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Determinants of E-Commerce Turnover in Europe: Consumer Protection Matters

Abstract: During the last decade the digital economy has expanded at a faster rate than traditional sectors. There is a strong consensus that e-commerce has a positive impact on labour productivity, GDP growth and consumer purchasing power. However, factors determining successful adoption of online commerce remain insufficiently studied. The consequences are clearly visible in the European Union whose countries failed to achieve the targets of the Digital Agenda 2015, with insufficient cross-border trade and inadequate participation of small to medium-sized enterprises (SMEs) in the digital market. The aim of this paper is to fill the research gap with an EU28 panel study describing the impact of policy factors on online sales from 2010 to 2015. The authors have found that internet network coverage and adequate protection of consumer rights are significant and equally important factors influencing online turnover. This implies the need to harmonise national policies between EU laggard countries and digital market leaders. Furthermore, our research rejects the hypothesis that geographical and demographic factors could create a permanent negative bias on online sales volume. The study also provides evidence that the impact of structural macroeconomic variables (i.e. country income measured by GDP per capita, education, and ICT skills) on final e-commerce turnover is limited. Finally, the authors have established that the national policies of Ireland and the Czech Republic are more effective than those of other EU countries, which is most likely due to increased support of SME engagement in online activities.

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Introduction

The purpose of this paper is to present a quantitative assessment of factors enhancing the expansion of e-commerce, based on a panel study of EU28 countries. The problem of online sales diffusion is complex as, counter-intuitively, some of the most developed member states with strong fundamentals (i.e. GDP per capita) fail to outperform peripheral economies.

E-commerce adoption refers to the establishment of a company's web presence, maintaining relationships and conducting transactions using electronic networks [Zwass, 1996]. According to Accenture and Oxford Economics [Knickrehm *et al.*, 2016], digital sales growth is outpacing dynamics in traditional areas. The share of output produced by entities active online in total Gross Domestic Product is projected to increase by 2.5 percentage points (to 25%) in the global economy and by approximately 5 p.p. in developed countries until 2020. There is a broad academic consensus [e.g. Falk, Hagsten, 2015; Biagi, Falk, 2017] that the development of digital commerce is having a positive impact on potential output, consumer purchasing power and labour productivity.

A clear understanding of this mechanism is visible in the European Union. The European Commission introduced a special Digital Agenda for Europe in its Europe 2020 strategy [EC, 2010]. The aim is to: (1) increase households' access to the internet (with 100% coverage of broadband speed above 30MB/s and at least 50% coverage of broadband speed above 100MB/S), (2) expand national e-commerce with the goal of 50% of households purchasing products online, including 20% performing cross-border commerce. The Digital Single Market strategy was adopted in 2015 and included 16 specific initiatives. The strategy aimed to enhance Europe's position as a world leader in the digital economy and e-commerce.

A mid-term evaluation of the strategy goals revealed slow progress of reform caused by two key factors. First, an economic slowdown in 2013 resulted in lower funds for investment in ICT infrastructure. Second, e-commerce adoption was slower than expected, with regulatory problems to unite European markets (i.e. the problem of geo-blocking). European countries were visibly outpaced by global peers in digital expansion. A study conducted by the Centre for Retail Research [Retailresearch.org., 2017] in the UK, Europe, the US and Canada confirmed the leading role of the United States in online retailing and mobile purchases.

Despite the strategic importance of e-commerce in Europe, factors determining its successful adoption remain only modestly researched. Macroeconomic studies focus on either cross-border online flows [Gomez-Herrera *et al.*, 2014; Cardona *et al.*, 2015; Kim *et al.*, 2016] or internet users and company behaviours [Anckar, 2005; Marten, 2013; EC, 2015; Qu *et al.*, 2015]. Numerous papers on e-commerce development present descriptive, market characteristics of specific countries [Sandberg, Håkansson, 2014; Rokicki, 2016 Nagy, 2016; Schwartz, 2017].

The purpose of this paper is to offer a quantitative assessment of factors increasing the share of e-commerce turnover in GDP based on an EU28 panel study. First, the authors attempt to verify to what extent internet coverage explains the percentage share of online sales in total retail turnover. Second, the study aims to highlight the significance of institutional development, i.e. consumer rights protection. Finally, the authors aim to discover whether geographical/demographic conditions can create a permanent negative bias on e-commerce. The paper takes a more quantitative approach, providing a "bird's-eye view" of the topic.

This paper is structured as follows. The next chapter presents an overview of the literature on e-commerce development and macroeconomic policies. Section 3 discusses the estimation methodology and data sources used for the model. Section 4 presents the estimation results and explains factors determining online activity. Finally, in Section 5 the authors make an attempt to recommend policies fostering e-commerce.

Literature review

Past research on digitisation strategies has focused on the positive impact of ICT infrastructure and regulatory frameworks on the adoption of e-commerce.

