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E-COMMERCE IN EU COUNTRIES AND TURKEY: AN ECONOMETRIC ANALYSIS

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Abstract:

Purchase and sale transactions of products and services include trade. Electronic commerce (E-commerce) is expressed as the realization of this process in electronic area. Today, e-commerce has been considered as one of the new trends of international trade. E-commerce offers individuals and businesses more product options with lower prices, allows them saving time, making payments faster and delivering products to long distances in a short time. In this study, the effect of per capita GDP in Turkey and EU countries on e-commerce has been investigated by using panel data analysis through the annual data of period between 2007 and 2019. Moreover the rate of internet usage and employment rate by education level have been added the study as the other independent variables that affect e-commerce. Empirical results demonstrate that a 1% increase in GDP per capita causes a rise of 7.29% on e-commerce. Also there is a significant and positive relationship between employment and e-commerce according to per capita GDP, internet usage rate and education level.

Key words: *Electronic commerce, Per capita GDP, European Union, Turkey, Panel Data Analysis*

1. Introduction and Lıterature Review

1.1. The Internet, International Trade and E-Commerce

The reduction of administrative impediments about trade, the decline in communication and transportation costs, fragmentation of production processes, developments in information and communication technology have enabled the opening of new markets and the acquisition of new raw materials. This situation caused by globalization is among the fundamental factors for resource diversity, creation, and

development of new investment opportunities (He and Wang, 2019). Today, information and communication technology are the focus of many countries around the world. The emergence of internet technologies has caused the communication channels and the operation of the companies to change. Electronic commerce (e-commerce) is one of the most important examples of these changes (Chee et al., 2016).

E-commerce simply refers to commerce using information technology. Technologically, e-commerce can be carried out using a computer or other electronic devices and equipment, as well as the internet and computer networks (Dumičić et al., 2018). That is, goods and services; production, advertising and sales transactions are carried out by providing a secure environment over the internet (Akbulut, 2014). E-commerce is also defined as commercial business activities that take place electronically without establishing a physical connection and without the need for physical exchange. In this context, an environment is created where individuals without physical boundaries can access the products and services they want at the touch of a button (Yamamoto, 2013). In another definition, E-commerce refers to doing business electronically. It covers the electronic processing and transmission of data in the form of written text, audio, and video. In addition, e-commerce includes different activities such as electronic exchange of products and services, public procurement, direct-to-consumer marketing and after-sales services (Ekici, 2013).

The Internet provides an infrastructure that brings more sellers and buyers together compared to physical businesses due to the low cost and various support services present in electronic environment (Turban et al., 2017). The internet and e-commerce have changed the way businesses operate by redefining how activities such as product design and development, supply, production, inventory, distribution, after-sales service support, and marketing are conducted. In this process, the Internet and e-commerce have also changed the relationships and roles between businesses and customers, encouraging new supply networks, services, and business models. As a result of these changes, productivity improvements, better asset utilization, faster marketization, decrease in total order fulfillment times and improved customer service have emerged (Terzi, 2011). Today, in the information and communication age, the economy is also called “information economy”. In addition, this information and communication technology (ICT) based economy is defined as “new economy” and “digital economy”. Developments in ICT and internet technology, which deeply affect the economies of countries, have led to the digitalization of business activities that have gradually become more independent of time and space (Akpınar, 2017). Today, buyers and sellers can make comparisons on the internet and access information easily. Therefore, they are equipped with faster information compared to the old times and can operate under the most favorable conditions. This is the reason why the new economy is named as knowledge economy (Özmen, 2013).

ICT has also changed the way individuals, organizations, and governments work. In today's information societies, the internet has become an important channel for the dissemination of information, products, and services. People use the internet as a means of transaction in different areas such as learning, shopping, marketing, travel, and commerce (Kabango and Asa, 2015). The advancement in technology has also been beneficial for the development of international trade. Millions of people around the world

use the internet for every kind of transaction in a very wide range, from researching to buying products online. The internet affects almost all businesses deeply; especially commercial organizations can advertise their business functions via the internet (Anvari and Norouzi, 2016). When the historical dimension of e-commerce development is examined, it is seen that there are two important determinants. One of these elements is that the computer, communication, and television broadcasting industries become interactive with the development of multimedia services. Another factor is liberalization that emerged as the result of globalization of markets. The development of international trade and, in parallel with this, product and service delivery methods have increased the economic interaction between countries and caused the markets to become global (Baydar, 2010).

