Internet on International Trade, Journal of International Economics 62, pp. 171-189.

Ferencz, J. and F. Gonzales (2019), "Barriers to trade in digitally enabled services in the G20", OECD Trade Policy Papers, No. 232, OECD Publishing, Paris, <u>https://dx.doi.org/10.1787/264c4c02-en</u>.

Giuffrida M., R. Mangiaracina, E. Marvasi and L. Tajoli (2018), Esportazioni e e-commerce delle imprese italiane, Rapporto ICE- Osservatorio Export Digitale del Politecnico di Milano, <u>https://www.ice.it/it/sites/default/files/inline-files/Rapporto%20E-Commerce_.pdf</u>

Grömling M. (2016), The Digital Revolution - New Challenges for National Accounting?, World Economics, January-March, pp. 1-13;

Guerrieri P., S. Bentivegna (2011), The economic impact of digital technologies. Measuring inclusion and diffusion in Europe, Edward Elgar Publishing, UK.

Huang X., Song X. (2019), Internet Use and Export Upgrading: Firm-Level Evidence from China, Review of International Economics 27 (4), pp. 1126-1147.

Lin F. (2015) Estimating the Effect of the Internet on International Trade, Journal of International Trade & Economic Development, 24 (3), pp. 409-428, DOI: 10.1080/09638199.2014.881906.

López González J., Jouanjean M. (2017), Digital Trade: Developing a Framework for Analysis, OECD Trade Policy Papers n. 205, OECD Publishing, Paris, <u>https://doi.org/10.1787/524c8c83-en</u>.

López González, J. and J. Ferencz (2018), "Digital Trade and Market Openness", OECD Trade Policy Papers, No. 217, OECD Publishing, Paris. <u>http://dx.doi.org/10.1787/1bd89c9a-en</u>

Lawrence, J. E. and Tar, U. A., (2010), Barriers to e-commerce in developing countries, Information, society and justice journal, 3 (1). pp. 23-35. ISSN 1756-1078

Maurseth P.B. (2018), The Effect of the Internet on Economic Growth: Counter-Evidence from Cross-Country Panel Data, Economics Letters 172, pp. 74-77.

Mayer T., Ottaviano G.I.P. (2008), The happy few: the internationalization of European firms, Intereconomics 43, 135-148, <u>https://doi.org/10.1007/s10272-008-0247-x</u>

OECD (2020), Leveraging digital trade to fight the consequences of COVID-19, <u>https://www.oecd.org/coronavirus/policy-responses/leveraging-digital-trade-to-fight-the-consequences-of-covid-19-f712f404/</u>.

Palese B., A. Usai (2018), The relative importance of service quality dimensions in E-commerce experiences, International Journal of Information Management, Vol. 40, pp. 132-140, https://doi.org/10.1016/j.ijinfomgt.2018.02.001.

Tajoli L. (2020), Trasformazioni digitali e competitività internazionale delle imprese italiane, Rivista di Politica Economica, n.1, pp. 107-122.

UNCTAD (2019), Value Creation and Capture: Implications for Developing Countries. *Digital Economy Report*, Geneva.

UNCTAD (2021), Estimates of global e-commerce 2019 and preliminary assessment of Covid-19 impact on online retail 2020, UNCTAD Technical Notes on ICT for Development No.18, (https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf).

van Ark B. (2016), The Productivity Paradox of the New Digital Economy, International Productivity Monitor (31), pp. 3-18.

WTO (2018), World Trade Report 2018: The future of world trade: How digital technologies are transforming global commerce, <u>https://www.wto.org/english/res_e/publications_e/world_trade_report18_e.pdf</u>.

Appendix

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A list of all collected variables for each Member States. The measurements are annual and refer to the closest available year to 2019

Labels	Description	Unit of measure	Year	Source
ICT_Skills	Individuals who have basic or above basic overall digital skills	% Individuals	2019	Eurostat
GDP per capita	Median equivalised net income	PPS	2019	Eurostat
Under_25	Persons under 25 years of age	% Individuals	2019	Eurostat
Internet_user	individuals using the internet	% Individuals	2019	Eurostat
Ent_DSL_FB	Enterprises use DSL or other fixed broadband connection	% Enterprises*	2019	Eurostat
Ent_broadband_100Mb/s	The maximum contracted download speed of the fastest fixed line internet connection is at least 100 Mb/s	% Enterprises*	2019	Eurostat
Ent_website	Enterprises with a website	% Enterprises*	2019	Eurostat
Employed_ICT_specialists	Employed ICT specialists - total	% Total employment	2019	Eurostat
Ent_social_media	Use social media for any purpose (of sm_advert, sm_pcuqor, sm_pcudev, sm_pbpcoll, sm_prcr, sm_pexchvok)	% Enterprises*	2019	Eurostat
e-sales firms		% Enterprises*		Eurostat
e-sales abroad		% Enterprises*		Eurostat
e-sales EU		% Enterprises*		Eurostat
e-sale ROW		% Enterprises*		Eurostat
Export /GDP				
Digital openness				

