

# EVALUATION AND COMPARISON OF B2C E-COMMERCE INTENSITY IN EU MEMBER STATES

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## Introduction

Electronic commerce (e-commerce), as part of e-business, is still undergoing dynamic development and significantly affects the economic reality in EU member states. E-commerce relates to the development of information and communications technologies (ICT). It has gone through development stages (detailed below), and since 2010 (Schneider, 2015) has been in its current maturity stage in developed countries and the European Union (EU) (Qin et al., 2014, according to whom the maturity stage of e-commerce dates back to 2004). This paper aims to propose a tool for assessing and comparing the intensity of B2C e-commerce in EU member states. Regarding this goal, the authors deal with the following research questions: What is the position of individual EU member states in terms of the intensity of B2C e-commerce? Is there a strong correlation between B2C e-commerce intensity and the level of economic development of EU member states? Is there a correlation between B2C e-commerce intensity and the length of the countries' EU membership?

In the first section of this paper, the terms e-commerce and B2C e-commerce, as well as the developmental stages of B2C e-commerce are defined. These definitions are followed by an overview of the indicators used in measuring B2C e-commerce intensity in an economy and the so-called B2C e-commerce indices, which in recent years, have been created to capture an aggregate view of various aspects of B2C e-commerce. The empirical section of our study introduces criteria for assessing the intensity of B2C e-commerce in EU member states and the procedure for creating the B2C e-commerce intensity index, which will allow a comprehensive comparison of B2C e-commerce in EU member states based on the selected criteria. Method TOPSIS was used in

designing the proposed index. The assessment criteria reflect the relevant publicly available data on the B2C e-commerce intensity in EU member states, which are quantified in the form of specific indicators. The output of the empirical section consists list of EU member states in terms of B2C e-commerce intensity, which consider all the selected assessment criteria. The application of the results of this study contributes to the development of the theory of e-commerce, as well as represents a practical contribution. Determining and comparing the positions of EU member states in terms of B2C e-commerce intensity allows us to identify countries that do not sufficiently utilize the potential of B2C e-commerce to increase their prosperity and achieve consumer utility. In the conclusion of this paper, the current research limitations are discussed along with a suggestion for further research.

## 1. Theoretical Background of e-Commerce

Over the course of its existence, e-commerce has become a phenomenon that has been defined in many ways (e.g. Ho et al., 2007; Qin et al., 2014; Reynolds, 2010; Schneider, 2015; Yadav et al., 2013). The development of ICT and its implementation in the sphere of e-commerce has led to more specific definitions. The fast growth of e-commerce has created the need to adopt a uniform and internationally accepted definition for statistical monitoring and measuring this new phenomenon in commerce. The analyses of scientific research into e-commerce (Ngai & Wat, 2001; Wang & Chen, 2010) suggest that the first studies (e.g. Treese & Stewart, 1998) were published in specialized journals in the early 1990s. The rapid growth of electronic transactions in the second half of the 1990s and the need for statistical measuring required a precise, and for reasons

of international comparison, an internationally acceptable definition of the term “electronic commerce” and its distinction from “electronic business” (e-business).

### 1.1 Defining e-Commerce

In 2009, the Organisation for Economic Co-operation and Development (OECD) published a revised definition, which is still used in OECD documents today: “E-commerce transactions are the sale or purchase of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing of orders; payment and delivery are not considered. Transactions can occur between enterprises, households, individuals, governments and other organisations. The definition includes orders made through web pages, extranet or EDI and excludes orders by telephone calls, fax or manually typed e-mail.” (OECD, 2013b, p. 226). A similar definition of electronic commerce is that by Eurostat (2015). However, scientific sources indicate other definitions of e-commerce and define e-commerce in a narrower and broader sense.

Defining electronic commerce in the narrow and broad sense relates to activities that are included in e-commerce. For example, Lee (2012) states that, in the narrow sense of the phrase, e-commerce is the process of buying, selling, or exchanging products, services and information via telecommunications networks. In the broader sense, e-commerce also includes, apart from buying and selling products and services, servicing customers, collaborating with business partners, and conducting electronic transactions within an organization.

The narrow definition of e-commerce, per Turban et al. (2015, p. 7), means “using the Internet and intranets to purchase, sell, transport, or trade data, goods, or services.” A broader concept is presented by Stallmann and Wegner (2015, p. 6), according to whom e-commerce is “the sum of all digital commercial transactions between economic entities, conducted through the Internet, most of it being the sale of goods and services.”

Issues with defining electronic commerce do not include only the varying scope of definitions used, but also the understanding of the relationship between e-commerce and e-business. In 2003, the OECD defined

electronic business as “(automated) business processes (both intra- and inter-company) over computer mediated networks” (OECD, 2003, p. 4). This definition was also adopted by the EU (European Commission, 2010, p. 174). Using this definition, electronic business includes a range of activities, including electronic commerce. However, according to some professional sources, the definition of e-commerce is virtually identical to that of e-business (e.g., Xu & Quaddus, 2010; Schneider, 2015).

The non-uniform approach to understanding electronic commerce also manifests itself in Czech professional literature. Machková (2009) uses the terms e-commerce and e-business synonymously, saying: “Typical of the second half of the 1990s was the growth in electronic commerce (e-commerce, e-business).” Suchánek (2012) and Machková, Černošlávková, Sato, Malý and Sedláček (2014), on the other hand, consistently distinguish between the terms e-commerce and e-business. In our study, we use the term e-commerce per the 2009 OECD definition (see above).