1.2. Growing Importance of E-Commerce

E-commerce first emerged in the 1970s as electronic data interchange (EDI) and electronic fund transfer (EFT) between businesses. Computers and credit cards have started to be used widely; e-commerce has entered a period of rapid development with the support of the government (Meng, 2009). Especially since the 1990s, e-commerce activities and studies have become popular with the increase in using of the internet for commercial purposes. Changes and developments in information technologies in recent years have caused international trade to take place more easily. For example, in 2018 e-commerce sales increased by 8% compared to 2017 and reached 25.6 trillion dollars in worldwide (UNCTAD, 2020). According to Coppola (2021) goods or services were purchased by approximately 2 billion people via internet in 2019. Today, e-commerce is considered as one of the new trends of international trade. Online purchasing approximately increased from 13% in 2019 to 17% in 2020 in global retailing along with the effect of the COVID-19 pandemic on e-commerce (UNCTAD, 2021). It is an undeniable fact that countries that invest in this tendency will have an edge over the other countries and profit more as a result.

When the literature is examined, it is seen that there are various studies investigating the e-commerce and GDP connections by using different analyses and countries. Rao et al. (2010), Liu (2013), Ou and Chen (2014) have examined electronic commerce and GDP relations in China at different time intervals via error correction model and Granger causality test econometrically on two time series, regression methods and the correlation analysis and Multiple Linear Regression Model. Their findings indicate that e-commerce has positive effects on GDP of China. Elseoud (2014) and Johri (2016) found the same results for Saudi Arabia (2001-2013 periods) and India (2006-2013 periods) through time series and regression methods and the Augmented Dickey Fuller (ADF) unit root, cointegration test and the ordinary least square methods. Anvari and Norouzi (2016) studied the effects of e-commerce and R&D 2005-2013 periods in selected 21 countries by using Panel data technique with Generalized Least Square Regression (GLS) methods. The results of the study demonstrated that e-commerce and R&D have effect on GDP positively and significantly. Kaneva and Dimitrova (2018) have examined the relationship between electronic commerce and gross domestic product growth in Bulgaria by means of

the statistical analysis of time-series. Study results indicate that e-commerce has positive effect on GDP albeit lower than expected.

The aim of this study is to examine the EU countries, and per capita GDP for Turkey's e-commerce impact on annual data for the years 2007-2019 using panel data analysis method. The model in this study includes data on internet use and employment by education level as well as per capita GDP. The data were obtained from Eurostat and World Bank databases and analyzed using Stata 14.

2. Method and Findings

In the analyzes, the data are classified as cross-section, time series and panel data sets that allow these two types of data to be examined together. It enables regression analysis by combining panel data analysis, cross section analysis and time series analysis. Data on which periodic observations can be made by considering cross-sectional data such as country, enterprise, household, individuals, and time series data such as day, month and year are expressed as panel data. The use of panel data to predict economic relations is defined as panel data analysis (Tatoğlu, 2013; Yaffee, 2003).

2.1. Variables Used in the Study and Descriptive Statistics

In this study, the relationship between per capita GDP and e-commerce is analyzed for total of 29 countries, including EU countries and Turkey using the annual data of 2007-2019 time periods. The countries examined within the scope of this study are listed in Table 1.

Table 1. Countries examined in the scope of analysis

Germany	Austria	Belgium	The United Kingdom	Bulgaria
Czech Republic	Denmark	Estonia	Finland	France
Croatia	Netherland	Ireland	Spain	Sweden
Italy	Cyprus	Latvia	Lithuania	Luxembourg
Hungary	Malta	Poland	Portugal	Romania
Slovak Republic	Slovenia	Turkey	Greece	

The data set of the study, which includes information about the variables used in the study, is as shown in Table 2.