Anckar [2005] identified a number of potential drivers and obstacles to online sales. These include accessibility, lack of trust in virtual sellers, delivery times, cost of entry (costs of acquiring a computer), cost of use (internet access fees), limited computer/internet experience, and poor connection speed (low bandwidth connections). More recent European research in developed economies focused on: (1) explaining the role of e-commerce in cross-border trade flows from the perspective of enterprises and adoption among SMEs, and (2) describing consumer activity on the internet [Martens, 2013].

The Joint Research Centre of the European Commission [Gomez-Herrera *et al.*, 2014] study highlighted a significant role of cashless payments in bolstering cross-border trade. Contrary to previous research, the paper rejected the hypothesis about the positive impact of institutional factors. The study identified two major obstacles to e-commerce expansion: language barriers and physical distance. Meanwhile, industry-level research [Cardona *et al.*, 2015] highlighted: (1) the significance of company capabilities in ensuring sufficient internet security, (2) knowledge of the legal framework in foreign markets,

and (3) readiness for shifts in the supply chain. Qu *et al*. [2015] emphasised social trust, especially in business-to-business (B2B) e-commerce. The analysis confirmed positive relationships between consumer confidence and the growth of e-commerce.

Research by Kim *et al*. [2016] provided an overview of the transit time problem. Even though the EU's area is only 45% of that of the United States, the 28-nation bloc has similar or even longer average transportation time due to non-harmonised regulations. Improving express delivery services are an important factor boosting e-commerce development.

A European Commission clickstream survey [EC, 2015] revealed the importance of education and demographic factors in explaining spending on digital content. The study confirmed a similar pattern of internet behaviour in urban and rural societies. It emphasised a link between cross-border purchases and travel to foreign countries. Another European Commission study, the Consumer Conditions Scoreboard 2017, indicated growing consumer trust as a factor supporting online purchases. Regulatory protection has increased over the years, but there are still significant differences between European countries. Conditions in northern and western EU countries are better than in the east and south. Furthermore, retailers are still reluctant to sell online to consumers in EU countries with higher risks of fraud and complex tax regulations. Finally, the European Commission announced its Digital Economy and Society Index (DESI), a composite index that summarises key indicators of Europe's digital performance (key performance indicators, or KPIs) and tracks the evolution of EU member states in digital competitiveness. The study focused on another important aspect: low SME involvement in online activities.

The significance of SME participation was confirmed by Sandberg and Håkansson [2014]. A case study of 12 microenterprises confirmed a relationship between online retailing and SME business growth. The skill level of employees was also identified as an important factor. A survey conducted by Schwartz [2017] explained the slow adoption of e-commerce by German SMEs as an outcome of a wide variety of economic and social factors, including generational change (aging society), information and communication behaviour. The author stressed that the potential for using e-commerce differs significantly from one industry to another, which indicates that the structure of the economy may be important. The use of digital sales channels is rare among service providers (13%), which may decrease e-commerce adoption in service-heavy economies. The study also confirmed a positive correlation between online retailing and the expansion of start-ups.

Senarathna *et al*. [2014] focused on the organisational culture of the company. The research concluded that firms with adhocracy cultures are more likely to adopt e-commerce. In contrast, hierarchical firms are less likely to adopt e-commerce in the initial stage, while clan and market culture-oriented firms exhibit no clear interest in embracing e-commerce.

Research perspectives vary among European countries. Research conducted in Central and Eastern European (CEE) countries tends to focus on IT infrastructure and internet coverage rather than regulatory aspects.

Nagy [2016] identified the drivers of double-digit e-commerce growth in Hungary. The author confirmed that internet coverage is the key driver of e-commerce development, while macroeconomic characteristics such as net monthly earnings, inflation and household consumption remained statistically insignificant. The study also found that the growth of the digital economy coincided with rising demand for smartphones and mobile services. Finally, the author highlighted the strong influence of social networks and online services (internet banking, use of digital public services), as well as the development of digital skills in EU countries.

Rokicki [2016] analysed the growth of Poland's e-commerce market from 2010 to 2014. The author found a strong positive correlation between e-commerce development and the general condition of the economy, proxied by GDP and other indicators (gross value added, value of domestic demand, value of exports and imports). In terms of growth rates, however, the relationship was not statistically significant. The study also stressed the role of telecommunications infrastructure (access to computers and the internet, and the development of the mobile internet). At the household level, age turned out to be a significant factor. In 2014, the highest percentage of internet buyers belonged to the 25–34 age group (59.9%).

