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MODELING THE IMPACT OF E-COMMERCE INVESTMENT ON R&D

Abstract

Ukraine is one of the developing countries. Although against the background of other countries, the pace of development of Ukraine is somewhat slower for various reasons: economic and political instability, the COVID-2019 epidemic, the devaluation of the hryvnia, and so on. However, it can be noted that development is still there. It was also decided to analyze the relationship between e-commerce and investment in R&D with the economic development of the country. The study constructed a multiple regression for Ukraine, identified the relationship between the selected indicators and their impact on GDP per capita, and provided some recommendations for further development of the country.

Keywords: GDP, regression models, correction models, E-commerce, technological progress.

Introduction

Every year, more and more you can see that the Internet occupies a significant place in people's lives. It occupies many areas of life. With the advent of the coronavirus COVID-2019, many companies have applied remote work mode, online trainings and courses, even schoolchildren and students have partially switched to online training. Now it is impossible to imagine a person who would not have heard about the Internet. The Internet is becoming a part of the life of everyone who wants to develop and run his or her own business.

In most cases, the Internet as a new territory for doing business provides many opportunities to display the real economy of the state in a virtual universe. The rapid development of e-commerce opens up new prospects for doing business. It is possible that E-commerce will become the catalyst that will lead to the creation of new models

of market relations, new associations of partners and, as a result, a completely new economy and technological progress.

Literature review

The paper, which examines trends and discusses the impact of e-commerce on the global economy and economic sectors such as technological innovation, also warns of negative consequences if developing countries fall further behind technologically behind the industrial world. It addresses the legal and regulatory issues that arise with the advent of the electronic age, and is intended largely as a guide for emerging countries to make the digital revolution work for them. The authors' works used the following methods:

- regression models, as in their comparison of the impact of investment in the country's technological development on GDP;
- econometric modeling of the relationship between indicators of financial and industrial activity of industries (types of economic activity) and investment processes based on models with distributed lags, cointegration relationships, and error correction models;
- identification of possible moments of endogenous structural jumps in the dynamics of the analyzed indicators and use of appropriate tools to take into account structural changes in modeling;
- econometric modeling of a stochastic production boundary based on a modified model with;
- bootstrap approaches for constructing confidence intervals of parameters and test statistics.

Purpose

The aim of this paper is to identify the impact of e-commerce investment on GDP in different countries, as well as the impact of e-commerce investment on the unemployment rate.

Methodological approach and discussions

Based on the article [2], the author constructed the following model:

$$GDPP = \alpha + \beta_1 RDE + \beta_2 CE + \beta_3 IU + e, \quad (1)$$

where α – constant (free variable); $\beta_1, \beta_2, \beta_3$ – model parameters; $GDPP$ – GDP per capita, measured in thousands of US dollars; RDE – R&D expenditure, measured

in thousands of US dollars; *CE* – consumption expenditure, measured in thousands of US dollars; *IU* – number of internet users.

A regression model was constructed that analyzed how such criteria affect GDP per capita in Ukraine from 2002 to 2020.

The obtained results of the regression can be seen in Figure 1.

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Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) 1.432e-01  6.322e-02  2.266  0.03870 *
rde         1.934e-07  6.271e-08  3.084  0.00757 **
ce          2.236e-05  9.618e-07  23.249 3.53e-13 ***
iu          5.158e-09  3.773e-09  1.367  0.19176
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08607 on 15 degrees of freedom
Multiple R-squared:  0.9935,    Adjusted R-squared:  0.9922
F-statistic: 762.9 on 3 and 15 DF,  p-value: < 2.2e-16

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Figure 1. Summary of the constructed regression

Source: modelling results

Substituting the obtained coefficients into equation (1), we obtain the following:

$$GDPP = 0,1432 + 1,934 * 10^{-7}RDE + 2,236 * 10^{-5}CE + 5,158 * 10^{-9}IU \quad (2)$$

Therefore, the coefficient of determination is 0.99, which indicates the quality of this model. The values of the F-criterion and p-level indicate the adequacy of the model.

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call:
lm(formula = u_ukr ~ rde_ukr + ce_ukr + iu_ukr)

Residuals:
    Min       1Q   Median       3Q      Max
-0.050747 -0.025748 -0.001006  0.020766  0.065061

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.206e-02  2.501e-02  1.282  0.219
rde_ukr     -1.018e-08  2.481e-08  -0.410  0.688
ce_ukr       4.589e-07  3.806e-07  1.206  0.247
iu_ukr      -3.561e-11  1.493e-09  -0.024  0.981

Residual standard error: 0.03406 on 15 degrees of freedom
Multiple R-squared:  0.2302,    Adjusted R-squared:  0.07619
F-statistic: 1.495 on 3 and 15 DF,  p-value: 0.2563

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Figure 2. The results of testing the model for heteroskedasticity by the Glaser method

Source: modelling results

Table 1**The results of correlation analysis**

<i>Ukraine</i>	<i>R&D expenditure</i>	<i>Consumption expenditure</i>	<i>Internet users</i>
<i>R&D expenditure</i>	1		
<i>Consumption expenditure</i>	0,354847323	1	
<i>Internet users</i>	0,406676885	0,562711768	1

Source: modelling results

When analyzing the model parameters, note the following:

- the following criteria have the most significant impact on GDP per capita: R&D spending, consumption spending;
- the least significant factors are the number of internet consumers;
- the model was tested for heteroskedasticity by the Glaser method. During the inspection it was found that heteroskedasticity is absent, because the constructed model was not adequate, which can be seen in Figure 2;
- the constructed model can be considered reliable, because the correlation coefficient for all independent variables is less than 0.5, except for a pair of the number of Internet users – consumer costs.

As we can see from the constructed model, there is a direct relationship between GDP per capita and the selected criteria, but we should not forget that the criteria for GDP per capita and consumer spending are beyond the acceptable level of relationship between independent changes.

Conclusions

It can be concluded that investment in e-commerce is directly related to GDP, but service providers that are financially important, especially from developing countries and transition economies, will have to overcome the high costs and high technological level of installing online payments before they can hope for «readiness for e-finance». The main recommendations for attracting investment to the regions include the following:

- increase investment in the scientific community to improve technological development, namely secondary, vocational and higher education institutions, which will help increase the level of training of young people and increase the knowledge of existing professionals;

- holding annual investment fairs to inform potential investors about existing investment projects in the regions, to increase the level of smart industrialization in the regions and the country as a whole;
- improving the business environment for FDI, namely reducing taxes on foreign investment, which will allow foreign companies to enter the Ukrainian market more easily, with the emergence of new jobs to reduce unemployment and accelerate the development of smart industrialization;
- development of new and improvement of existing platforms for smart contracts, which will reduce the level of corruption, optimize the process of signing contracts, increase the level of security and protection of information;
- ensuring transparency and transparency in decision-making related to investment activities. Transparency and publicity of information about the company will avoid excessive corruption, and users and potential investors will be able to assess the situation and the company without going directly to the representatives of the company.

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