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The Role of ICT Development in Boosting Economic Growth in Transition Economies

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ABSTRACT

During the last decades, the substantial development of information and communication technologies (ICTs) has led to a number of economic and non-economic changes in all countries worldwide. The ICT progress can significantly influence macroeconomic outcomes and it is widely recognized as an important factor of the transition toward a new economic system. This transition was especially challenging for former command economies. Since these economies are characterized by relatively low standards of living, poor infrastructure and continuous changes in economy structure and regulatory framework, the ICT development can have adverse effect on economic activities. In that sense, this study addresses the role of ICT development in enhancing the economic growth in 11 EU transition economies over the 2009-2024 period, using the linear regression analysis. The obtained results suggest that ICT development has a positive impact on economic growth in the countries under consideration. However, only the link between the number of internet users and economic growth is statistically significant.

Keywords: ICT development, economic growth, transition economies, macro and microeconomic effects, legal environment.

INTRODUCTION

Having irreversibly transformed individuals' habits, lifestyle, forms of work, communication, business and even governance processes, the ICT sector plays an important role in creating new jobs, new sources of income, new business models and reducing the cost of access to public services.

According to Jorgenson and Vu (2016), the development of ICT infrastructure as well as the use of this infrastructure have a significant impact on economic growth, especially in regions where communication, access to information, learning, research and innovation are the key drivers of

economic progress. It is argued that investment in ICTs not only generates lower future costs but also contributes to higher productivity and sales potential. Maximum benefits come from modifying and modernizing business processes and exploiting ICT capacities.

The development of the ICT sector affects economic growth at both macro and micro levels. At the macro level, this influence mainly manifests through contribution to productivity, effectiveness, innovation, and the efficiency of financial markets, while at the micro level, rapid access to information, knowledge and social networks accelerates communication, paves the way for new markets, reduces production and capital costs, and promotes business sustainability.

There is a growing body of research in scientific literature focused on the analysis of the relationship between the ICT sector, ICT infrastructure development and investment in ICTs and national or regional economic growth. Based on the results of previous empirical studies, many researchers see ICT development as one of the key drivers of economic growth. Nevertheless, some researchers (Hodrob et al., 2016; Toader et al., 2018; Myovella et al., 2020, etc.) note that economic growth largely depends on the level of national economic development and population's ICT skills, which implies that ICT development can bring greater economic benefits to developed than developing or transition economies.

Although previous literature is rich in the studies addressing the relationship between ICT development and economic growth, the researchers mainly focus on large economic regions (Vu, 2011; Farhadi et al., 2012; Majeed and Ayub, 2018, etc.), developed (Spiezia, 2012; Toader et al., 2018, etc.) and/or developing economies (Andrianaivo and Kpodar, 2011; Amiri and Woodside, 2017, etc.), while the situation in transition economies has hardly been considered separately, though economic characteristics of transition economies may significantly differ from those possessed by either developed or developing economies. The EU transition economies have undergone the arduous processes of privatization, liberalization, macroeconomic stabilization as well as the series of legal and institutional reforms aimed at raising their competitiveness and harmonising national economic, legal and institutional framework with the EU policies.

In this study, considering the relevant empirical findings, we research the effects of ICT development on economic growth in the sample of 11 EU transition countries. The major purpose of this study is to empirically research the role of ICT development on economic growth in considered countries over the 2000-2019 period. To fulfil the defined purpose, the following objectives were set: 1) to present the results obtained in previous studies regarding to the link between ICT development and economic growth; 2) to select the appropriate methodology for the empirical research; 3) to discuss obtained results.

The research methods cover systematic and comparative literature analysis and linear regression analysis.

This study complements the previous literature addressing the effects of ICT development on economic growth according to most recent available data on ICT progress and economic growth in transition economies. During the observed period, these economies implemented a number of reform processes that significantly changed their business environment, economic structure and growth strategies. Although the transition process began at the end of the last century, over the past two decades the process of implementing market-oriented reforms has intensified, so it is necessary to pay special attention to analyzing the role of ICT development in the development path of these countries in such conditions. Taking into account that these economies experienced significant transformation of their economy structure, authors also included the level of ICT goods export as one of the independent variables in the model.