### 1.2 Classification of e-Commerce

E-commerce is classified based on various criteria. The basic categories of classification of the entities involved include business-to-business (B2B) and B2C. Interactions between consumers mediated by a third party fall under the consumer-to-consumer (C2C) category; however, direct interaction between consumers, e.g., on social media networks, without the use of a third party, are referred to as peer-to-peer (P2P). A category that grew in significance later was consumer-to-business (C2B), in which the impetus comes from consumers who place their demand, for example, on the Internet. The number of e-commerce categories has increased with the inclusion of government institutions that provide their services to other entities online, which has given rise to the categories G2B, G2C, G2G, B2G, and C2G (Waghmare, 2012). The inclusion of employees has led to the creation of other categories, e.g., B2E (Turban et al., 2015) or E2E, formed by employees using a company network – intranet (Chaffey, 2015). According to OECD data, approximately 90% of the value of e-commerce comprises B2B transactions and 10% of those transactions are of the B2C, B2G, and

C2C variety (OECD, 2013a, p. 4). Further classification is, for example, based on the openness of the medium used (OECD, 1999b) or the degree of use of ICT (e.g., Suchánek, 2012; Tassabehji, 2003; Turban et al., 2015). From the geographical point of view, there is a distinction between local, national, cross-border (Gomez Herrera et al., 2014) and global e-commerce.

### 1.3 Development of B2C e-Commerce

Since the mid-1990s, B2C e-commerce has seen rapid development. The significant milestones in e-commerce include the launch of the first e-shops in 1995 (Amazon, eBay), the so-called dotcom crash in 2000, and the huge increase in the sale of smartphones in 2013.

For example, Schneider (2015) defines B2C e-commerce in context with the development of online business in the USA and views it as a long-term process divided into three stages. The first stage was the period between 1995 and 2003; the second stage lasted between 2004 and 2009, and the third stage has been in progress since 2010. The milestones between the individual stages are represented by the beginning of the rapid development of e-shops in the USA in 1995, termination of the second wave of investments in e-commerce and e-business in the USA in 2003 following the dotcom crash, and the parallel appearance of new factors in 2010, which had a significant impact on further development of B2C e-commerce.

Similarly, Qin et al. (2014) characterize the development of e-commerce during the period from 1995 to 2000 as a Phase of e-commerce based on the Internet. During this phase, B2C e-commerce went through the germination stage (1995-1997) and the innovation stage (1997-2000).

The period after 2000 is referred to by the authors as the stage of e-concept-based e-commerce, during which e-commerce experienced a crisis following the dotcom crash. In 2004, e-commerce entered its maturity stage, which has lasted to this day. Further, they claim that after 2004 e-commerce ceased to be a phenomenon confined to the USA and became a business model that has spread to an increasing number of countries.

In the most recent period, since 2010 (Schneider, 2015), several new e-commerce models have rapidly become widespread:

mobile commerce (m-commerce), social commerce (s-commerce), and the electronic sale of mobile apps, following the "App Store" model. The massive increase in the number of users of the social network Facebook and its use for B2C e-commerce has given rise to the term f-commerce (Turban et al., 2015, p. 13). Social networks also represent a new phenomenon in e-commerce (Khan & Sagar, 2015).

## 2. Measuring B2C e-Commerce

Starting in 1999, an OECD task force dealt intensively with questions of how to measure e-commerce. Their task was to suggest an internationally accepted definition of electronic commerce and a set of indicators for measuring and comparing internationally electronic commerce and its economic and social impacts (OECD, 1999a). The basis for identifying e-commerce indicators was the S-curve, representing three stages in the life cycle of e-commerce (e-commerce readiness, e-commerce intensity, and e-commerce impact) and its measurement priorities. A different type of information is given priority in each stage of the life cycle of e-commerce. Some research studies (e.g., Chaffey, 2015; Gomez Herrera et al., 2014; Ho et al., 2007; Kartiwi & MacGregor, 2007; Kshetri, 2007; Savrul et al., 2014; Sing et al., 2001; Spremic & Hlupic, 2007; Zhu et al., 2003) search for factors supporting the development of B2C e-commerce or, on the other hand, representing obstacles in its development, and thus contribute to the development of the methodology of measuring e-commerce.

In this study, we focus on the second stage of B2C e-commerce, e-commerce intensity, which comes after e-commerce readiness, and is followed by the third stage, focused on the future, e-commerce impact. In the second stage, that is, e-commerce maturity, the intensity of the use of e-commerce is tracked, and the current question is: What effect does e-commerce have on the economy and society? (OECD, 1999a; OECD, 2011)

### 2.1 Measuring B2C e-Commerce Intensity

The use of B2C e-commerce includes the intensity and growth of B2C e-commerce, the nature of transactions, the sellers' activities, the consumers' behaviour, and other aspects (see Tab. 1). Statistical tracking of the aspects listed

Tab. 1: Indicators of B2C e-commerce intensity and selected data sources

Indicators of B2C e-commerce intensity	Selected data sources (data published with varying periodicity)
Companies selling online. Individuals shopping online. Turnover of B2C e-commerce. Average value of an online order. Frequency of online shopping. Structure of goods and services sold online. Payment methods used. Ways of delivering products.	The Czech Statistical Office The Eurostat database Ecommerce Europe. Worldpay. Global payments report. Commercial and research organizations
Domestic and cross-border online purchases, sales.	The Czech Statistical Office Eurostat database

Source: own

above makes it possible to identify sectors, industries, and whole economies that do or do not use the possibilities of B2C e-commerce.