Based on the existing literature, we have divided potential factors influencing e-commerce expansion into three groups:

1. Structural factors (GDP per capita, infrastructure coverage, payment systems, human capital and digital skills) impacting e-commerce expansion (Pillar I);
2. Institutional factors (quality of institutions, ease of doing business, consumers' and retailers' comfort) impacting e-commerce expansion (Pillar II);
3. Geographical and demographic factors (median age, share of rural population, weather) impacting e-commerce expansion (Pillar III);

In the next chapter, we explain the data and estimation methodology used in the search for factors determining differences in the percentage share of online sales in total retail turnover based on a Eurostat digital economy dataset.

Data and estimation methodology

This chapter discusses the data sources used in the estimated model. The aim of the analysis is to explain what factors determine the differences in the percentage share of online sales in total retail turnover based on the Eurostat digital economy dataset. The European statistical office has reported data for most EU28 countries (except Luxembourg) as well as Norway annually since 2010. Given the progressive nature of e-commerce (the constantly rising share of online turnover across all the countries from 2010 to 2016), we

decided to estimate a Fixed Effects model with period effects. Also, given the limited time frame of the data (effectively 2010–2015), the selected approach does not include cross-country effects. Otherwise, the relatively small changes in structural factors and policy variables could have resulted in dummy effects obscuring the picture of significant variables. Furthermore, in order to specifically focus on differences between countries, each explanatory variable was transformed to show the percentage deviation from the median performer in each studied year. Such data transformation makes it possible to capture the time-varying impact of absolute differences (i.e. a difference of USD 1,000 in GDP per capita had far more important consequences for wealth in 2010 than 2015) over time, which would not be possible with more typical transformations (i.e. using the natural logarithm).

The study focuses on core macroeconomic and ICT development parameters based on the results of previous studies (divided into three core Pillars, as described in the previous chapter). The explanatory variables used during model estimation are listed in Table 1.

Table 1. Explanatory variables

Variable	Proxy	Data Provider	Literature reference
Pillar I – structural factors			
Country income and society welfare	GDP per capita modified by Purchasing Power (PPS US$)	IMF – WEO	Martens [2013], Rokicki [2016], Nagy [2016]
Infrastructure coverage (access to internet, mobile phones, internet servers)	World Bank's Development indicators	World Bank	Anckar [2005], Rokicki [2016], Nagy [2016]
Human capital	Tertiary educational attainment level measured by ISCED classification	Eurostat	Sandberg and Håkansson [2014], EC [2015], Schwartz [2017]
Digital competences	Online skills, internet skills (DESI dataset)	Eurostat European Commission	Anckar [2005], Nagy [2016]
Payment systems	Credit cards per capita	ECB	Nagy [2016]
	ATM machines per 1,000 citizens	World Bank	
Pillar II–Institutional factors			
Institutional quality	World Bank's Governance Indicators	World Bank	EC [2017], Gomez-Herrera *et al*. [2014]
Ease of doing business	Cost and administrative burdens related to trade, taxation, cost of resolving claims, maintaining electricity etc. – data from World Bank's Doing Business report series	World Bank	Anckar [2005], Gomez-Herrera, *et al*. [2014], Cardona *et al*. [2015], Kim *et* al. [2016]
Consumers' comfort	Consumer scoreboard survey indicator	European Commission	Anckar [2005], Qu *et al*. [2015], EC [2017], Cardona *et al*. [2015]
Retailers' assessment of policy	Consumer scoreboard survey indicator	European Commission	EC [2017]

Variable	Proxy	Data Provider	Literature reference
Pillar III – Geographical & Demographic factors			
Weather	Precipitation per square meter (mm/m^2)	World Bank	Steinker *et al.* [2017]
Demography	Median age in society	Eurostat	EC [2015], Rokicki [2016], Schwartz [2017]
Society's structure	Share of rural population	World Bank	Nagy [2016], Schwartz [2017]
Others			
Dummies	Dummies for Ireland and Czech Republic	-	-

This table presents a detailed summary of proxies used during estimations. Links between each abovementioned factor and subject literature are presented in column 4. Detailed descriptive statistics are available in Appendix 1.

Source: Authors' summary.

Country income and society welfare are proxied by GDP per capita modified by purchasing power parity as presented in the IMF World Economic Outlook. Infrastructure coverage (access to the internet, mobile phones and internet servers) is described using the World Bank's Development indicators. Human capital data (tertiary education attainment level measured by the ISCED classification) and digital competences (online skills, internet skills) were based on Eurostat data and the European Commission's DESI index respectively. In the case of the bi-annual Eurostat ICT survey, the authors transformed the frequency to annual replacing missing data with the latest available information. Finally, data on payment systems came from the ECB (credit cards per capita) and the World Bank (ATM machines per 1,000 citizens)

The second, regulatory pillar is probably the most interesting from a view of a policy maker. This research focused on both institutional quality proxied with World Bank Governance Indicators and the ease of doing business (i.e. cost and administrative burdens related to trade, taxation, cost of resolving claims, maintaining electricity etc.—data from the World Bank's Doing Business report series). Finally, the consumers' comfort and retailers' assessment of policy variables are based on the European Commission's consumer scoreboard survey.