LITERATURE REVIEW

According to Piatkowski (2004), future growth potential and prospects in transition economies depend to a large extent on ICT development, investment in ICTs and the ability to ensure the efficient use of ICT infrastructure by the population at both macro and micro levels.

Toader et al. (2018) based their study on the panel-data estimation to explore the effect of using the ICT infrastructure on economic growth in EU-28 and disclosed that in terms of the influence of ICT development, economic progress in the EU member states is mainly driven by developing ICT infrastructures. Although the authors note that the effects of different types of technology may vary depending on which set of types is selected for examination, fixed-broadband subscriptions and mobile cell subscriptions are recognised as being most conducive to economic growth in the sample countries with the former contributing to a 0.0767 percent, and the latter – to a 0.396 percent of GDP per capita growth. The research also confirms that in the macroeconomic context, the impact of using the ICT infrastructure is accompanied by such macroeconomic factors as inflation, unemployment rate, the degree of trade openness, government expenditures and foreign direct investment.

Table 1. Review of some previous findings regarding the relationship between ICT development and economic growth at the macro level

| Author(s), year | Research method | Country(ies), period | Findings |
|---------------------------------|--|--|---|
| Fernandez-Portillo et al., 2020 | Partial Least Squares | OECD EU countries, - | ICT deployment and use contribute to economic growth |
| Toader et al., 2018 | Panel-data estimation techniques | EU-28, 2000-2017 | The use of ICT infrastructure has a strong positive effect on economic growth in the EU countries |
| Cioaca et al., 2020 | Two panel data regression models | EU-28, 2008-2018 | Increasing access to the Internet promotes economic growth, while enlargement of the ICT sector leads to inequality reduction |
| Adeleye & Eboagu, 2019 | Pooled ordinary least squares, random and fixed effects, system generalised method of moments | 54 African countries, 2005-2015 | The expanding use of ICTs promotes economic growth |
| David & Grobler, 2020 | In-depth descriptive statistical techniques | 46 African countries, 2000-2016 | ICT penetration positively affects economic growth |
| Rath & Hermawan, 2019 | Autoregressive distributed lag cointegration technique, an augmented neoclassical growth model | Indonesia, 1980-2014 | ICT development has a positive impact on economic growth in both the short and long run |
| Hodrob et al., 2016 | Panel regression, ordinary least square (OLS) model, random effects model, fixed effects model | 18 Arab countries, 1995-2013 | ICT positively affects economic growth in the sample countries |
| Piatkowski, 2004 | The aggregate production function | 8 transition economies in CEE, 1995-2001 | ICT development promotes national economic progress through capital deepening and TFP |

| | | | growth in the ICT sector |
|--------------------------------|---|--|---|
| Samoilenko & Osei-Bryson, 2008 | Cobb-Douglas production function | Transition economies, - | Interaction between ICTs and labour force has a statistically significant effect on economic growth |
| Samoilenko & Ngwenyama, 2011 | A longitudinal panel data study, data envelopment analysis (DEA), multivariate regression | 8 transition economies, 1993-1997, 1998-2002 | Interaction between ICTs and labour force has a positive effect on economic growth |
| Ishida, 2015 | Autoregressive distributed lag | Japan, 1980-2010 | ICT investment does not promote an increase in GDP |

The empirical results disclosed that the level of the Internet access statistically significantly and positively affects GDP per capita representing economic growth, while an enlargement of the entire ICT sector leads to a decrease in income inequality representing social development. Thus, it can be stated that ICT development contributes to sustainable development of the EU.

The opposite results were, however, delivered by Ishida (2015) whose research provided that although the investment in ICT *ceteris paribus* moderately contributes to reduction in the use of energy, it does not promote a GDP growth, i.e. the long-run relationship between the ICT development and economic growth was not confirmed.

METHODOLOGY

The study investigated the growth effect of ICT development in 11 EU transition economies for the 2000-2019 period through linear regression analysis. The dependent variable of economic growth was proxied by GDP per capita PPP in constant prices estimated by the World Bank (2021). On the other side, the independent variable of ICT development was represented by mobile cellular subscriptions (per 100 people), individuals using the Internet (% of population) and ICT goods exports (% of total goods exports). All the variables were annual, and dataset consists of panel data for period 2000-2019 in order to capture the most accurate trends in this area.

