

STATISTICAL EVALUATION OF E-COMMERCE IN THE EUROPEAN UNION AND THE REPUBLIC OF NORTH MACEDONIA¹

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Abstract

In the current study, we conduct a comparative analysis of the European Union countries and the Republic of North Macedonia in terms of the e-commerce development in the period 2010-2021. We identify the place of e-commerce as a key element of business digitalisation. We present the information sources of the indicators for characterising e-commerce and classify them as direct and indirect indicators based on their relation with the e-commerce development. We analyse and compare the dynamics of the indicators for the EU countries and the Republic of North Macedonia by growth rates and their ratios. We apply an approach where, based on the level of the indicators in 2010 and the change over the period 2010-2021, the countries are classified into four groups – running ahead, lagging ahead, catching up and falling behind. We thus position countries in terms of their prospects for e-commerce development.

Keywords: e-commerce, comparative analysis, growth rates and their ratios

¹ original research paper

INTRODUCTION

As a result of using digital technologies, the business environment is changing, and the efficiency in the activities of enterprises is increasing. In addition, new technologies are facilitating the implementation of modern management, communications and access to information. Creating an environment for the widespread application of information and communication technologies in all areas of the economy and social life is one of the goals of “Shaping Europe’s digital future” (2020) and is among the priorities of “A new strategic agenda” (2019).

The COVID-19 pandemic has confronted us with new challenges. The restrictions imposed, objective or coercive, on the activities of firms in various sectors have also affected the commercial relationships between producers and customers. The benefits of e-commerce as good opportunities for developing enterprises, attracting new customers and expanding markets, and improving financial performance, has become even more evident during the extraordinary crisis conditions. In specific periods, when many retail stores were closed, e-commerce became the only source and supplier of necessary goods for a large part of the population and, simultaneously, an acceptable way of commercial business functioning (Tran, 2021; Amsari & Sari, 2022).

The object of study in the current paper are the state and opportunities for e-commerce development in the EU and the Republic of North Macedonia. The subject of study are the indicators used to assess the potential of e-commerce integration in enterprises' activities and the results of its implementation. The aim of the paper is to examine the differences between EU countries, including the Republic of North Macedonia as a candidate for membership, in terms of the state of e-commerce and the speed at which changes are occurring. The analysis is conducted only for e-commerce in non-financial enterprises.

E – COMMERCE AND BUSINESS DIGITALISATION

E-commerce is demonstrating the implementation of digital technologies in business. At the EU level, several legislative acts forming a complex framework, starting with (Directive 2000/31/EC), regulate the digitalisation process. This series of documents represents a set of interrelated measures that enable European citizens to use e-commerce.

In the scientific literature, there are various definitions of e-commerce. The basis of all of them is the use of information and communication technologies and, in particular, connection through computer networks, including the Internet (Angelovska & Ivanovska, 2019; Turban, King, Lee, Liang, & Turban, 2015; Tian & Stewart, 2008). In the public domain, advertising the products and/or services offered by a firm through its website – presenting the firm, providing a product catalogue and possibly prices, represents e-commerce. The fast development of digital technologies enhances e-commerce. Customers place orders and sometimes make payments online. Providing feedback to customers, for instance, via embedded e-mail, chat or an electronic forum for questions and comments, constitutes a higher standard of e-commerce.

Various authors, among which (Tosheva, 2020; Gunasekaran, Marri, McGaughey, & Nebhwani, 2002; Falk & Hagsten, 2015) highlight the advantages of e-commerce in different aspects. A website or a mobile application has a positive image effect for the company and is an opportunity for its portfolio to reach more customers, thereby increasing the market coverage. Interactive tools allow the features of the offered goods and services to reach customers in a faster and more attractive way and provoke their interest. Removing the time and space constraints of selling and buying saves time and money on communication between the trader and the customer. At the same time, ensuring an ongoing relationship with the supplier, where the consumer can get a quick answer to their questions, wins more customers. Automation of buying and selling processes reduces the cost of maintaining physical stores. Modern information technology and the possibilities of “big data” allow the personalisation of offers and increase the competitiveness of companies. Therefore, many firms are increasing their investments in web content and mobile applications to reach more suppliers and consumers.