The third pillar includes geographical and demographic factors such as precipitation, median age in society and the share of the rural population. Those variables have a rather deterministic character, yet they may be significant in resolving cross-country differences.

Finally, the authors used dummy variables to describe the evolution of e-commerce in Ireland (from 2013 onwards) and the Czech Republic. The Irish government in 2013 announced the development of a digital strategy including: (1) an online trading voucher scheme subsidising costs to e-commerce entry by EUR 2,500 (as a result, the country is the leader in SME online engagement), (2) complex system of ICT training programmes for persons

technically excluded from using the internet. However, the development of the Irish digital market appears to be blurred by the strong presence of international companies such as Google, Facebook and Apple, which benefit from a lower corporate tax rate. A similar situation occurs in the Czech Republic where strong SME participation (ranked 4th in the DESI Index) and strong market position of concentrated players (Mall.cz, Alza.cz) result in above-average e-commerce turnover.

The aim of the research was to identify factors shaping e-commerce turnover. The initial equation has the following form (Model 1):

$$ecommerce(t) = \gamma + period\_effect_t + B_1 * users(\%) + B_2 * servers +$$

$$+ B_3 * Cons.Comfort + B_4 * Czechia_{Dummy} + B_5 * Irish\_strategy_{Dummy} + e_t \quad (1)$$

Where γ denotes the average share of e-commerce in the retail sales volume across the selected sample, $period\_effect_t$ approximates technical progress and related diffusion of online sales over time. Three variables were selected: the share of the population using the internet, the number of servers per thousand citizens, and consumer comfort assessment. Finally, e_t stands for the equation residual. In order to verify whether the obtained results are robust we decided to expand the selected model by adding other variables.

During the second estimation (Model 2), the authors introduced (i) structural factors related to education (the share of the population with a secondary education and GDP per capita corrected by purchasing power), (ii) geographical factors (precipitation), (iii) parameters from a Doing Business survey describing administrative performance in the case of imports/exports and electricity costs, and (iv) institutional variables based on the World Bank's regulatory quality index.

In the third estimation (Model 3), the Doing Business indices were replaced by a set of institutional variables (i.e. political stability, control of corruption, government effectiveness) provided by the World Bank (further described as the WB indices).

Finally, the fourth and last estimation (Model 4) further expanded the previous model and provided additional variables from the European Commission Consumer Scoreboard (further described as the EC consumer board) such as retailers' assessment and reports regarding unfair practices within e-commerce.

The output of the model estimations is presented in the next chapter.

Model estimation and results

This section presents the specifications of the estimated models. Statistically non-significant structural variables were excluded. The panel models were estimated using 2010–2015 monthly data for EU28 countries, which results in 153 observations. However, it is necessary to note that the panel is not balanced as some of the variables for specific periods/countries are missing.

Table 2. Estimation output

	Model 1 – Base equation	Model 2 – Doing Business	Model 3 – WB indices	Model 4 – WB + EC consumer board
Constant	12.61 0.28 (45.08)***	12.68 0.27 (46.62)***	12.56 0.26 (47.5)***	12.63 0.26 (48.77)***
Internet users (%)	18.54 2.9 (6.39)***	17.17 3.57 (4.81)***	15.05 3.65 (4.12)***	17.76 3.69 (4.82)***
Server (per 1,000 citizens)	–2.06 0.52 (–3.95)***	–2.35 0.76 (–3.08)***	–2.90 0.68 (–4.26)***	–2.77 0.63 (–4.41)***
Secondary education ratio (%)		–3.13 1.57 (-2)**	–3.34 1.67 (–1.99)**	–3.76 1.44 (–2.62)***
Average precipitation		2.46 1.24 (1.98)**	2.89 1.24 (2.33)**	2.28 1.25 (1.82)*
GDP per capita (PPP)		–1.09 1.92 (–0.57)	–2.40 1.88 (–1.27)	–2.38 1.75 (–1.36)
Consumer Scoreboard – protection assessment	15.92 2.64 (6.03)***	12.87 3.26 (3.94)***	15.47 3.11 (4.98)***	10.80 3.42 (3.16)***
Doing Business – electricity cost (% income)		–0.77 0.36 (–2.11)**	–0.67 0.36 (–1.85)*	
Doing Business – import time (days)		3.69 1.39 (2.65)***		
Regulatory quality		4.48 2.56 (1.75)*	0.34 2.43 (0.14)	1.10 2.2 (0.5)
Political stability			2.91 0.82 (3.56)***	3.23 0.79 (4.11)***
Consumer Scoreboard – retailers assessments				4.87 2.09 (2.34)**
Consumer Scoreboard – unfair practices				2.17 1.24 (1.76)*
Czech Republic – dummy	14.76 1.47 (10.02)***	12.86 1.73 (7.44)***	16.17 1.77 (9.12)***	14.72 1.52 (9.72)***
Ireland – 2013 strategy dummy	18.04 2.45 (7.35)***	15.52 2.71 (5.74)***	16.03 2.61 (6.14)***	16.00 2.55 (6.27)***