Individual indicators measure only selected aspects of B2C e-commerce. For a comprehensive assessment of B2C e-commerce, the not only the choice of individual indicators, but also their aggregation into an overall indicator, which can express a global view of B2C e-commerce based on the evaluation criteria, is important. The aggregate indicators of B2C e-commerce (referred to as indices in foreign sources) are relatively new. There are currently several B2C e-commerce indicators, each of which focuses on tracking B2C e-commerce from a different point of view, however, none of them indicates the intensity of B2C e-commerce and its use.

Since 2012, the ATKearney consulting company has been publishing "The Global Retail E-commerce Index" (ATKearney, 2013), which expresses the attractiveness of economies for investments in B2C e-commerce on a 100-point scale. In 2014, The Economist Intelligence Unit published "The G20 e-Trade Readiness Index" (The Economist Intelligence Unit, 2014), which expresses the conditions for engagement in cross-border B2C e-commerce in G20 countries. It is evident that it does not comprehensively compare the use of e-commerce in the area that we are concerned. Since 2015, the "The UNCTAD B2C E-commerce Index" (UNCTAD, 2016) has been published, which compares economies based on four criteria: the share of individuals using the Internet, the number of secure Internet servers per 1 million people, the share of individuals with a credit card, and the postal reliability score. This index allows us to compare

economies in terms of their readiness for B2C e-commerce and to identify their strengths and weaknesses in this area. Apart from the indices listed, there is also "The Readiness Index Forrester," put forth by the Forrester Company (2016). This index assesses the conditions for the development of B2C e-commerce based on 25 indicators. It is available only for clients of Forrester, and information regarding its structure or values is not publicly accessible.

## 2.2 Issues with Measuring B2C e-Commerce

Although B2C e-commerce has been around for more than 20 years, measuring and statistically tracking it is still problematic. In the early stage of its existence, B2C e-commerce was difficult to measure and the statistical data obtained wasn't comparable, as there was neither a uniform definition of B2C e-commerce nor any methodology of how to measure it (cf. Hawk, 2004). Introducing an internationally acceptable definition of B2C e-commerce and development of a methodology to measure it have contributed to resolving the initial problems. However, the problem with the objectivity and accessibility of data on B2C e-commerce transactions provided by business entities continues to this day (mainly regarding revenues from online sales, the average value of an online purchase, the number of orders, the average value of an order, and others). However, the fewest problems concern the availability of data regarding the readiness of the economy for B2C e-commerce.

Problems with measuring B2C e-commerce transactions are due to several factors, which include: a large number of companies engaged

in B2C e-commerce; the fact that a number of companies engage in both electronic and traditional (brick-and-mortar) sales, yet their records do not make a distinction between the two sales methods; the tight competition in the field of B2C e-commerce, which leads to the concealment or distortion of data; the dynamic development of ICT and the resulting new trends in B2C e-commerce; and lastly, the ongoing methodological issues with measuring B2C e-commerce.

A large obstacle in measuring B2C e-commerce objectively is competition, which was mentioned by the OECD in the 1990s (OECD, 1997) as an obstacle in gaining business data for measuring B2C e-commerce, but it is mentioned by other professional sources as well. Gomez Herrera et al. (2014) point out that data on B2C e-commerce are generated mainly by private companies involved in online e-commerce; however, commercial interests stop them from publishing this data. Cardona et al. (2015) and similarly Duch-Brown and Martens (2015) point to the problem with statistical data on e-commerce in the EU. The problem with data availability also applies to the Czech economy (e.g., Hlavenka, 2011).

Measuring B2C e-commerce is also affected by methodological problems, e.g., different procedures in data collection, in measuring cross-border B2C e-commerce, or in measuring B2C e-commerce in multinational corporations (OECD, 2015). Some of these problems can be eliminated by international standards for tracking and measuring B2C e-commerce. An example of such a standard is the Global Online Measurement Standard for E-commerce (GOMSEC), adhered to by the international association for B2C e-commerce, Ecommerce Europe, including its national associations, and other cooperating organizations (Ecommerce Europe, 2016). Among other things, GOMSEC has defined the categories of products and services included in B2C e-commerce (e.g., Media and entertainment, Fashion, Toys, Electronics, and others), and determined which items will be excluded from reports on B2C e-commerce (e.g., the sale of motor vehicles, real estate, stocks and bonds, and others).

Since January 1, 2008, the Czech Statistical Office has been using the NACE international classification, which has considered technological development and structural changes in the economy, and made it possible

to compare the statistical data from the Czech Republic with those of the EU as well as globally (Czech Statistical Office, 2008). In recent years, data on the development of B2C e-commerce has also been published by Eurostat in connection with the goals of the Europe 2020 strategy. The OECD publishes statistical data for all e-commerce categories without the distinction of B2C e-commerce. Information on selected B2C e-commerce indicators, without an extensive time series, is published on a limited scale by various organizations (e.g., Ecommerce Foundation, Statista.com, Forrester, Boston Consulting Group), which provide the full versions of documents only to their members. In the Czech Republic, apart from the Czech Statistical Office, e-commerce is monitored mainly by e-commerce consulting companies APEK and ACOMWARE.