The importance of e-commerce has been growing naturally in the wake of the Covid-19 pandemic (Koch, Frommeyer, & Schewe, 2020). Consumer awareness has increased, which has led to a decrease in purchase decision time. The e-commerce portfolio is expanding to offer specific services. The variety of online educational tutorials and courses on the web and e-learning is a logical extension of conventional education through “edtech” tools. As a result of the authorities’ call to minimize physical contact, patients are given medical advice and provided with medical care through so-called “telemedicine”. Through virtual shopping, customers are able to visit a shop, try on clothes or see a simulation of furniture in their homes.

INFORMATION ASPECTS OF THE STATISTICAL EVALUATION OF E-COMMERCE

Data

Eurostat, the statistical office of the EU, provides reliable and high-quality numerical information on e-commerce. The primary data source is the annual surveys conducted since 2004 in the areas of ICT and e-commerce use in enterprises and ICT use by households and individuals. Periodic surveys from other European Commission services and “ad hoc” ones on specific issues complement the information acquired by the annual surveys.

The population of the e-commerce survey is all economically active enterprises in the country with ten or more employees. The data are collected through a questionnaire and aggregated by economic activity, size, depending on the number of employees, or territorial location. The questionnaire consists of several modules, one of which is “e-commerce”. There are two subtopics – e-purchases and e-sales, together with the payment method. Questions are included on both the geographical scope of e-commerce and the generated turnover. Specific issues, for example, best practices in e-commerce and barriers to e-commerce, are explored through particular modules in different years.

We select from a causal point of view, i.e. reflecting their different importance for the development of e-commerce, the indicators characterising e-commerce in enterprises, for which we apply statistical analysis. Therefore, we separate them into two groups. The indicators from the first group we call *indirect* because they serve to describe the prerequisites necessary for e-commerce. These are access to the Internet, use of computers and the Internet by employees in the enterprise, type of Internet connection, availability of a website and its functionalities, etc. We refer to the indicators from the second group as *direct* because they represent the results of e-commerce. These can include volume and value of e-commerce sales, e-commerce purchases, e-invoicing, barriers to e-commerce, etc.

In correspondence with the two criteria mentioned above, for the aims of the analysis, we have selected the following two indicators. The direct indicator is **E1** “Enterprises with e-commerce sales”, representing the share of all enterprises that have made sales through e-commerce in the previous calendar year. The indirect indicator analysed in this study is **E2** “Enterprises with a website”. It represents the share of all enterprises that have a functioning website. The unit of measurement for both indicators is a percentage.

The primary source of the statistical dataset for the analysis is the Eurostat database (ICT usage in enterprises, n.d.). Considering the length of

the time series available on the “Digital Economy and Society” theme, we set the study period to 2010-2021. For some EU countries and some years of that period, there are missing values of the selected indicators. For this reason, we use two different imputation approaches (Handbook on constructing composite indicators: methodology and user guide, 2008, p. 55). When the missing value of the time series is between the first and the last year, we substitute it with the average of the two known adjacent values. We apply this approach for the values of indicators *E1* in 2020 for Greece and *E2* in 2019 for Finland. In case the missing value is for 2021, we use the predicted value resulting from straight-line modelling of the corresponding time series. We use this technique for Belgium, Denmark and Estonia for indicator *E2*. For the Republic of North Macedonia data, we use the MAKStatDatabase (Information Society, n.d.).

Methodology

We conduct the statistical analysis of the selected indicators in the following two aspects:

- analysis of the dynamics of the indicators;
- evaluation of the state and development of e-commerce.

We evaluate the *dynamics of the indicators* characterising e-commerce by measuring the speed and direction of their change. We use descriptive statistics such as absolute growths and growth rates to assess absolute and relative changes, and their intensity, in e-commerce. We use the average exponential growth rate as a summary measure of the speed (intensity) at which indicators change.

In order to *assess the state of e-commerce*, we identify groups of countries for each indicator. The justification for forming the groups lies in two criteria. The first one represents the indicator level for each country at the beginning of the period under study. For this purpose, we calculate the “initial relative level”, denoted by v_0 . For each of the indicators under study, it is calculated as the ratio of two levels in 2010, the indicator level for the specific country and for the EU-27. Thus constructed, the metric takes only positive values. Moreover, if the country-specific value is above the EU-27 average, then $v_0 > 1$. Conversely, if the level is lower than the European average, $v_0 < 1$.