RESULTS AND DISCUSSION

As the first step in analysis, the checking of assumptions for linear regression was performed. The first of them is multicollinearity, which can be perceived by identifying level of correlation among considered variables and values of Variance Inflation Factors (VIF) and tolerance. The correlation coefficients are presented in Table 4.

The values of Pearson correlation coefficient indicate that there is relatively high correlation between GDP per capita and number of internet users and mobile subscriptions, while correlation with ICT export is low. There is also high correlation between number of internet users and mobile subscriptions as the independent variables, which can be indicator of multicollinearity. In order to check this assumption more detailed, the values of VIF and tolerance are presented in Table 5.

Table 4. Correlations among considered variables

| | | GDP_per_capita_PPP | INTERNET | MOBILE | ICT_EXPORT |
|---------------------|--------------------|--------------------|----------|--------|------------|
| Pearson Correlation | GDP_per_capita_PPP | 1,000 | ,766 | ,635 | ,208 |
| | INTERNET | ,766 | 1,000 | ,813 | ,200 |
| | MOBILE | ,635 | ,813 | 1,000 | ,097 |
| | ICT_EXPORT | ,208 | ,200 | ,097 | 1,000 |

| | | | | | |
|-----------------|--------------------|------|------|------|------|
| Sig. (1-tailed) | GDP_per_capita_PPP | . | ,000 | ,000 | ,001 |
| | INTERNET | ,000 | . | ,000 | ,001 |
| | MOBILE | ,000 | ,000 | . | ,075 |
| | ICT_EXPORT | ,001 | ,001 | ,075 | . |
| N | GDP_per_capita_PPP | 220 | 220 | 220 | 220 |
| | INTERNET | 220 | 220 | 220 | 220 |
| | MOBILE | 220 | 220 | 220 | 220 |
| | ICT_EXPORT | 220 | 220 | 220 | 220 |

Table 5. Collinearity statistics

| | Tolerance | VIF |
|------------|-----------|----------|
| INTERNET | 0.323608 | 3.090158 |
| MOBILE | 0.333882 | 2.995072 |
| ICT_EXPORT | 0.947455 | 1.055459 |

Taking into account values of collinearity statistics and thresholds defined in literature (tolerance value higher than 0.1 and VIF lower than 10) it can be concluded that problem of multicollinearity is not present in this case (O'brien, 2007; Aljaaidi et al., 2021; Salmerón Gómez et al., 2020).

Besides multicollinearity, the assumptions that should be tested are normality, linearity, homogeneity of variance and independence of residuals. All these assumptions can be checked by insight in two graphs-Normal Probability Plot (P-P) of the Regression Standardized Residual and Scatterplot (see Figure 1 and Figure 2).

From the Normal P-P Plot diagram presented in Figure 1, it can be seen that the all points lie in an approximately straight diagonal line from the lower left to the upper right corner of the diagram. It indicates that there are no major deviations from normality. In the scatter diagram of the standard residues

Scatterplot (Figure 2), it can be seen that the residues are approximately rectangular and that most of them are grouped in the center (around point 0). Both figures indicate that the initial assumptions of multiple regression were not violated.