### 3. Comparison of EU Member States in Terms of B2C e-Commerce Intensity

The goal of this study is to propose a tool for assessing and comparing the intensity of B2C e-commerce in EU member states and, in relation to this, answer the following research questions: What is the position of individual EU member states in terms of B2C e-commerce intensity? Is there a strong correlation between B2C e-commerce intensity and the level of economic development of EU member states? Is there a correlation between B2C e-commerce intensity and the length of the countries' EU membership?

#### 3.1 Method

To assess and compare B2C e-commerce intensity in EU member states, method of multi-criteria evaluation of alternatives, that fall into the category of multi-criteria decision analysis methods, was chosen. Methods of multi-criteria evaluation of alternatives allow the aggregation of partial evaluation based on selected criteria into an aggregate assessment, which considers all the assessment criteria. The multi-criteria evaluation of the alternatives used results in the compilation of an order of alternatives (EU member states) from "the best" to "the worst" alternative (Kunešová, 2016).

Multi-criteria decision analysis is both an approach and a set of techniques, with the aim of providing an overall ordering of options,

from the most preferred to the least preferred option (Dinçer, 2011). Multi-criteria decision problems are characterized by a set of decision alternatives, a set of evaluation criteria, and a number of links between the criteria and the alternatives. The decision-maker inputs information on the alternatives and evaluation criteria, which helps to formulate the multi-criteria model. Multi-criteria evaluation of alternatives makes it possible to assess a finite number of alternatives based on the finite number of criteria. The number of alternatives can range from several to thousands of alternatives. The alternatives are “screened, prioritized, selected and/or ranked” (Yoon & Hwang, 1995, p. 2).

Crucial to the evaluation of alternatives is the choice of evaluation criteria, specifically, attributes according to which the alternatives are assessed. Yoon and Hwang (1995, p. 2) state that the number of evaluation criteria depends on the nature of the problem. The criteria must be independent, should cover all the evaluation attributes, should not be too many in number to avoid making the problem chaotic (Šubrt et al., 2015), and must be quantifiable. To resolve problems of multi-criteria evaluation of alternatives, it is important whether and how certain criteria are given preference.

In the study, the preference of criteria is expressed by criteria weights. Generally, criteria weights are values in the interval  $(0, 1)$ , which express the relative importance of individual criteria in comparison with others. The sum of all criteria weights is equal to 1. The greater the importance of a criterion, the bigger its weight. The relative importance of an individual criterion is expressed by the criteria weight vector (Fiala, 2013).

This study uses the point method, which is based on the supposition that the decision-maker is able, not only to determine the order of criteria based on their importance, but also quantify the importance of each criterion by a number of points on a pre-selected scale. This method is suitable even for evaluation by multiple experts (Šubrt et al., 2015). The assigning of points to criteria by a larger number of experts (e.g., through questionnaires) increases the level of objectivity in determining criteria weights. The calculation of criteria weights (the normalization of weight vector values) from the point evaluation was done using the following formula:

$$v_i = \frac{b_j}{\sum_{j=1}^n b_j} \tag{1}$$

where  $b_j$  is the sum of all points assigned by the individual experts to criterion  $j$ , and  $j = 1, 2, \dots, n$ .

In our study we used the TOPSIS method (the Technique for Order of Preference by Similarity to Ideal Solution – TOPSIS), which was developed by Hwang and Yoon (1981) and represents methods based on the principle of minimization of the distance from the ideal solution and maximization of the distance from the negative-ideal solution. The TOPSIS method allows us to determine the order of all the alternative solutions. The required input data include cardinal information (the actual values of the alternatives based on individual criteria in different units) and individual criteria weights. The TOPSIS method evaluates the decision matrix which refers to  $p$  alternatives which are evaluated in terms of  $k$  criteria. The TOPSIS method consists of the following six steps (for example Dinçer, 2011; Fiala, 2013; Šubrt et al., 2015; Triantaphyllou et al., 1998).

**Step 1: Construct the normalized decision matrix**

This process tries to convert the various attribute dimensions into non-dimensional attributes. For the normalization of input values, the TOPSIS method uses an approach based on the Euclidean distance (formula 2). The element  $r_{ij}$  of the normalized decision matrix  $R$  can be calculated as follows:

$$r_{ij} = \frac{y_{ij}}{[\sum_{i=1}^p (y_{ij})^2]^{1/2}} \tag{2}$$

where  $y_{ij}$  is the input value of the  $i$  alternative assessed by the  $j$  criterion;  $p$  is the number of alternatives,  $i = 1, 2, \dots, p$ ,  $j = 1, 2, \dots, k$ .

**Step 2: Construct the weighted normalized decision matrix**

The weighted normalized criteria matrix  $W = (w_{ij})$  is based on the normalized criteria matrix  $R = (r_{ij})$  in such a way that each element  $r_{ij}$  of the  $R$  matrix is multiplied by the appropriate weight  $v_j$  (formula 3):

$$w_{ij} = v_j r_{ij} \tag{3}$$

where  $v_j$  is the weight of criterion  $j$ , and  $r_{ij}$  are the matrix elements of the normalized criteria matrix  $R$ .

### Step 3: Determine the ideal and the negative-ideal solutions

The elements of the matrix  $W$  determine the ideal solution  $H_j$  with criteria values  $(H_1, H_2, \dots, H_k)$  and the negative-ideal solution  $D_j$  with criteria values  $(D_1, D_2, \dots, D_k)$ , given the values in the weighted criteria matrix  $W$ . The ideal solution delivers the best values based on each criterion; the negative-ideal solution delivers the worst values based on each criterion.