Top number represents Beta parameter, left its standard deviation. T-Student statistics is presented in bracket. *** denotes p-value (t-Student) below 0.01, ** below 0.05, * below 0.1

Table confirms leading role of consumer rights protection in successful adoption of e-commerce. Variables related to institutional environment explain 11 p.p. (joint impact calculated as sum of Betas*Variables belonging to category) of discrepancy between leaders and laggards (of total 31 p.p.). Infrastructure coverage (internet users) explains a further 9 p.p. Countries with successful adoption of online channels in SME sector (Czech Republic, Ireland) have a premium of approximately 15 p.p. compared to other peers.

Source: Authors' calculations.

Table 3. Model diagnostics

R-squared	0.75	0.79	0.80	0.80
Adjusted R-squared	0.74	0.76	0.77	0.78
F-statistic	43.28	27.55	28.15	30.12
Prob (F-statistic)	0.00	0.00	0.00	0.00
Number of observations	153	152	152	153
Wooldridge's test for autocorrelation of residuals				
Regression Beta1 Parameter	–0.36	–0.34	–0.35	–0.40
Regression Beta1 Standard deviation	0.08	0.08	0.09	0.08
Wald Test (H0: Beta1 = –0.5)				
F-statistic	2.84	3.60	2.89	1.46
d.f.	(1,91)	(1,90)	(1,90)	(1,91)
P-value	0.09	0.06	0.09	0.23
Normal distribution of residuals				
Residual Skewness	0.11	0.19	0.44	0.13
Residual Kurtosis	3.45	3.52	3.4	2.76
Jarque-Bera test – statistic	1.66	2.679	5.95	0.80
Jarque-Bera test – p-value	0.43	0.26	0.05	0.67
Redundant period effect test				
Period F Statistics	3.61	3.87	4.18	4.50
d.f.	(5,142)	(5,133)	(5,132)	(5,135)
P-value	0.00	0.00	0.00	0.00

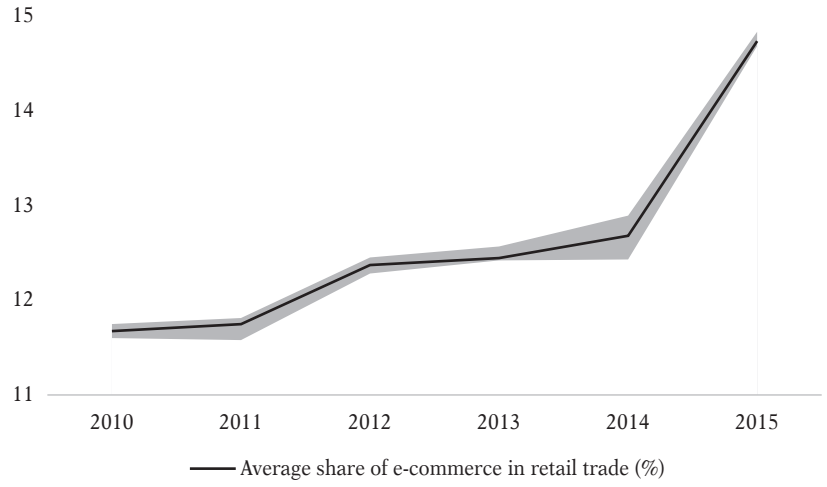
The models' basic diagnostics are presented above. In the case of each specification the hypothesis about the lack of autocorrelation under a normal distribution of residuals was not rejected. The hypothesis about the lack of statistical significance of period effects was rejected. The detailed diagnostics of Variance Inflation Factor statistics for Model 4 are presented in Appendix 2. Source: Authors' calculations.

The selected models suggest that the exogenous share of e-commerce in retail turnover increased from 11.7% to 14.7% on average, with limited progress in the 2010–2014 period and solid expansion by 2 p.p. in 2015. Countries falling under such a boundary should be classified as laggards and their policies as unfavourable to e-commerce diffusion.