The second criterion assesses the speed with which changes occur in different countries. Here, we use the “average rate of growth rate” ($\overline{K_a}$), calculated as the ratio of the average growth rate for the specific country and the average growth rate for the EU-27. Again, the comparison of values is

against the number 1. Changes are more intense if $\overline{K_a} > 1$ and are slower if $\overline{K_a} < 1$.

As a result of the combination of the possible cases under the two criteria, we classify the countries into four groups:

- **running ahead**, for which the initial relative level of the indicator is above the average EU level and the changes are more intense than the average for the EU;

- **lagging ahead**, for which the initial relative level of the indicator is below the average EU level and the speed of changes is slower than the EU average;

- **catching up**, for which the initial relative level of the indicator is below the average EU level and the speed of changes is faster than the EU average;

- **falling behind**, for which the initial relative level of the indicator is below the average EU level and the speed of changes is slower than the EU average.

It is possible to obtain a limiting value of 1 for either of the two metrics. When $v_0 = 1$, the country is classified as catching up or falling behind, depending on the value of $\overline{K_a}$. If $\overline{K_a} = 1$, then the country is classified as either running ahead or lagging ahead, depending on the value of v_0 .

EVALUATION OF THE STATE AND DYNAMICS OF E-COMMERCE

Evaluation of the dynamics of the indicators characterising e-commerce

The graphical representations of the level of the analysed indicators for the EU-27, presented in Fig. 1 and Fig. 2, reveal an increasing trend. Although the level of indicator **E2** (between 66% and 78%) is higher than the level of indicator **E1** (between 15% and 22%), the increasing trend is more pronounced for indicator **E1**. The average growth rate over the period for indicator **E1** is 3.63%, and for indicator **E2**, is 1.42%. The conclusion is confirmed by the results for the absolute growths and growth rates on a chained basis. The absolute growths for the two indicators are similar, up to 2 percentage points, so the growth rates explain the differences in the dynamics. The increase in the level of indicator **E1** is more than 5.00%, with the largest growth rate of 11.76% in 2015. In the case of indicator **E2**, the increase is up to 3.03% (the value for 2011). Despite these differences, there is also a similarity in the dynamics of the two indicators. With large fluctuations in indicator **E1** and minor fluctuations in **E2**, their growth rates

decrease over the period, indicating a slowdown in the upward trend in levels.

The development of e-commerce in the separate EU-27 countries can also be assessed as an upward trend. The results for the average growth rate of each indicator support this conclusion - only 3 of the values of both indicators for the 27 countries are negative. It turns out that over the period, a downward trend in the levels of the respective indicators is found in Germany and Luxembourg with a 1.31% and 2.15% average annual decrease for indicator *E1*, respectively, and in Slovakia with a 0.04% average annual decrease for indicator *E2*. The average growth rates of indicator *E2* for all countries are up to 3.18%, which is evidence of the smooth development of the process. More intense is the dynamics of indicator *E1*, where the average growth rates for most countries are between 2.01% and 7.71% on average per year, and extreme values of 10.28% for Romania and 12.95% for Italy are reached.