### Step 4: Calculate the separation distances of each alternative to the ideal solution and the negative-ideal solution

$$d_i^+ = \sqrt{\sum_{j=1}^k (w_{ij} - H_j)^2}, i = 1, 2, \dots, p \quad (4)$$

where  $d_i^+$  is the separation (in the Euclidean sense) of each alternative from the ideal solution.

$$d_i^- = \sqrt{\sum_{j=1}^k (w_{ij} - D_j)^2}, i = 1, 2, \dots, p \quad (5)$$

where  $d_i^-$  is the separation (in the Euclidean sense) of each alternative from the non-ideal solution.

### Step 5: Calculate the relative distances of each alternative from the negative-ideal solution

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-}, i = 1, 2, \dots, p \quad (6)$$

where  $c_i$  is the indicator of the relative distance of an alternative from the negative-ideal solution.

### Step 6: Rank the preference order

Rank the alternatives, sorting them by the value of the indicator  $c_i$ , in decreasing order. The best alternative is the one that has the longest distance from the negative-ideal solution.

## 3.2 Criteria for Evaluating B2C e-Commerce Intensity

For the purpose of comparing EU member states in terms of B2C e-commerce intensity, two criteria were selected that relate to the engagement of consumers and sellers in B2C e-commerce, and one criterion that relate to commercial transactions within B2C e-commerce (relative size of the turnover of B2C e-commerce). Following research into the potential sources of data on the use of B2C e-commerce, the Eurostat database (2017) was chosen to provide statistical data for these criteria. Tab. 2 details the selected criteria, their quantification in the form of a specific indicator, and the data source. The study uses the latest data from the sources listed.

All the criteria in Tab. 2 are maximization criteria, i.e., the higher the value of the particular criterion, the better the result of the country in the area that is being evaluated. In connection with the above-mentioned criteria and selected method of multi-criteria evaluation of alternatives, the authors have suggested the following hypotheses:

*H1: There is a strong correlation between the order of EU member states in terms of B2C e-commerce intensity and their order in terms of their economic development.*

**Tab. 2: Criteria for evaluating B2C e-commerce intensity**

Criterion No.	Criterion	Quantification of the criterion	Data source
1	Internet purchases by individuals	The percentage of individuals (aged 16-74) who made last online purchase in the past 12 months, data obtained in 2016	Eurostat (2017)
2	Enterprises selling via a website - B2C	The share of enterprises that sold online on the B2C market in 2016 (% of enterprises excluding those in the financial sector)	Eurostat (2017)
3	Relative size of the enterprises' turnover from web sales - B2C	The share of the turnover from web sales – B2C in the total turnover of enterprises in 2016 (in %)	Eurostat (2017)

Source: own

Tab. 3: The decision matrix for evaluating B2C e-commerce intensity

Criterion No.	1	2	3
Type of criterion	max.	max.	max.
Period	2016	2016	2016
Alternative / unit	%	%	%
Austria	58	12	1
Belgium	57	17	3
Bulgaria	17	6	0 <sup>(n)</sup>
Croatia	33	11	1
Cyprus	29	12	1
Czech Republic	47	17	2
Denmark	82	15	2
Estonia	56	12	2
Finland*	67	13	2
France	66	12	2
Germany	74	18	1
Greece	31	10	3
Hungary	39	11	1
Ireland	59	22	12
Italy*	29	7	0 <sup>(n)</sup>
Latvia	44	7	1
Lithuania	33	15	2
Luxembourg**	78	8	3
Malta	48	18	1
Netherlands	74	14	3
Poland	42	8	1
Portugal	31	10	2
Romania	12	4	1
Slovakia	56	9	1
Slovenia	40	12	1
Spain	44	11	2
Sweden	76	15	3
United Kingdom	83	15	4

Source: Eurostat (2017) and authors' own elaboration

Note: (n) not significant

\* For countries marked with an asterisk, data for criterion 3 for the year 2016 were not available and the last known data were used instead (Finland: 2015, Italy: 2014).

\*\* In the case of Luxembourg, there were no data for criterion 3 available for any year (according to Eurostat, data for Luxembourg are confidential). The missing value of criterion 3 for Luxembourg was set as the average of the values for criterion 3 of Belgium and the Netherlands (countries of the Benelux).



*H2: The highest B2C e-commerce intensity can be found in countries that have been members of the EU the longest.*

*H3: The lowest B2C e-commerce intensity can be found in new EU member states with low economic development.*

The input data contained in Tab. 3 shows that none of the alternatives assessed are the best or worst in all criteria. Using the point method, a weight was assigned to each criterion, based on a questionnaire survey conducted among experts on B2C e-commerce. The criteria weights are calculated according to formula (1). The points assigned by the experts and the calculation of criteria weights are shown in Tab. 4. The experts include representatives of three Czech universities, who have been engaging with the topic of online marketing and e-commerce for a long term (five years experience minimum), representatives of major companies, such as Google Czech Republic, ACOMWARE, MarketUP, and representatives of regional professional agencies that administer a number of e-shops, such as ANT Studio and ProSEO Media, and finally representatives of e-shop owners. These experts make up a representative sample for the purpose of determining the weights of selected B2C e-commerce criteria.