In line with the literature, the internet coverage ratio remains a significant driver of digital turnover. An increase in the proportion of internet users in the population by 10 p.p. above the median performer expands the share of online sales by approximately 1.5–2 p.p. above the exogenous growth pace. Due to a greater percentage of online users, the share of e-commerce in total turnover in Norway is approximately 3.75 p.p. higher than in the case of middle performers such as Spain, Ireland and Cyprus. Meanwhile, the gap between Norway and Romania, the biggest laggard in the sample, is 9 p.p. Counter-intuitively, the number of ICT servers per capita has a slightly negative relationship with e-commerce turnover. There are two explanations of this statisti-

cally significant finding. First, on the general level (including less developed countries), the authors expect the relationship between e-commerce and ICT infrastructure to be described by the inverted U-shape curve. The development of the European market has come to a point where quantity does not mean quality. Some developed countries were able to limit infrastructure without negative consequences for the economy (i.e. France, Ireland and Spain) and reduce the costs of maintaining ICT infrastructure. Second, the magnitude of problems is greater in small economies. The largest numbers of servers are found in Denmark and the three Benelux countries, Belgium, the Netherlands, and Luxembourg. This is most likely because of regulatory reasons, including the requirement of maintaining data domestically. Both Denmark and the Benelux countries have an approximately 4 p.p. disadvantage compared to median peers. They have a greater percentage of internet users than Spain, for example, yet the benefits of greater connectivity are not in evidence in these four countries, most likely due to their inefficient ICT infrastructures.

Chart 1. Exogenous pace of e-commerce adoption Policy-neutral share of online sales in retail turnover suggested by model



This chart presents the evolution of the median e-commerce turnover share in retail sales over five years according to the model parameters (calculated as constant + period effect). The share of online sales in the total volume increased by an additional 3.5 p.p. The grey area presents the dispersion between the lowest and highest estimates of different models.

Source: Authors' calculations.

The underlying data does not make it possible to quantitatively confirm to what extent the development of mobile technology bolsters online sales. This may be due to the problem of data collection by the World Bank. The dataset does not distinguish between smartphones and traditional devices (without web browsers). This hypothesis is rationalised by a strong increase in the period effect in 2015.

The results validate the significance of consumer protection. The European Commission Scoreboard consumer comfort assessment remains strongly significant. Furthermore, the cumulative impact of institutional factors remains relatively robust with different specifications including more detailed indices (i.e. political stability) or different market participant perspectives (i.e. retailer assessments). Institutional factors explain a 5.5 p.p. difference between market leaders (UK, France) and the middle performers, while the institutional gap widens to more than 11 p.p. for the worst performing CEE states.

The study rejects the hypothesis of the positive association of cashless transactions via credit cards and the negative relationship of demand for cash and cash transactions (proxied by a higher number of ATM machines per capita). It is worth noting that there was no reliable data at this writing on internet-based financial intermediaries and FinTech transactions. Another surprising finding is the lack of statistical significance of macroeconomic fundamentals such as GDP per capita, tertiary education attainment level, computer skills, and ICT literacy assessment.

We have found a marginally positive relationship between lower energy costs proxied by Doing Business indicators (energy costs as a percentage of total revenues) and increased imports bureaucracy ("average number of days required to actually import"). While the positive relationship between lower energy costs and e-commerce is intuitive, the positive impact of higher non-tariff import barriers indicates that e-commerce is likely to fill the gaps with regulatory limited market access from larger entities. Hypothetically, imports of small volumes of goods for personal purposes require much less paperwork than wholesale. Still, energy costs and non-tariff import barriers seem far less important than the factors discussed in previous paragraphs.

Finally, the Czech and Irish policies added more than 15 p.p. to the share of e-commerce sales in the overall retail volume. This could in part be attributed to these two countries' successful implementation of programmes for the SME sector. But such a hypothesis cannot be validated at the macroeconomic level because DESI subcomponents are available from 2014 onwards, which yields an insufficient number of observations to provide statistically significant results. However, data published by Eurostat for 2016 show that e-commerce activities among small and medium-sized enterprises from Ireland and the Czech Republic play a leading role in the EU28.

Conclusions

This paper examines factors determining the share of e-commerce in retail sales among EU28 countries. The key finding is that the regulatory side of consumer rights protection is as important as physical internet coverage. The share of e-commerce in retail sales is lower by up to 5 p.p. in Central, Southern and Eastern European countries such as Poland, Hungary, Romania, and Bulgaria due to weaker consumer protections (compared to the middle per-

formers). Thus, an important consequence should be the harmonisation of EU countries' national policies to enable lagging member states to catch up with digital market leaders such as France, Germany, Austria, and the UK. The Balkan and CEE states would be among those standing to benefit.

A major area for improvement is increasing awareness of the three key consumer rights aspects, namely: (1) the right to return a product bought at a distance within 14 days without giving any reason; (2) the right to a replacement and/or the repair of faulty products; (3) the right to neither pay for nor return unsolicited products. The Consumer Scoreboard indicates that awareness ranges from 41% in emerging economies to 66% in developed countries. The discrepancy between emerging and developed economies is even greater in the case of international transactions involving unusual problems such as unsolicited products, for example.