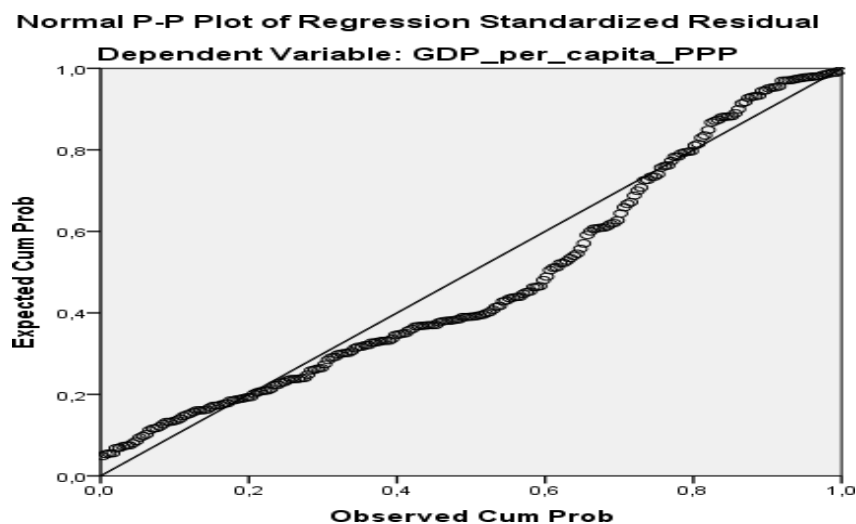


Figure 1. Normal Probability Plot (P-P) of the Regression Standardized Residual

Source: author's compilation

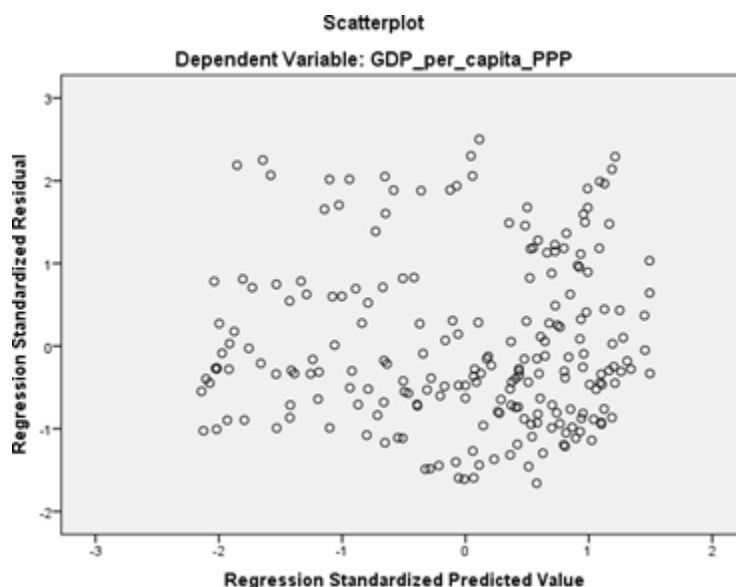


Figure 2. Scatterplot

Source: author's compilation

The next step in the analysis is the model valuation, which is based on R² value presented in Table 6.

Table 6. Model summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|--|-------------------|----------|-------------------|----------------------------|
| 1 | .769 ^a | .591 | .585 | 4177.141 |
| a. Predictors: (Constant), ICT_EXPORT, MOBILE, INTERNET; b. Dependent Variable: GDP_per_capita_PPP | | | | |

Source: calculated by the authors

In this case R² amounts 0.769, meaning that the model explains 76.9% of the variation of the variable GDP per capita PPP, which is a relatively large percentage. In order to assess the statistical significance of this indicator, it is necessary to consider the results shown.

CONCLUSION

The dynamic progress of ICT sector during the last two decades have transformed the world and increased the influence of globalization and liberalization on doing business and competitive position of each economy in the world market. Such developments, motivated researchers to investigate relationship between the development and economic growth, so body of literature on this topic has been increasingly growing. To contribute the investigation of this important issue, this paper is dealing with assessment of ICT development impact on economic growth in the sample of 11 EU transition economies for the period 2000-2019, using the linear regression.

The obtained result suggested that all observed independent variables (number of internet users, number of mobile subscribers and ICT goods exports) have positive impact on economic growth in transition countries. However, the impact of Internet users number is the largest and statistically significant, indicating that Internet penetration should be one of the top priority in the development strategies in transition countries. Government of these countries should foster the Internet penetration and promote usage of internet in everyday life and business, as a first and most important step towards information age. The increased usage of ICT, especially Internet, can boost economic growth through fostering the technology diffusion and innovation, usage of e-government and e-commerce, improving decision-making in firms, households and economy as a whole, increasing demand, lowering the production costs, transforming the structure of economy and foreign trade. Considering that all observed economies are New Member States, it can be

assumed that ICT usage will foster their convergence to the economic, technological, and organizational practices and standards of Old Member states, contributing to balanced regional development of the EU and improving its competitive position on the world market.

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