The following text presents the output of the selected method of multi-criteria evaluation of alternatives that was applied to the selected evaluation criteria and their preference given by the criteria weights. All the calculations were performed in MS Excel.

#### 4. The Order of EU Member States Determined by the TOPSIS Method

The decision matrix for evaluating B2C e-commerce intensity (Tab. 3) was converted according to the formula (2) to a normalized criteria matrix (Tab. 5).

Based on the normalized criteria matrix in Tab. 5 and the criteria weights (Tab. 4), the weighted criteria matrix was constructed according to the formula (3). Using its elements, the hypothetical negative-ideal solution  $D_j^-$  was determined with the criteria values ( $D_1^-, D_2^-, \dots, D_k^-$ ) and the hypothetical ideal solution  $H_j^+$  with the criteria values ( $H_1^+, H_2^+, \dots, H_k^+$ ) with respect to the values in the weighted criteria matrix. Using the formulas (4) and (5) for calculating the distance of individual alternatives from the ideal and negative-ideal solutions, the coefficient  $d_i^+$  was determined, which expresses the distance of the alternative  $i$  from the ideal solution, and the coefficient  $d_i^-$ , which expresses the distance of the alternative  $i$  from the negative-ideal

**Tab. 4: Determining criteria weights for evaluating B2C e-commerce intensity by the point method**

Experts	Criteria		
	1	2	3
Expert 1	9	8	8
Expert 2	5	8	5
Expert 3	7	8	6
Expert 4	10	7	10
Expert 5	7	6	9
Expert 6	10	9	8
Expert 7	10	10	8
Expert 8	9	5	10
Expert 9	4	3	3
Subtotal	71	64	67
Total No. of points assigned: 202			
Criterion weight	0.351	0.317	0.332

Source: own

Tab. 5: Normalized criteria matrix according to the TOPSIS method

Criterion No.	1	2	3
Austria	0.2036	0.1766	0.0635
Belgium	0.2001	0.2502	0.1905
Bulgaria	0.0597	0.0883	0.0000
Croatia	0.1159	0.1619	0.0635
Cyprus	0.1018	0.1766	0.0635
Czech Republic	0.1650	0.2502	0.1270
Denmark	0.2879	0.2208	0.1270
Estonia	0.1966	0.1766	0.1270
Finland	0.2352	0.1913	0.1270
France	0.2317	0.1766	0.1270
Germany	0.2598	0.2649	0.0635
Greece	0.1088	0.1472	0.1905
Hungary	0.1369	0.1619	0.0635
Ireland	0.2072	0.3238	0.7620
Italy	0.1018	0.1030	0.0000
Latvia	0.1545	0.1030	0.0635
Lithuania	0.1159	0.2208	0.1270
Luxembourg	0.2739	0.1177	0.1905
Malta	0.1685	0.2649	0.0635
Netherlands	0.2598	0.2060	0.1905
Poland	0.1475	0.1177	0.0635
Portugal	0.1088	0.1472	0.1270
Romania	0.0421	0.0589	0.0635
Slovakia	0.1966	0.1325	0.0635
Slovenia	0.1404	0.1766	0.0635
Spain	0.1545	0.1619	0.1270
Sweden	0.2668	0.2208	0.1905
United Kingdom	0.2914	0.2208	0.2540

Source: own

solution. Using the formula (6) the indicator  $c_i$  was calculated. The alternatives are arranged in a descending order, from the highest to the lowest values of the indicator  $c_i$ . This way, all the alternatives are ordered according to their relative distance from the hypothetical negative-ideal solution (Tab. 6).

Next Tab. 7 shows the order of EU member states in terms of B2C e-commerce intensity determined by the TOPSIS method of multi-criteria evaluation. The ordered list considers

three selected evaluation criteria. Based on the similarity of the relative indicator of the distance of the alternatives from the negative-ideal solution, the EU member states were divided into clusters (see Tab. 7). The division of countries into clusters was carried out using the centroid clustering method (Klímek, 2008) and the appropriate software. Countries assigned to the same group are more similar to one another in terms of overall use of B2C e-commerce than countries assigned to other clusters. The

Tab. 6: Determining the order of alternatives according to the TOPSIS method

Alternatives	$d_i^+$	$d_i^-$	$c_i$	Order of alternatives
Austria	0.2385	0.0711	0.2295	17
Belgium	0.1938	0.1037	0.3485	5
Bulgaria	0.2760	0.0112	0.0389	28
Croatia	0.2454	0.0467	0.1599	23
Cyprus	0.2457	0.0477	0.1626	22
Czech Republic	0.2167	0.0855	0.2830	11
Denmark	0.2133	0.1089	0.3379	7
Estonia	0.2185	0.0782	0.2635	12
Finland	0.2159	0.0902	0.2947	9
France	0.2169	0.0872	0.2867	10
Germany	0.2329	0.1027	0.3060	8
Greece	0.2079	0.0730	0.2599	13
Hungary	0.2436	0.0512	0.1736	21
Ireland	0.0296	0.2728	0.9022	1
Italy	0.2708	0.0252	0.0851	26
Latvia	0.2470	0.0469	0.1595	24
Lithuania	0.2221	0.0713	0.2430	15
Luxembourg	0.2008	0.1047	0.3428	6
Malta	0.2366	0.0817	0.2567	14
Netherlands	0.1937	0.1096	0.3614	4
Poland	0.2462	0.0465	0.1588	25
Portugal	0.2273	0.0558	0.1970	19
Romania	0.2617	0.0211	0.0746	27
Slovakia	0.2420	0.0627	0.2057	18
Slovenia	0.2424	0.0550	0.1850	20
Spain	0.2222	0.0663	0.2299	16
Sweden	0.1927	0.1134	0.3704	3
United Kingdom	0.1718	0.1319	0.4343	2

Source: own

last two columns of Tab. 7 indicate the year of the country's accession to the European Union (or the European Community, or the European Economic Community) and the economic development of the country in the year 2016 expressed by GDP per capita in Purchasing Power Standards (PPS). This indicator is expressed in relation to the European Union (EU28) average set to equal 100.

