

## FINTECH IN ECONOMIC GROWTH: CROSS-COUNTRY ANALYSIS

**Shahin Sadigov**

*Azerbaijan State University of Economics (UNEC)  
Baku, Istiqlaliyyat str., 6, AZ1001, Azerbaijan  
agshin.s.sh@gmail.com*

**Tetyana Vasilyeva**

*Sumy State University  
Sumy, Rymsky-Korsakov str., 2, 40007, Ukraine  
tavasilyeva@fem.sumdu.edu.ua*

**Pavlo Rubanov**

*Sumy State University  
Sumy, Rymsky-Korsakov str., 2, 40007, Ukraine  
p.rubanov@finance.sumdu.edu.ua*

### ABSTRACT

*The development of the financial sector has always been regarded as one of the components of countries' economic development and GDP growth. However, the current state of the financial system is in a transformational phase in most countries. It is characterized by the processes of digitization and technologization of financial services. The purpose of the article is to investigate the role of the FinTech sector in ensuring the economic development in different countries' groups by means of regression and correlation analysis. The article substantiates that the most significant transformational impact of the FinTech segment on the financial services market concerns banking services, namely payments and transfers. Therefore, the indicators selected as the leading indexes of the development of the FinTech sector are the indicators of the digitalization of banking services. They are the share of the population using a mobile phone or the Internet to access a financial institution account, the share of the people using the Internet to pay bills, or to buy something online, the percentage of the individuals who made or received digital payments. Economic growth rates are estimated by the GDP growth rate and GDP per capita. The results of the correlation analysis made it possible to confirm the existence of a direct correlation between GDP per capita and selected banking sector digitization indicators. FinTech development contributes to economic growth by increasing GDP generated in the financial sector, and indirectly by increasing e-commerce turnover and real sector financing, in particular by creating more favorable lending conditions for small and medium-sized businesses.*

**Keywords:** *Digital banking, Economic growth, FinTech, GDP, Digitization indicators*

### 1. INTRODUCTION

At the current stage, the economic systems of the developed countries can be called digital economies, and the corresponding technological shift – Industry 4.0 (Bilan, Rubanov et al., 2019; Milon et al., 2018). Developing countries are characterized by tendencies to strengthen the role of ICT in socio-economic development and the gradual growth of the level of digitalization in all spheres of society (Beyi, 2018; Grenčíková et al., 2019; Kostel et al., 2017; Kyrychenko, 2018). In scientific studies, modern information technology is determined as an essential or critical factor in economic growth (Khan, 2018; Marcel, 2019; Nguedie, 2018). The ICT sector provides GDP growth and helps to increase the efficiency of all other sectors of the economy through increased automation, optimization of production and marketing processes, acceleration of document flow, increased transparency, and more (Berzin et al., 2018;

