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MODELING THE IMPACT OF E-COMMERCE ON RESEARCH AND DEVELOPMENT

Abstract

With the development of the information technologies more and more businesses benefits from using Information Communication Technologies. One of the nowadays trends of digitalization for business is "e-commerce". The main focus of this paper is to examine the impact of e-commerce on research and development in 3 selected European countries: Hungary, Poland and Slovenia. This study shows that for selected countries there is linear dependence of research and development expenditure and e-commerce. Moreover, the biggest impact on R&D by e-commerce measured in Internet purchases of goods and services by individuals is for Slovenia.

Key words: e-commerce, research and development, economic growth, digital economy, economic modeling.

Introduction

With the development of the information technologies more and more businesses benefits from using Information Communication Technologies. It allows not only to decrease different kind of costs (financial, labor, time and so on), but also to perform with a higher productivity. One of the nowadays trends of digital economies for business is "e-commerce".

Accessibility to e-commerce platforms is not a privilege but rather a necessity for most people, particularly in the urban areas. There are alternative e-commerce platforms available (instead of the traditional physical platforms) for almost every aspect of our lives, starting from purchasing of everyday household items to online brokerage." As in 21st century as internet has become most important and frequently and most necessity device, it will surely race to achieve more growth and sales via internet.

E-commerce sales worldwide from 2014 to 2019 and forecasts for the 2020-2023 presented on the Fig. 1 [7]. For the last 5 years the volume of e-commerce sales increased in 2,3 times reaching 3535 billion dollars in 2019. As can be seen from forecasts for 2020-2023, the volume of e-commerce will be continuously growing for future years.
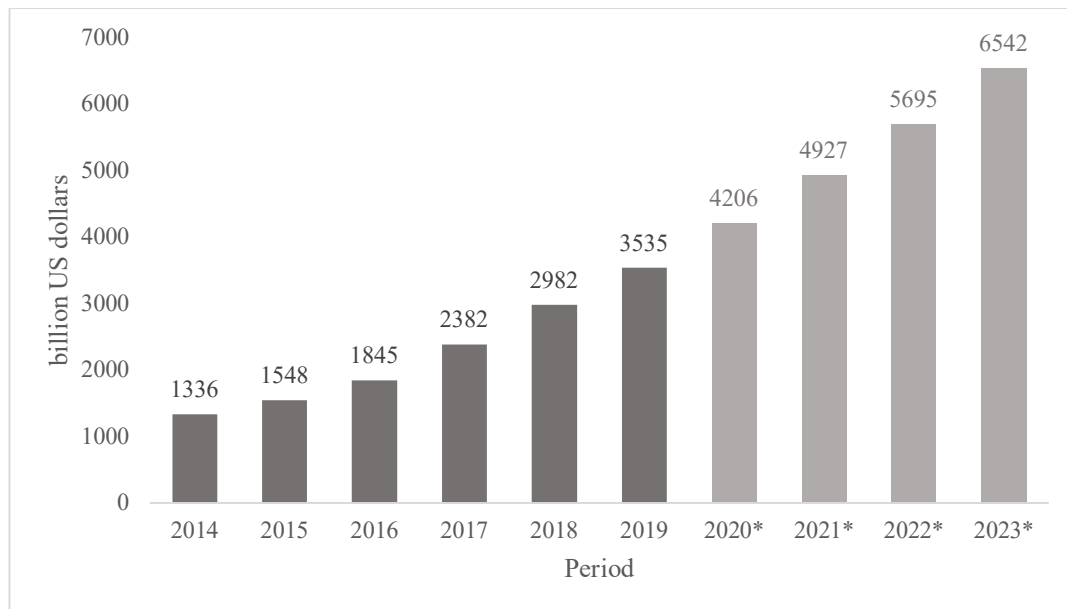

Figure 1. E-commerce sales worldwide from 2014 to 2023.
Source: data from [7]

As it comes to Europe, e-commerce in Europe is expected to be worth 717 billion euros at the end of 2020. That would mean an increase of 12.7 percent compared to the situation last year. This growth is somewhat lower than the 14.2 percent increase of the European ecommerce in 2019 [8].

Literature overview
During last years the scientists pay attention to the topic of the relationship e-commerce and economic growth. Some papers presented below.

Suwandy and Setyari were conducted the study concerning the relationship between e-commerce transactions and economic growth. They come to the conclusion that connection between mentioned measures is a positive and significant relationship between e-commerce transactions and economic growth in Indonesia and United States of America [5].