## 5. The Results of the TOPSIS Method: Comparison of B2C e-Commerce Intensity

The results of the multi-criteria evaluation and the positions of individual countries in the overall order indicate that in terms of B2C e-commerce intensity, EU member states are a rather heterogeneous group. Among other things, this leads to the fact that only certain economies can use B2C e-commerce for their

**Tab. 7: The order of alternatives in terms of B2C e-commerce intensity and their division into clusters**

Order	Alternative	Indicator $c_i$	Clusters and centroids	Accession to the EU	GDP per capita in PPS 2016 (EU28 = 100)
1	Ireland	0.9022	<b>Cluster 1</b> Centroid: 0.9022	1973	177
2	United Kingdom	0.4343	<b>Cluster 2</b> Centroid: 0.3659	1973	108
3	Sweden	0.3704		1995	124
4	Netherlands	0.3614		1958	128
5	Belgium	0.3485		1958	118
6	Luxembourg	0.3428		1958	267
7	Denmark	0.3379		1973	125
8	Germany	0.3060		<b>Cluster 3</b> Centroid: 0.2653	1958
9	Finland	0.2947	1995		109
10	France	0.2867	1958		105
11	Czech Republic	0.2830	2004		88
12	Estonia	0.2635	2004		74
13	Greece	0.2599	1981		67
14	Malta	0.2567	2004		95
15	Lithuania	0.2430	2004		75
16	Spain	0.2299	1986		92
17	Austria	0.2295	1995		126
18	Slovakia	0.2057	<b>Cluster 4</b> Centroid: 0.1753		2004
19	Portugal	0.1970		1986	77
20	Slovenia	0.1850		2004	83
21	Hungary	0.1736		2004	67
22	Cyprus	0.1626		2004	81
23	Croatia	0.1599		2013	59
24	Latvia	0.1595		2004	65
25	Poland	0.1588		2004	69
26	Italy	0.0851	<b>Cluster 5</b> Centroid: 0.0662	1958	96
27	Romania	0.0746		2007	59
28	Bulgaria	0.0389		2007	48

Source: own and Eurostat (2017), European Union (2017)

own growth and take advantage of the benefits that e-commerce offers to both vendors and consumers.

Intensive use of B2C e-commerce is found in Ireland, which significantly outperform all other EU member states. Ireland exhibits the highest share of turnover of B2C e-commerce in the overall turnover of businesses and the

highest share of businesses with online sales in the B2C market (see Tab. 3). Ireland is followed, after a large gap, by highly developed economies of Northern and Western Europe, which form a relatively homogenous group concentrated in cluster 2. The high engagement of the population of Great Britain in online shopping, together with the large turnover of

Amazon and other online retailers (e.g., Tesco and Sainsbury's) puts Great Britain in a leading position in this group.

The third group includes EU member states with an average and slightly below-average B2C e-commerce intensity. This group also includes the Czech Republic, which took the eleventh place on the list. This cluster includes highly developed economies (Austria, Germany, Finland, France), as well as countries with significantly lower economic level (e.g. Estonia and Greece).

The EU member states in clusters 4 and 5 are engaged very little in B2C e-commerce. A problematic situation is especially in Bulgaria, Romania and Italy.

The correlation between the order of countries in terms of B2C e-commerce intensity and in terms of their economic development is calculated using the Spearman Rank Correlation Coefficient according to the formula (7) with correction for tied ranks (Neubauer et al., 2016, p. 240):

$$r_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1) - n_x - n_y} \quad (7)$$

where  $r_s$  is the value of the Spearman Coefficient,  $d_i$  is the difference in paired ranks,  $n$  is the number of cases,  $n_x$  and  $n_y$  are the correction factors for the variables  $x$  and  $y$ , respectively, when tied ranks occur (i.e., two or more cases receive the same rank on the same variable):

$$n_x = \frac{1}{2} \sum_{j=1}^r (n_{x,j}^3 - n_{x,j}) \quad (8)$$

$$n_y = \frac{1}{2} \sum_{k=1}^s (n_{y,k}^3 - n_{y,k}) \quad (9)$$

where  $r$  is the number of groupings of different tied ranks and  $n_{x,j}$  is the number of tied ranks in the  $j$ -th grouping,  $s$  is the number of grouping of different tied ranks and  $n_{y,k}$  is the number of tied ranks in the  $k$ -th grouping.

The Spearman Coefficient,  $r_s$ , can take values from +1 to -1. A  $r_s$  of +1 indicates a perfect association of ranks, a  $r_s$  of zero indicates no association between ranks and a  $r_s$  of -1 indicates a perfect negative association of ranks.