Karaoulanis, 2018; Kendiukhov, Tvaronaviciene, 2017; Kozarezenko et al., 2018; Logan, Esmanov, 2017; Vasilieva et al., 2017). Innovative direction of economic development contributes to faster overcoming of economic instability and smoothing of cyclical fluctuations in the economy (Bilan, Brychko et al., 2019; Balas, Kaya, 2019). In the financial sector, the symbiosis of modern information technology with traditional financial services has led to radical changes in the industry, which have affected the way of providing financial services, the emergence of new types of financial services and new market players who provide these services (Lyeonov, Bilan et al., 2019). All these changes can be characterized by the general concept of FinTech innovation (Drugov et al., 2019). Due to the emergence of new market players, FinTech innovations have changed the nature of competition in the financial services market. Many studies are concerned with promoting FinTech innovation to improve the quality and availability of financial services (Dave, 2017; Didenko et al., 2018; Leonov et al., 2018; Rizwan, Semenog, 2017; Tiutiunyk, 2018). On the other hand, the favorable basis for the development of FinTech services (mobile applications for digital payments, mobile wallets, platforms for crowdfunding and peer-to-peer funding, etc.), as well as for new players in the financial services market (technology companies, developers, FinTech startups and others) are not formed in every country of the world (Alikariev, Poliakh, 2018; Rubanov et al., 2019). The functioning of the FinTech innovation market raises many issues regarding the state regulation of this market and minimization of possible risks created by new technologies and new institutional participants (Bilan, Vasyliieva et al., 2019; Levchenko, Boyko et al., 2019; Lyeonov, Kuzmenko et al., 2019; Poliakh, Nuriddin, 2017; Vasyliieva, Harust et al., 2018). Therefore, governments are often reluctant to promote the development of certain FinTech innovations, and in some countries even introduce bans (for example, on the circulation of cryptocurrencies). However, due to the online way of providing services and the absence of the need for a physical presence of an intermediary, national borders are not an obstacle to the spread of FinTech services (Njegovanović, 2018; Lebid et al., 2018; Vasyliieva, Leonov et al., 2017). As for the third component – new ways of providing traditional financial services, they are manifested primarily in the increasing level of digitalization in the financial sector, the emergence of financial intermediaries without a physical branch network (neobanks), increasing the share of online services of financial intermediaries (Oweis, Alghaswyneh, 2019; Zekeri, Kadiri, 2018). The development of online payment technologies contributes significantly to the digitalization of other areas of the economy, including the development of e-commerce (Kwilinski, 2018). Both the financial sector development and innovative activities have always been regarded as the components of countries' economic development and GDP growth (Ibragimov et al., 2019; Kouassi, 2018; Levchenko, Kobzieva et al., 2018; Lyulyov, Pimonenko, 2017). Thus, it is worth exploring how current trends in digitalization and technologization of the financial sector affect the dynamics of economic growth in different countries. Therefore, the purpose of the article is to investigate the role of the FinTech sector in ensuring the economic development in different countries' groups using regression and correlation analysis. The choice of indicators and countries for analysis is significantly limited to the available data on the object of study. The most detailed list of statistical indicators on the digital economy and society is accumulated in the Eurostat database for the European Union countries since 2009. The sources of statistical data on particular indicators of digital financial services by countries of the world are the databases of the World Bank and the IMF. Taking into account that the most significant transformational impact of the FinTech segment on the financial services market concerns banking services, namely payments and transfers, the indicators selected as the leading indexes of the development of the FinTech sector are the indicators of the digitalization of banking services. They are the share of the population using a mobile phone or the Internet to access a financial institution account, the share of the people using the Internet for internet banking, or for ordering goods or services, the percentage of the

individuals who made or received digital payments. Besides, we will study the impact of digitalization of the economy through the indicator of the share of enterprises' turnover on e-commerce. GDP growth rate and GDP per capita indicators are used as parameters of economic growth rates. The sample of countries for the study and the period of the research in the correlation and regression analysis for different pairs of indicators differ slightly based on available statistics.

## 2. CORRELATION ANALYSIS RESULTS

The first stage of the study of the impact of the FinTech innovation on economic development is conducted using the method of correlation analysis. Correlation analysis is performed between pairs of the following parameters of digital banking, e-commerce, and economic growth:

- Share of population who used a mobile phone or the Internet to access a financial institution account in the past year – GDP growth and GDP per capita;
- Share of population who made or received digital payments in the past year – GDP growth and GDP per capita;
- Share of enterprises' turnover on e-commerce – GDP growth and GDP per capita;
- Individuals using the Internet for internet banking – GDP growth and GDP per capita;
- Individuals using the Internet for ordering goods or services – GDP growth and GDP per capita.

To ensure the comparability of the results, the values of all indicators are taken for 2017. Since the analysis uses the values of indicators for one year for different countries, it is advisable to use the method of Spearman rank correlation. Spearman rank correlation is a nonparametric measure of the statistical relationship between two variables, ranked in ascending or descending order. The advantage of the chosen method is that the Spearman correlation coefficient determines the strength and direction of monotonic relations between two rank variables, and not the strength and direction of linear relationships, which determines the Pearson correlation. The results of the correlation analysis for the selected pairs of indicators are presented in table 1.

*Table 1: Spearman rank order correlations*

	Used a mobile phone or the Internet to access a financial institution account in the past year (% age 15+)	Made or received digital payments in the past year (% age 15+)	Share of enterprises' turnover on e-commerce (%)	Individuals using the Internet for internet banking (% of individuals aged 16 to 74)	Individuals using the Internet for ordering goods or services (% of individuals aged 16 to 74)
Sample of countries	138 countries worldwide	141 countries worldwide	31 European countries	30 European countries	35 European countries
GDP growth (annual %)	<b>-0.2493</b>	<b>-0.2315</b>	-0.0867	-0.3335	-0.3289
GDP per capita (current US\$)	<b>0.7908</b>	<b>0.8365</b>	<b>0.5672</b>	-0.1429	<b>0.8608</b>