Second, southern and eastern European countries more frequently fail in forcing retailers to comply with consumer rules and stop unfair practices, thus making consumers feel vulnerable. Such problems are especially visible in Poland, Croatia and Bulgaria, where only 60% to 63% of entities fully comply with the standards, compared to 85% in the UK and France. The major problems reported in southern and eastern Europe refer to relatively low requirements for providing adequate information about product characteristics (i.e. writing fake reviews with the support of internet scripts, advertising false technical details). Finally, CEE states fail to provide a successful legislative framework for handling consumer complaints. There is a disparity of 20–25 p.p. between consumers in leading and lagging countries as far as process satisfaction responses are concerned. Dissatisfaction is often caused by a lengthy complaint handling process and an ineffective redressing mechanism. Some of these problems are likely due to insufficient budgets of national consumer rights protection organisations (e.g. Poland spends five to 10 times less than median performers).

Our research has highlighted the importance of focusing on the digital development of the SME sector. The top two performers among SME sectors in the EU, Ireland and the Czech Republic, achieved an over 15 p.p. edge over other European countries. This leads to a recommendation that special strategies for sector development be announced and carried out in southern and eastern EU countries. Best-case practices include the Irish online trade voucher scheme, which has produced a significant effect (increasing the SME share by 6 to 8 p.p.) at a relatively low fiscal cost.

Finally, geographical and demographic variables have turned out to have a limited impact on discrepancies in e-commerce adoption. These factors are deterministic in nature and do not depend on short-term policies, which provides further indirect evidence that e-commerce may be stimulated by right policy decisions at either the national or EU legislation level.

References

Anckar B. [2005], *Drivers and inhibitors to e-commerce adoption: exploring the Rationality of consumer behavior in the electronic marketplace*, Institute for Advanced Management System Research. Abo Akademi University, Finland.

Biagi F., Falk M. [2017], *The impact of ICT and e-commerce activities on employment in Europe*, Ratio Working Papers 285, The Ratio Institute.

Cardona M., Duch-Brown N., Francois J., Martens B., Yang F. [2015], *The macro-economic impact of e-commerce in the EU digital single market*, JRC Working Papers on Digital Economy, no. 09, Joint Research Centre (Seville site).

EC [2010], *EUROPE 2020: A European strategy for smart, sustainable and inclusive growth*, European Commission.

EC [2015], *Identifying the main cross-border obstacles to the digital single market and where they matter most*, European Commission.

EC [2017], *Consumer conditions scoreboard: consumers at home in the single market – 2017 edition*, European Commission.

Falk M., Hagsten E. [2015], E-commerce trends and impacts across Europe, *International Journal of Production Economics*, *Elsevier*, vol. 170 (PA): 357–369.

Gomez-Herrera E., Martens B., Turlea G. [2014], The drivers and impediments for cross-border e-commerce in the EU, *Information Economics and Policy*, vol. 28: 83–96, ISSN 0167–6245.

Kim T.Y., Dekker R., Heij C. [2016], *The value of express delivery services for cross-border e-commerce in European Union markets*, No. EI2016–12, Econometric Institute Research Papers, Erasmus University Rotterdam, Erasmus School of Economics (ESE), Econometric Institute.

Knickrehm M., Berthon B., Daugherty P. [2016], *Digital disruption – the growth multiplier. Optimizing digital investments to realize higher productivity and growth*, Accenture.

Martens B. [2013], What does economic research tell us about cross-border e-commerce in the EU digital single market?, *JRC Working Papers on Digital Economy*, no. 05, Joint Research Centre (Seville site).

Nagy S. [2016], E-commerce in Hungary: a market analysis, *Theory, Methodology, Practice*, no. 12: 25–32.

Retailresearch.org. [2017], *Online retailing: Britain, Europe, US and Canada 2017*, Centre for Retail Research, Nottingham UK, available online at: http://www.retailresearch.org/onlineretailing.php (27.09.2017).

Rokicki T. [2016], E-commerce market in Poland, *Information Systems in Management*, vol. 5(4): 563−572.

Sandberg K., Håkansson F. [2014], Barriers to adapt e-commerce by rural microenterprises in Sweden: A case study, *International Journal of Knowledge and Research in Management and E-Commerce*, vol. 4, no. 1.

Schwartz M. [2017], SMEs in Germany are slow to adopt e-commerce, *KfW Research*, no. 161, 12 February.

Senarathna I., Warren M., Yeoh W., Salzman S. [2014], The influence of organisation culture on e-commerce adoption, *Industrial Management & Data Systems*, vol. 114, issue 7: 1007–1021.

Steinker S., Hoberg K., Thonemann U.W. [2017], The value of weather information for e-commerce operations, *Production and Operations Management*, vol. 26, issue 10, October: 1854–1874.

Qu W.G., Pinsonneault A., Tomiuk D., Wang S. [2015], The impacts of social trust on open and closed B2B e-commerce: a Europe-based study, *Information & Managemen*t, vol. 52, issue 2, March: 151–159.