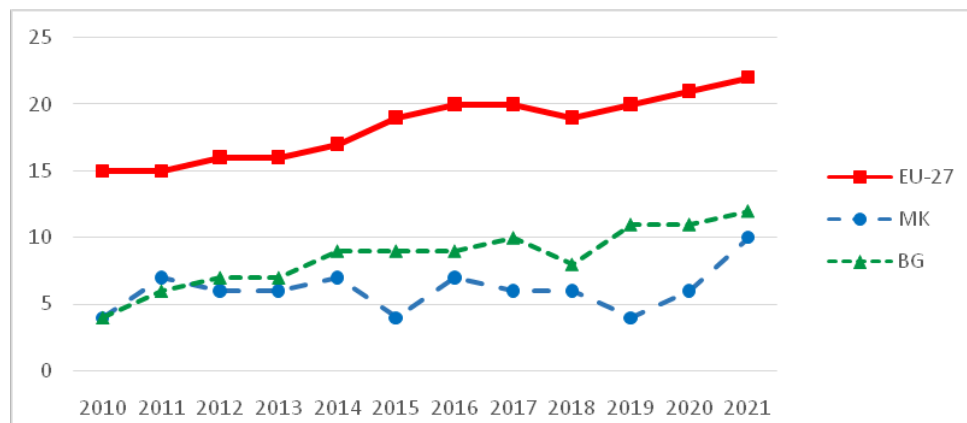


Figure 1. Dynamics of the indicator *E1* “Enterprises with e-commerce sales” in the EU-27, Bulgaria and the Republic of North Macedonia in the period 2010-2021
Source: the authors

The dynamics of the indicators for the Republic of North Macedonia differ from the identified patterns for the EU-27 but have many common features with Bulgaria. From the graphical representation in Fig. 1, the lower levels of the indicators for both countries and the larger fluctuations for the Republic of North Macedonia are prominent. Although both countries start from the same level of 4% for indicator *E1* in 2010, at the end of the period Bulgaria

reaches a higher level with an average annual growth rate of 7.88%. Until 2019, the dynamics of indicator *E1* for the Republic of North Macedonia are characterised by oscillations around a constant level with an average growth rate close to 0, which does not allow us to conclude a trend. The 67% jump in 2021 compared to 2020 is the largest growth rate not only for the Republic of North Macedonia but also for all EU27 countries over the study period. As a result, the average annual growth rate for indicator *E1* for the Republic of North Macedonia over the entire period is positive – 2.10%. If this trend continues, the gap can be shortly closed.

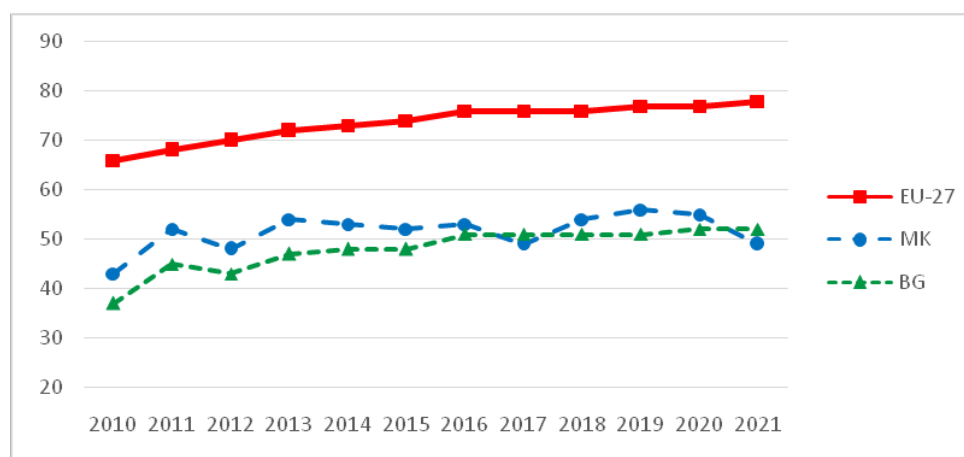


Figure 2. Dynamics of the indicator *E2* “Enterprises with a website” in the EU-27, Bulgaria and the Republic of North Macedonia in the period 2010-2021

Source: the authors

The Republic of North Macedonia has a 16.21% higher initial level of indicator *E2* than Bulgaria. Over the period, the development of the indicator for Bulgaria is characterised by an upward trend with small fluctuations therefore the average annual growth rate is 2.44%, and in 2021 its level is 6.12% higher than for the Republic of North Macedonia. This is also partly due to the fact that in 2021 the Republic of North Macedonia registers the highest negative growth rate -10.90% for indicator *E2* of all countries in the period 2010-2021. This, together with the larger fluctuations in the dynamics, is reflected in the small average annual growth rate of 0.99% for indicator *E2* for the Republic of North Macedonia.