Anvari and Norouzi in their study showed that e-commerce and R&D had a positive and significant relationship with GDP per capita based on purchasing power parity. Moreover, they discobered that e-commerce had a stronger development-enhancing effect in comparison to R&D [4].

T. Zatonatska, O. Rozhko and N. Tkachenko were investigating the impact of e-commerce and investment in research and development on the economic development among 3 countries: Austria, Poland and Ukraine. Researchers comes to the conclusion that expenditure on R&D and e-commerce had a significant impact on the country's economic development and contributes to increasing of gross domestic product and productivity of manufacture [1].

Liu investigated the impact of e-commerce and research and development on productivity, using a unique panel dataset obtained from Taiwanese manufacturing firms for the period of 1999 to 2002. The author conclude that both e-commerce and R&D capital had a positive influence on productivity, while R&D exhibited a larger productivity- enhancing effect [3].

Methodology

The main goal of this paper is to examine the impact of e-commerce on research and development in 3 selected European countries: Hungary, Poland and Slovenia.

This study implies the regression technique to the data during the period of 2008 to 2019 for Hungary, Poland and Slovenia [9-10]. The specification of the model described below:

$$R\&D_{it} = \alpha + \beta_1 EC_{it} + \beta_2 GDPP_{it} + \varepsilon_{it},$$

where $R\&D_{it}$ *stands for* gross domestic expenditure on research and development (R&D). It comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications [9]. EC_{it} represents the e-commerce measured in Internet purchases of goods and services by individuals. $GDPP_{it}$ stands for gross domestic product (GDP) per capita expressed in current

international dollars converted by purchasing power parity (PPP) conversion factor. GDP is the sum of gross value added by all resident producers in the country plus any product taxes and minus any subsidies not included in the value of the products. conversion factor is a spatial price deflator and currency converter that controls for price level differences between countries [10]. The coefficient α is the intercept, β_1, β_2 are the slope coefficients of the models, t is indexed for chosen period of time, i is indexed for chosen countries.

Results

To determine the impact of e-commerce on R&D different models were created in three chosen European countries. The criteria for choosing one model over another was the indicator of R-squared value. The results from modeling stage can be described by following equations for each country:

1. For Hungary: $R\&D_{it} = 0.50 + 0.010 \cdot EC_{it} + 2.36 \cdot 10^{-5} GDPP_{it}$;

2. For Poland: $R\&D_{it} = -0.25 - 0.01 \cdot EC_{it} + 2.14 \cdot 10^{-5} GDPP_{it}$;

3. For Slovenia: $R\&D_{it} = 3.83 + 0.07 \cdot EC_{it} - 0.13 \cdot 10^{-3} GDPP_{it}$.

More descriptive results of modeling presented in table 1.

Table 1

Results of modeling

Country	Hungary			Poland			Slovenia		
Adjusted R Squared	0.889			0.987			0.751		
Significance F	$0.08 \cdot 10^{-2}$			$0.67 \cdot 10^{-7}$			0.02		
Variable	Constant	EC	GDPP	Constant	EC	GDPP	Constant	EC	GDPP
Coefficients	0.20	0.01	$2.36 \cdot 10^{-5}$	-0.25	-0.01	$2.14 \cdot 10^{-5}$	3.83	0.07	$0.13 \cdot 10^{-3}$
p-value	0.007	0.04	0.003	0.005	0.007	$2.03 \cdot 10^{-6}$	0.001	0.01	0.007

Source: author's calculations based on data from [4]

From the table 1, we can conclude that results of the modeling are significant, all models have high R-squared. According the numbers of P-value all variables are also significant with a 0.05 level of significance. For Poland relationship between R&D and

e-commerce and GDPP is negative. The biggest impact on R&D by e-commerce measured in Internet purchases of goods and services by individuals is for Slovenia.

Conclusions

The rapid growth of the information technologies helps companies to make use from the process of digitalization. Nowadays more and more companies use the Internet to conduct business transactions nationally or Internationally, so sphere of e-commerce is continuously increasing.

The main goal of this paper is to examine the impact of e-commerce on research and development in 3 selected European countries: Hungary, Poland and Slovenia. This study implies the regression technique to the data during the period of 2008 to 2019 for Hungary, Poland and Slovenia. Models shows the relationship of e-commerce and GDPP on research and development expenditure. The modeling results as well as variables are significant, the quality of models are high. The biggest impact on R&D by e-commerce measured in Internet purchases of goods and services by individuals is for Slovenia.

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