Appendix 1: Descriptive statistics

Table 4. Descriptive statistics

	2010				2016			
	Max	Min	Median	Std	Max	Min	Median	Std
E-commerce share (%)	24	1	13	5.6	35	4	14	6.6
Internet users (%)	93.4	39.9	69.3	14.9	96.8	55.8	79.7	11.0
Server (per 1,000 citizens)	2.28	0.04	0.31	0.65	2.91	0.00	0.81	0.74
Secondary education ratio (%)	71.1	18.8	45.8	12.8	67.1	24.7	44.6	10.8
Average precipitation	1 414	498	688	249	1 414	498	688	249
GDP per capita (PPP US$)	61 520	15 670	30 607	10 922	69 249	20 327	35 693	12 752
Consumer Scoreboard – protection assessment	80.7	45.0	62.9	10.8	85.3	46.4	65.0	12.4
Doing Business – electricity cost (% income)	392.1	13.4	77.8	94.3	603.5	11.9	76.5	146.0
Doing Business – import time (days)	22	5	11	5.37	19	5	9	4.18
Regulatory quality	1.89	0.56	1.31	0.41	1.86	0.36	1.12	0.49
Political stability	1.39	–0.29	0.74	0.41	1.19	–0.23	0.80	0.34
Consumer Scoreboard – retailers' assessments	78.2	37.6	53.7	10.8	76.2	41.3	58.2	10.0
Consumer Scoreboard – unfair practices	64.0	24.2	37.2	9.3	39.2	7.7	22.6	8.3

Source: Author's calculations.

Appendix 2: Variance Inflation Factor Test

The aim of this appendix is to present Variance Inflation Factors for the most complex equation (4th Model). The test results are available below.

Table 5. Variance Inflation Factor statistics

Variable	Coefficient Variance	Uncentred VIF	Centred VIF
Constant	0.07	1.06	NA
Internet users (%)	11.53	5.64	5.64
Server (per 1,000 citizens)	0.37	4.18	4.18
Secondary education ratio (%)	1.83	1.88	1.88
Average precipitation	1.53	2.21	2.21
GDP per capita (PPP)	3.04	5.40	5.39
Consumer Scoreboard – protection assessment	9.55	4.45	4.45
Consumer Scoreboard – retailers' assessment	4.30	2.22	2.22
Consumer Scoreboard – unfair practices	1.49	1.52	1.52
Regulatory quality	3.46	7.48	7.48
Political stability	0.56	2.33	2.33
Czech Republic – dummy	2.09	1.31	1.26
Ireland – 2013 strategy dummy	6.46	1.32	1.30

Source: Authors' calculations.

The authors have identified increased collinearity in the case of regulatory quality. However, the underlying value of VIF statistics is lower than the typically selected threshold of 10. No problems were reported in other specifications.

DETERMINANTY ROZWOJU E-COMMERCE W EUROPIE – OCHRONA KONSUMENTA JEST WAŻNA!

Streszczenie

Przez ostatnią dekadę tempo wzrostu gospodarki cyfrowej istotnie przekraczało postęp w tradycyjnych sektorach. Literatura ekonomiczna podkreśla pozytywny wpływ e-commerce na produktywność pracy, siłę nabywczą konsumentów i PKB. Zbiór badań opisujących politykę gospodarczą wspierającą handel internetowy jednak jest skromny. Konsekwencje zaniedbań widoczne są w Unii Europejskiej – kraje członkowskie zanotowały porażkę we wdrażaniu agendy cyfrowej z uwagi na małe obroty międzynarodowe w handlu internetowym oraz niskie uczestnictwo małych i średnich przedsiębiorstw (MSP) w rynku cyfrowym. Celem badania jest ilościowa analiza czynników wspierających rozwój e-commerce na podstawie panelu gospodarek UE w latach 2010–2015. Autorzy wskazują istotną rolę inwestycji w infrastrukturę ICT oraz działań prowadzonych dla ochrony konsumenta. Taki wniosek implikuje zasadność dostosowania przepisów związanych z bezpieczeństwem zakupów przez słabsze gospodarki do liderów. Autorzy odrzucili hipotezę wskazującą, że niesprzyjające czynniki geograficzne i demograficzne mogą permanentne spowolnić rozwój handlu elektronicznego. Badanie wskazuje również na niewielki związek czynników strukturalnych np. poziomu PKB per capita, wskaźników skolaryzacji czy umiejętności informatycznych z łącznym udział e-commerce w handlu detalicznym. Autorzy zidentyfikowali również strategię digitalizacji zaaplikowane przez rządy Irlandii i Czech jako najbardziej skuteczne w UE m.in. z uwagi na sukces wdrożenia handlu internetowego w sektorze MSP.

Słowa kluczowe: agenda cyfrowa, e-commerce, Komisja Europejska, tablica wyników dla konsumentów, model panelowy

Kody klasyfikacji JEL: C23, F62, O52