Rank	Country	Total e- commerce sales (\$ bn) 2018	Total e- commerce sales (\$ bn) 2019	Share of total e- commerce sales in GDP (%)	B2B e- comme rce sales (\$ bn)	Share of B2B e-commerce sales in total e-commerce (%)	B2C e- commerce sales (\$ bn)
1	USA	8,640	9,580	45	8,319	87	1,261
2	Japan	3,280	3,416	67	3,238	95	178
3	China	2,304	2,604	18	1,065	41	1,539
4	S. Korea	1,364	1,302	79	1,187	91	115
5	UK	918	885	31	633	72	251
6	France	807	785	29	669	85	116
7	Germany	722	524	14	413	79	111
8	Italy	394	431	22	396	92	35
9	Australia	348	347	25	325	94	21
10	Spain	333	344	25	280	81	64
	10 above	19,110	20,218	36	16,526	82	3,691
	World	25,648	26,673	30	21,803		4,870

Table 1 – E-commerce sales: the main countries in 2019

Source: UNCTAD, based on national sources (<u>https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf</u>)

Table 2 - Cross border B2C e-commerce sales: Top ten merchandize exporters, 2019

Rank	Country	Cross border B2C e-commerce sales (\$ billions)	Share of cross border B2C ecommerce sales in merchandize exports (%)	Share of cross border B2C sales in total B2C ecommerce sales (%)
1	China	105	4.2	6.8
2	USA	90	5.5	7.1
3	UK	38	8.2	15.2
4	Hong Kong	35	6.2	94.3
	(China)			
5	Japan	23	3.3	13.2
6	Germany	16	1.1	14.7
7	France	12	2.2	10.6
8	S. Korea	5	0.9	4.4
9	Italy	5	0.9	13.9
10	Netherlands	1	0.2	4.3
	10 above	332	3.4	9.0
	World	440	2.3	9.0

Source: UNCTAD

Table 3 – Panel regression on the share of firms involved in e-commerce in the European countries

	e-sales (% firms)	e-sales (% firms)
GDPpc	0.345 ***	- 0.062
	(0.058)	(0.063)
рор	0.017	0 .048 **
	(0.025)	(0 .018)
ent_websites		1.266 ***
		(0.249)
ent_dsl_fb		1.883 ***
		(0.585)
year	0.037**	0.047 ***
	(0.022)	(0.0157)
R2	0.34	0.66

Table 4 – Panel regression on the correlation between the share of firms involved in cross-border e-commerce and the share of firms doing e-sales in the European countries

	e-sales abroad (%	e-sales abroad (%	e-sales abroad (%
	firms)	firms)	firms)
e-sales (% firms)	0 .929 ***	1.006 ***	1.052 ***
	(0.095)	(0.014)	(0.025)
Export/GDP		0.001	0.002
		(0.012)	(0.011)
Digital openness		2.606 ***	2.650 ***
		(0.058)	(0.060)
GDPpc			-0.015
			(0.012)
ent_websites			-0.066
			(0.055)
ent_dsl_fb			-0.028
			(0.117)
year	0.009	0.006	0.004
	(0.034)	(0.005)	(0.005)
R2	0.65	0.99	0.99

Table 5 – Panel regression on share of firms involved in cross-border e-commerce in the European countries: role of digital technologies

	e-sales EU (% firms)	e-sales RoW (% firms)	e-sales abroad (%
			firms)
GDPpc	-0.056	-0.077	-0.078
	(0.091)	(0.114)	(0.076)
Export/GDP	0.088	-0.195 **	0.054
	(0.081)	(0.101)	(0.068)
Digital openness	1.237 ***	1.541 ***	1.583 ***
	(0.407)	(0.512)	(0.342)
ent_websites	1.195 ***	0.586	1.117 ***
	(0.335)	(0.421)	(0.282)
ent_dsl_fb	2.308 ***	1.284	1.832 ***
	(0.798)	(1.004)	(0.672)
ent_social	0.063	0.857 ***	0.184
	(0.187)	(0.236)	(0.158)
year	0.057	0.006	0.046
	(0.035)	(0.044)	(0.029)
R2	0.73	0.65	0.78

Table 6 – Panel regression on share of firms involved in cross-border e-commerce in the European countries: domestic market characteristics

	e-sales EU (% firms)	e-sales RoW (% firms)	e-sales abroad (% firms)
GDPpc	0.001	0.183	-0.019
	(0.123)	(0.151)	(0.107)
Export/GDP	0.159	-0.354 **	0.110
	(0.136)	(0.166)	(0.118)
Digital openness	2.204 ***	2.466 ***	2.646 ***
	(0.617)	(0.754)	(0.535)
Pop ICT skills	0.975 **	0.672	0.806 **
	(0.393)	(0.480)	(0.341)
Employed_ICT_spec	0.478 *	0.490	0.543 **
	(0.251)	(0.307)	(0.218)
Internet users	-1.175	-1.677 *	-1.074
	(0.777)	(0.949)	(0.674)
Pop under 25	0.253	0.939	0.320
	(0.530)	(0.648)	(0.460)
year	0.066	0.074	0.059
	(0.048)	(0.058)	(0.041)
R2	0.59	0.50	0.65





Source: Eurostat

Figure 2- Percentage of enterprises (more than 10 employees) with e-Commerce sales of at least 1% turnover in Europe, 2019.





Figure 3 - Estimated cross border B2C sales as a share of B2C sales: Top 10 merchandise exporters, 2017.

Source: UNCTAD



Figure 4a - Percentage of enterprises with E-Commerce sales to other EU-28 countries and to the rest of the world, 2019.

Figure 4b - Businesses using e-commerce to sell to customers in other countries as a share of all businesses making e-commerce sales.

(An e-commerce sale refers to the sale of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing orders.)



Source: The OECD Going Digital Toolkit, based on the Eurostat Digital Economy and Society Statistics Comprehensive Database.