Table 2. The data set of the study

Variables	Name of the Variable	Code	Definition	Source
Dependent Variable	E-commerce	Ecom	The ratio of the population aged 16-74 to order goods or services online (%)	Eurostat
Independent Variables	GDP per capita	lnPcgdp	Natural logarithm of gross domestic product per capita	World Bank

			(Current US $)	
	Rate of internet usage	Iu	The rate of internet users to the population (%)	World Bank
	Employment according to the education level	Emp	Employment rate of the population aged 20-64 by education level (%)	Eurostat

GDP per capita obtained by dividing the GDP of a country by the population is used as a measure of income. GDP per capita within a country is also regarded as a driver of growth. However, high per capita GDP levels in countries encourage the adoption and spread of e-commerce (Yap et al., 2006; H et al., 2007).

Internet use refers to the ability to use a computer and the Internet. This ability is seen as a necessary skill for shopping online. Therefore, internet usage skills have an important effect on e-commerce (Chen et al., 2004).

Although the debate on the effects of technological change on employment is almost as old as the economy itself, information, and communication technologies, including e-commerce have gained importance especially in the last 20 years. Economists began to explore the "skill-biased technological change" hypothesis in the early 1990s. Even though this hypothesis emphasizes the importance of education level in employment, it also shows that education level affects people's spending behavior (Biagi and Falk, 2017; Lim et al., 2004).

Table 3. Descriptive statistics and correlation matrix

Variables	Ecom	lnPcgdp	Iu	Emp
Number of Observatios	376	348	348	377
Mean	40.85106	10.18406	71.93848	52.73979
Standard Deviation	22.41486	.6514709	15.49922	5.248679
Minimum	2	8.680324	28.03	38.689
Maximum	87	11.6854	98.1	64.336
Correlation Matrix				
Ecom	1.000			
lnPcgdp	0.7285	1.000		
Iu	0.9189	0.6521	1.000	
Emp	0.5716	0.4863	0.5538	1.000

Table 3 includes descriptive statistics and correlation matrix such as total number of observations, arithmetic mean, standard deviation, minimum and maximum value during 2007-2019 periods for 29 countries included in the data set of the research. The correlation matrix shows the direction and strength of the relationships that exist between these variables. When this matrix is examined, it is seen that there is a positive correlation between the dependent variable, e-commerce, and the independent variables such as GDP per capita, internet usage rate and employment according to education level. When the correlation coefficients were examined, it was concluded that the highest correlation

value was found to be 91% between e-commerce and internet usage. Then, the VIF (Variance Inflation Factor) test was conducted to test whether there was a multiple linear connection problem between the independent variables. Test findings are as shown in Table 4.

Table 4. VIF Test

Variable	VIF Test Value	1/VIF Value
lnPcgdp	1.81	0.552229
lu	1.99	0.501447
Emp	1.50	0.666087
Average VIF Statistics Value	1.77	

When the literature is examined, the fact that VIF values have a value less than 10 indicates that there is no multiple linear connection problem between the independent variables (Kuan et al., 2008; Ramanathan, 2011; Thompson et al., 2017). Accordingly, when the values in table 4 are examined, it is seen that this problem does not exist among the variables.

2.2. Regression Analysis

The effect of per capita GDP on e-commerce has been analyzed with the regression model established in the panel data format shown below.

Model: Ecomit = β0 +β1lnPcgdp it+ β2lnlu it + β3lnEmp it it
Here;
β0 : constant value,
β1, β2, β3 : coefficients to be estimated,
it : the error term,
i : country group,
t : refers to the time.

After determining the variables to be used in the study, examining the correlation relationship, performing the VIF test and creating the model, tests were conducted to select the appropriate regression model for panel data analysis.

The three most commonly used methods in panel regression analysis are classical model, fixed effects model and random effects model. Two different tests are performed to determine which of these three models should be used for the study. First, the “Breusch-Pagan Test” is conducted to test the suitability of the study for the classical model, that is, whether the data differ according to the units. If the presence of unit effects in the data is determined after the test, the classical model will not be suitable for the study. Following

this result, “Hausman Test” is applied to choose between fixed effects model and random effects model. Breusch-Pagan and Hausman test results are shown in Table 5.