*Note: Marked in bold correlations are significant at  $p < 0.05$*

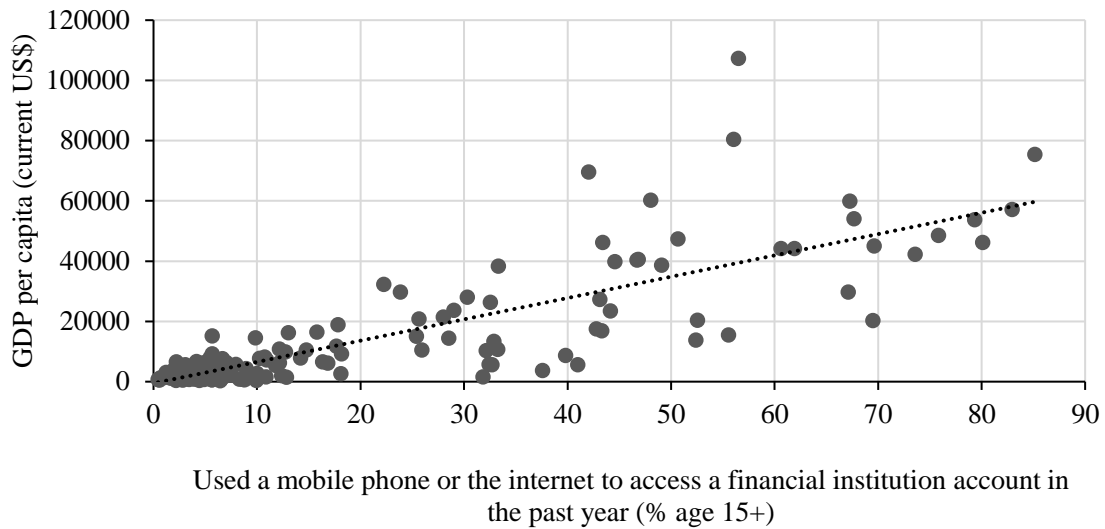
*Source: Authors' calculations based on the World Bank and Eurostat data*

The calculated Spearman rank correlation coefficients showed a close direct relationship between most indicators of digitalization of the economy, digital banking, and the indicator of GDP per capita. In particular, correlation analysis of the relationship between the share of population who used a mobile phone or the Internet to access a financial institution account, share of population who made or received digital payments, individuals using the Internet for

ordering goods or services and GDP per capita testified to the presence of a strong direct connection between these pairs of parameters. The corresponding values of the correlation coefficients are in the range of 0.79-0.86. The share of enterprises' turnover on e-commerce also shows a direct correlation with the GDP per capita indicator, but the strength of this relationship is moderate. E-commerce allows you to increase sales and optimize sales costs, which contributes to the growth of GDP per capita. The corresponding value of the correlation coefficient is 0.5672, i.e., the change in the values of the studied indicators is described by the same functional dependence only in 56% of cases. At the same time, most of the correlation coefficients of GDP growth and digitalization of the economy and digital banking are not statistically significant. Only correlation coefficients of GDP growth and the share of population who used a mobile phone or the Internet to access a financial institution account, and the share of population who made or received digital payments, are statistically significant. However, the values of these coefficients are negative and close to zero. That means that there is a weak inverse relationship between GDP growth and digitization indicators. The obtained results of the correlation analysis of the GDP growth are due, firstly, to the fact that the sample was formed in 1 year, while the manifestation of the correlation with the GDP growth should be studied in dynamics. Secondly, the general pattern (with some exceptions) is that developing countries show higher GDP growth rates, while the GDP per capita in these countries is lower. Therefore, the correlation between GDP growth and GDP per capita is negative. Accordingly, in the developed countries with a higher level of digitalization, the level of GDP per capita is higher. Similarly, in developing countries, the level of technologization of the financial sector and the level of GDP per capita are lower. These conclusions are confirmed by high values of Spearman rank correlation coefficients for the corresponding pairs of indicators. In general, Spearman correlation coefficients showed a lower level of closeness for the sample of European countries. The link between digital banking and economic growth in European countries is not clear, i.e., digitalization in the financial sector does not have a direct effect on GDP growth. That can be partly explained by the fact that most European countries have a high level of banking system development; the banking services market is significantly integrated within this group of countries; the activities of the largest banks are transnational, extend to all European countries, and not limited to one country. Besides, European countries have already reached a high or above-average level of digitalization of the banking sector, so this factor is not crucial to influencing economic growth. Correlation analysis is complemented by the construction of scatter charts for digital banking indicators, which showed the highest level of correlation with GDP per capita. Figure 1 shows a scatter plot of GDP per capita and the share of the population who used a mobile phone or the Internet to access a financial institution account for 138 countries in 2017. The appearance of the diagram indicates the presence of a correlation between the variables and the possibility of establishing a linear functional relationship between them. At the same time, there is an accumulation of values that correspond to low levels of both indicators – GDP per capita and the share of the population who used a mobile phone or the Internet to access a financial institution account. The scatter of indicators for larger values of the analyzed pair of indicators is broader, but the linear dependence remains.