The calculated value of the Spearman Coefficient is 0.7844. This demonstrates a strong and statistically significant correlation

between the two rankings (the critical value of Spearman's coefficient for a two-tailed test,  $n = 28$  and significance level  $\alpha = 0.05$  is 0.3749). The H1 hypothesis was thus confirmed. The level of economic development appears to be a significant factor in B2C e-commerce intensity; however, it does not sufficiently explain the differences in B2C e-commerce intensity in the various EU states (see Tab. 7).

The data in Tab. 7 suggest not a strong correlation between the order of countries in terms of B2C e-commerce intensity and the length of their EU membership. Tab. 7 shows that B2C e-commerce intensity is not highest in countries with the longest duration of EU membership, therefore Hypothesis 2 is not confirmed. The Spearman Coefficient was also used to determine the correlation between the order of the countries in terms of B2C e-commerce intensity and their order in terms of the length of their EU membership. In this case, its value, calculated using the formula (7) and the data in Tab. 7, is 0.6596, which indicates a moderate and statistically significant correlation of the said rankings.

## Conclusions and Research Limitations

An overall view of the evaluation criteria provides clear information on the B2C e-commerce intensity in EU member states. The order of countries based on the value of the aggregate indicator and the differences between countries suggest that currently there is a large unused potential of B2C e-commerce in the EU, not only in countries with weaker economies, but also in highly developed countries. The differences in the level of economic development of the countries do not sufficiently explain the differences in the intensity of B2C e-commerce. The order of countries also suggests a likely link between the B2C e-commerce intensity and other factors. The low B2C e-commerce intensity in the southern part of the EU indicates a possible influence of other factors: for example, the countries' geographical location and the low B2C e-commerce intensity in neighbouring countries (see Ho et al., 2007). On the contrary, linguistic proximity with another country (e.g., in English- or German-speaking EU member states) presents an advantage of cross-border e-commerce and results in higher B2C e-commerce intensity.

With respect to factors influencing B2C e-commerce, it is obvious that B2C e-commerce

relates to ICT development itself (Qin et al., 2014; Schneider, 2015; Shih, 2010) and the implementation of new ICT in the economies of EU member states (see the position of countries according to the ICT Development Index 2015 (ITU, 2016)). The development of B2C e-commerce is also narrowly connected with innovation activities in the commercial sector, which for a number of years have been co-financed from the EU structural funds, and also with creating an integrated EU market, harmonizing the relevant legislation, including consumer protection, etc. Still, the correlation between the order of countries in terms of B2C e-commerce intensity and in terms of the length of their EU membership is not very strong. It would be beneficial for further research to focus on the question of which factors have boosted the relatively high use of B2C e-commerce in some new EU member states with lower level of economic development (Estonia and Lithuania) and what obstacles prevent more intensive use of B2C e-commerce in Italy and Austria, whose level of economic development significantly exceeds that of the aforementioned countries.

Research limitations are driven mainly by the limited availability of relevant data regarding the use of B2C e-commerce and missing or insufficient methodology of data supplied by private companies.

Our study of B2C e-commerce significantly enhances an understanding of this area and complements the above-mentioned and otherwise focused indices of AT Kearney (2013) and UNCTAD (2016) with a B2C e-commerce intensity index created from three selected evaluation criteria using method of multi-criteria evaluation of alternatives (TOPSIS). Further research may focus on refining this index, if, for example, the methodology for defining e-commerce is elaborated in more detail, and more internationally comparable data in this segment become available. It is also apparent that further ICT development, as well as the development of new forms of e-commerce and online marketing will have an impact on the subsequent analysis and comparison of B2C e-commerce.

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## Abstract

**EVALUATION AND COMPARISON OF B2C E-COMMERCE INTENSITY IN EU MEMBER STATES****Hana Kunešová, Ludvík Eger**

*Electronic commerce in the business-to-consumer sphere (B2C e-commerce) represents a significant factor in the competitiveness of companies and entire economies. The purpose of this paper is to propose a tool to evaluate and compare B2C e-commerce intensity in economies. The authors address the following research questions: What is the position of individual EU member states in terms of B2C e-commerce intensity? Is there a strong correlation between B2C e-commerce intensity and the level of economic development of EU member states? Is there a correlation between B2C e-commerce intensity and the length of the countries' EU membership?*

*From a theoretical background, key indicators of B2C e-commerce intensity are selected, which are aggregated into the B2C e-commerce intensity index using the TOPSIS method. The results of the multi-criteria evaluation and the positions of individual countries in the overall order indicate that in terms of B2C e-commerce intensity, EU member states are a rather heterogeneous group. The order of countries based on the value of the B2C e-commerce intensity index exhibits a strong and statistically significant correlation with the order of the countries in terms of the level of their economic development. However, the differences in the countries' economic development do not sufficiently explain the differences in the use of B2C e-commerce. The results indicate that there is a large unused potential of B2C e-commerce in the EU, not only in countries with weaker economies, but also in highly developed countries. The correlation between B2C e-commerce intensity and the duration of EU membership is moderate. It would be beneficial for further research to focus on the question of which factors have boosted the relatively high use of B2C e-commerce in some new EU member states with lower level of economic development (Estonia and Lithuania) and what obstacles prevent more intensive use of B2C e-commerce in Italy and Austria, whose level of economic development significantly exceeds that of the aforementioned countries.*

**Key Words:** B2C e-commerce, e-commerce intensity index, European Union, multi-criteria decision analysis, TOPSIS.

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