Table 5. The results of Breusch-Pagan ve Hausman tests

Name of the test	Chi-Square Test Statistics	Probability Value
Breusch-Pagan	497.13	0.0000
Hausman	8.66	0.0035

When Table 5 is examined, it is seen that according to the results of the Breusch-Pagan test, the hypothesis that the variance of unit effects is equal to zero is rejected and the classical model is not suitable for this study. After getting this result, Hausman test rejected the hypothesis that the random effects model is valid because the probability value is less than 0.05 and shows that the fixed effects model should be used.

Models should be estimated in ways that address the problems affecting them. Models for panel data generally assume that variance, autocorrelation and cross-section dependency problems do not exist. However, the presence of one or more of these problems in the model causes loss of efficiency in the estimated parameters and standard errors cannot be estimated correctly. Accordingly, “Modified Wald Test” for variance, “Baltagi Wu Local Best Invariant Test” for autocorrelation and “Friedman Test” for cross-section dependency of units were used to test these problems. Test results are as shown in Table 6.

Table 6. Changing variance, autocorrelation and cross section dependence test results

Name of the test	Test Statistics	Probability Value
Modified Wald Test	2316.77	0.0000
Baltagi Wu Yerel Locally Best Invariant (LBI) test	0. 69280	0.0000
Friedman Test	45.480	0.0019

When the statistics in Table 6 are examined, it is seen that the null hypothesis, which states that there is no changing variance, autocorrelation and cross-section dependence, is rejected, and these problems exist in the established model. Therefore, in this study, a prediction method resistant to these problems should be used.

Driscoll-Kray estimator is used to obtain resistive standard errors when there are variance, autocorrelation, and cross-section dependence problems in fixed effect models (Güriş, 2018; Aydın, 2020). Driscoll-Kraay standard errors and fixed effects regression analysis results are as shown in Table 7.

Table 7. Fixed effects regression analysis with Driscoll-Kraay standard errors

Ecom	Coefficients	Standard Deviation	t	Probability Values
lnPcgdp	7.297573	.8761592	8.33	0.000

lu	1.07993	.0387465	27.87	0.000
Emp	.2193169	.0986985	2.22	0.027
F: 80.96 (0.0000)				
R^2: 0.8752				
Number of observations:347				

When the results of the regression analysis have examined in Table 7, it is apparent that there is a significant and positive relationship between per person GDP and e-commerce for the total of 29 countries -including the EU countries and Turkey. A 1% increase in GDP per capita causes an increase of 7.29% on e-commerce. In addition, an increase of 0.10 in employment according to the internet usage rate and education level, which are other dependent variables, causes an increase of 0.107 and 0.021, respectively, on e-commerce. The fact that the R-square value representing the significance of the model as a whole is 0.875 shows that the independent variables can explain 87% of the changes in the dependent variable.

3. Conclusion and Recommendations

Rapid changes and developments in information and communication technologies make the lives of individuals easier. E-commerce, which causes significant changes in economic and social areas, is of great importance in the globalization and intense competition environment. E-commerce enables information, product or service purchases and sales to be carried out over computer networks. Individuals prefer to shop in e-commerce environments for reasons such as increasing competition, diversity in products and services, ability to order from long distances, home delivery, and time constraints.

In this study, the effect of per capita GDP in Turkey and EU countries on e-commerce was investigated using panel data analysis. In addition, the rate of internet usage and employment rate according to education level were added to the model established for analysis as the other independent variables that affect e-commerce. The data used within the scope of the study were obtained from Eurostat and World Bank databases and analyzed using Stata 14 software. Analysis findings show that there is a significant and positive relationship between employment and e-commerce according to per capita GDP, internet usage rate and education level. A 1% increase in GDP per capita causes an increase of 7.29% on e-commerce. This finding is as high as expected and proves that income significantly affects the purchasing behavior of individuals.

The economic effects caused by e-commerce around the world have caused the traditional understanding of trade to be abandoned and countries to turn to modern communication channels. This situation makes it necessary for countries to constantly work towards the development of e-commerce. In future studies, researchers are recommended to make comparisons by using other variables that affect e-commerce and by evaluating them with different analysis methods.

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