*Figure following on the next page*

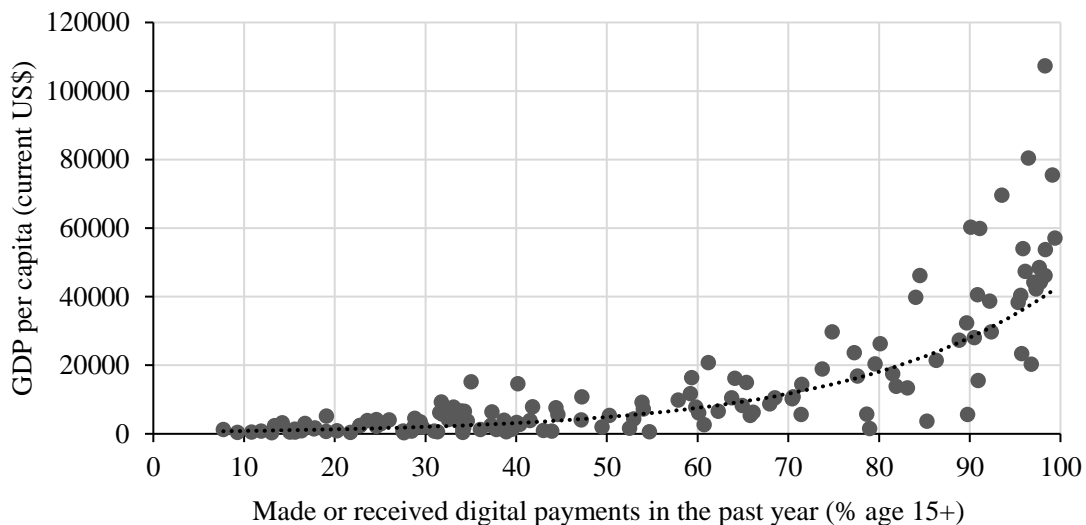
*Figure 1: Scatter chart between GDP per capita and the share of the population who used a mobile phone or the Internet to access a financial institution account*



*Source: Authors' calculations based on the World Bank data*

The analysis of the correlation between the indicators of GDP per capita and the share of the population who made or received digital payments showed the presence of an even closer relationship compared to the previous pair of indicators (Figure 2).

*Figure 2: Scatter chart between the GDP per capita and the share of the population who made or received digital payments*



*Source: Authors' calculations based on the World Bank data*

The scatter chart has the form of an exponential dependence, i.e., with the increase in the share of the population who made or received digital payments, the growth of GDP per capita accelerates.

### 3. REGRESSION ANALYSIS RESULTS

In the next stage of the study, we determine the presence of functional regression relationships between the value of mobile and internet banking and the share of enterprises' turnover on e-commerce, on the one hand, and GDP growth and GDP per capita, on the other hand.

The sample of countries taken for analysis and the study period are determined by the available statistics on the analyzed indicators:

- 18 countries for the period 2010-2018 for analysis of the impact of the value of mobile and internet banking on GDP growth and GDP per capita;
- 19 countries for the period 2009-2018 for analysis of the impact of the share of enterprises' turnover on e-commerce on GDP growth and GDP per capita.

The results of modeling regression dependences for selected countries and pairs of indicators are presented in tables 2 and 3. According to Table 2, a statistically significant regression dependence of economic growth indicators (GDP growth and GDP per capita) on the value of mobile and internet banking was found only in a small number of countries. For most countries, the functional relationship between parameters was not confirmed. Among the statistically significant results, the identified direction and strength of the regression relationship differ significantly between the studied countries. Therefore, the nature of the relationship of the studied parameters is influenced by other factors specific to each country. The development of digital banking cannot be considered an unambiguous factor in GDP growth rate or GDP per capita growth.