4.2. Classification of the EU-27 countries and the Republic of North Macedonia according to the state and development of e-commerce

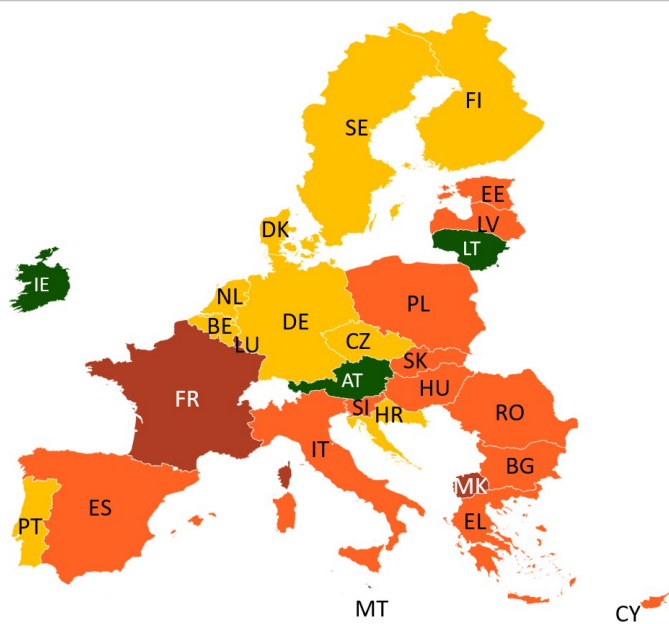
For indicator *E1*, there are two more countries for which the values of v_0 are less than 1 as a benchmark for dividing countries into different groups. Bulgaria and the Republic of North Macedonia have the smallest v_0 value of 0.27. Values above 1 are between 1.13 for Malta and 1.93 for Denmark and Belgium. For indicator *E2*, there are smaller differences between all the countries, including the Republic of North Macedonia and the EU27 average in terms of the initial relative level. Here the values of v_0 are between 0.53 (for Romania) and 1.35 (for Sweden).

The differences between countries in terms of the average rate of growth rate $\overline{K_a}$ are much smaller, i.e. the changes in the levels of the indicators take place at approximately the same speed compared to the EU27 average. For indicator *E1*, the values of $\overline{K_a}$ are between 0.94 for Luxembourg and 1.09 for Italy, with more countries having $\overline{K_a} > 1$. This margin narrows - between 0.95 and 1.03 - for countries whose initial relative level is greater than 1. Even smaller differences between countries according to the values of the average rate of growth rate are observed for indicator *E2*. Here, the smallest value of 0.99 is obtained for Slovakia and the largest value of 1.02 for Romania. $\overline{K_a}$ has a value above 1 for only 1/3 of the countries. No country for which the initial relative level is above 1 achieves an average rate of growth rate also above 1.

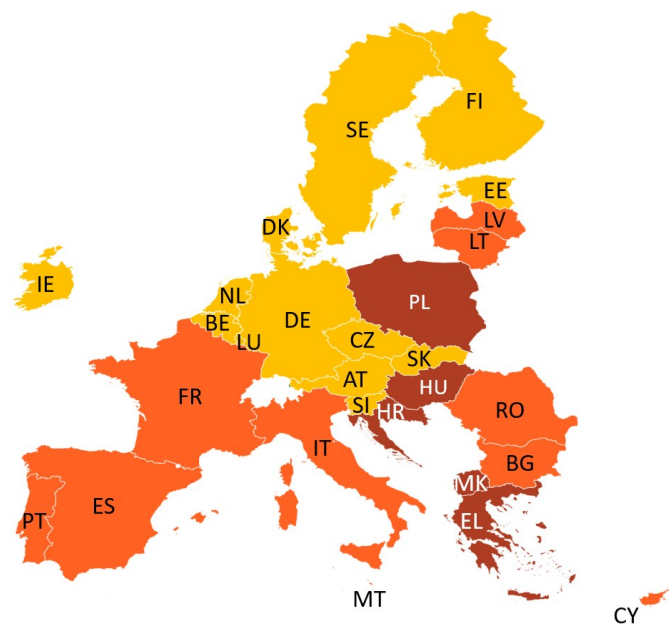
Based on the two criteria - initial relative level and average rate of growth rate, for each of the indicators, countries are classified into four groups - running ahead, lagging ahead, catching up and falling behind. A cartogram of the groups is presented in Fig. 3.

The distribution across country groups is uneven for both metrics. Countries which are lagging ahead and catching up dominate the map. Running ahead and falling behind countries can be taken as exceptions. Moreover, there are no running ahead countries for indicator *E2*. It is noteworthy that the countries in the lagging ahead group for both indicators are concentrated in Northern and Central Europe. The catching up group for indicator *E1* is located in Southern and Eastern Europe and the Baltics, and for indicator *E2* in Western Europe and the Baltics.

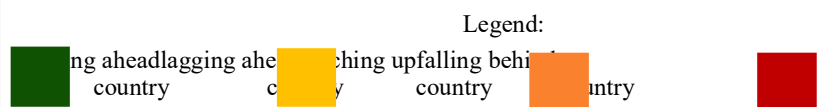
Half of the countries belong to the same group for both indicators: the Republic of North Macedonia is *falling behind*, Italy, Romania, Bulgaria, Cyprus, Latvia and Spain are *catching up*, while Finland, the Czech Republic, Germany, the Netherlands, Sweden, Denmark and Belgium are *lagging ahead*. The largest group for indicator *E2* is the *lagging ahead* with 13 countries.



a) Indicator *E1*



b) Indicator *E2*



commerce
Source: the authors

For indicator *E1*, 9 countries are better. Austria and Ireland are running ahead, Malta and Lithuania are lagging ahead for *E1*, and all are catching up for *E2*. For *E1*, Croatia is lagging ahead, and Hungary, Poland and Greece are catching up but are falling behind for *E2*. Portugal is lagging ahead for *E1* but is catching up for *E2*. The remaining 5 countries are in a “better” group for *E2*. France and Luxembourg are falling behind for *E1*, but they are catching up and lagging behind for *E2*, respectively. Slovenia, Estonia and Slovakia are catching up for *E1*, but they are lagging ahead for *E2*.

CONCLUSION

In order to evaluate e-commerce in this study, indicators are selected using a criterion based on the cause-effect relationship. The indirect indicator “Enterprises with e-commerce sales” characterises the prerequisites for e-commerce and the direct indicator “Enterprises with a website” presents its results.

The dynamics of the levels of e-commerce indicators, both overall in the EU27 and by individual country, show an increasing trend over the period 2010-2021. The indicator that characterises the preconditions for e-commerce has a higher level than the indicator that can be used to assess the outcome of e-commerce. A slowdown in the speed with which changes occur is found.

The EU-27 countries and the Republic of North Macedonia are classified into groups according to the state and development of e-commerce. The basis for forming the groups are two criteria. The first one represents the indicator level for each country at the beginning of the study period. The second criterion assesses the speed at which changes occur in the different countries. The combination of the possible cases under the two criteria results in four groups of countries: running ahead, lagging ahead, catching up and falling behind.

The distribution across country groups according to the initial relative level and the speed of change is uneven across the two indicators. Lagging ahead and catching up countries dominate the EU map. The exceptions are the running ahead and falling behind countries. There are no running ahead countries for “Enterprises with a website”. For this indicator, the catching up countries are located in Western Europe and the Baltics, and for the indicator

“Enterprises with e-commerce sales” in Southern and Eastern Europe and the Baltics. Countries falling into the group of lagging ahead for both indicators are concentrated in Northern and Central Europe.

Most countries identified as lagging ahead fall into this group due to high levels of indicators, significantly greater than the EU27 average. Therefore, and due to the saturation level of indicators, the slowdown in the rate of increase is an objective process.

The catching up countries give a good example to the rest by aiming to approach the best. This is especially true for those countries whose indicator levels are slightly below the EU27 average - a faster than EU average speed of change can place them in the group of running ahead in a short time.

The development of e-commerce remains a problem in the catching up countries, including Bulgaria, where the levels of indicators are far below the EU-27 average. Even with a much faster speed of change than the EU27 average, it would be difficult to reach the European average in the foreseeable future.

The greatest efforts to create the conditions for the development of e-commerce and to exploit its advantages should be made by the countries in the group of falling behind, where the Republic of North Macedonia falls. The actions of companies need to be supported by government measures to stimulate the acceleration of processes.

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