*Table 2: Results of regression analysis of the impact of the value of mobile and internet banking on GDP growth and GDP per capita in some countries*

Country	Y <sub>1</sub> – GDP growth; X – value of mobile and internet banking		Y <sub>2</sub> – GDP per capita; X – value of mobile and internet banking	
	Regression coefficient	R <sup>2</sup>	Regression coefficient	R <sup>2</sup>
Albania	<b>0.0485</b>	<b>0.4753</b>	<b>16.58</b>	<b>0.4804</b>
Brazil	-0.0487	0.4237	-10.34	0.0854
Cabo Verde	<b>0.1983</b>	<b>0.4505</b>	7.01	0.0330
Colombia	<b>-0.0546</b>	<b>0.6372</b>	-17.12	0.2354
Costa Rica	-0.0031	0.2345	<b>8.51</b>	<b>0.8907</b>
Dominican Rep.	-0.0399	0.0375	<b>-76.26</b>	<b>0.7442</b>
Estonia	-0.0063	0.2623	-2.83	0.0355
Latvia	-0.0008	0.0281	-1.33	0.2226
Mexico	0.0032	0.0554	3.34	0.0742
North Macedonia	-0.0107	0.0778	<b>8.60</b>	<b>0.5254</b>
Norway	0.0058	0.2271	-145.50	0.4190
Russian Federation	<b>-0.0170</b>	<b>0.6127</b>	-12.47	0.2103
Serbia	0.0709	0.3249	-2.26	0.0040
Slovenia	-0.0040	0.0769	-3.07	0.1017
Sweden	<b>-0.0548</b>	<b>0.5039</b>	<b>108.74</b>	<b>0.4934</b>
Switzerland	0.0271	0.0518	<b>-376.30</b>	<b>0.6543</b>
Thailand	-0.0073	0.0187	<b>13.29</b>	<b>0.8862</b>
Zimbabwe	-0.0383	0.1039	<b>5.02</b>	<b>0.8313</b>

*Note: Coefficients marked in bold are significant at  $p < 0.05$*

*Source: Authors' calculations based on the World Bank and IMF data*

Table 3 shows the results of the regression analysis of the impact of the share of enterprises' turnover on e-commerce on GDP growth and GDP per capita. According to the results of the investigation, the moderate direct impact of the share of e-commerce in the turnover of enterprises on GDP growth was revealed. In particular, this relationship is statistically confirmed for Austria, Bulgaria, the Czech Republic, Hungary, Ireland, Romania, Spain and the United Kingdom. According to the regression coefficient, the most significant influence of growth in the share of enterprises' turnover on e-commerce on GDP growth is characteristic of Bulgaria and Romania.

An increase in the share of e-commerce in the turnover of enterprises by 1% in these countries leads to a rise in GDP growth by 1.3%. It is worth noting that most of the countries in which the relationship between the studied parameters is statistically confirmed are countries with a relatively lower level of economic development in this sample. For example, of the eight such countries, Romania, Hungary, the Czech Republic, and Bulgaria belong to the countries of the Eastern European region. For other countries, the strength of the relationship between the parameters is low and not statistically confirmed. Still, in most cases, the growth of e-commerce is a decisive factor in GDP growth. As for the other indicator – GDP per capita, a clear pattern of its relationship with the indicator of the share of enterprises' turnover on e-commerce was not found. In particular, such countries as Hungary, Ireland, Romania and the United Kingdom have a direct impact of the share of e-commerce on GDP per capita. And in Cyprus, Italy, and Norway, there is a reverse relationship between GDP per capita and the share of enterprises' turnover on e-commerce. In both cases the strength of the relationship is moderate. Thus, the results of the regression modeling for European countries cannot establish a single pattern of the relationship between GDP per capita and the share of enterprises' turnover on e-commerce.

*Table 3: Results of regression analysis of the impact of the share of enterprises' turnover on e-commerce on GDP growth and GDP per capita in European countries*

Country	Y <sub>1</sub> – GDP growth; X – share of enterprises' turnover on e-commerce		Y <sub>2</sub> – GDP per capita; X – share of enterprises' turnover on e-commerce	
	Regression coefficient	R <sup>2</sup>	Regression coefficient	R <sup>2</sup>
Austria	<b>0.9380</b>	<b>0.4842</b>	-871.27	0.2137
Bulgaria	<b>1.3095</b>	<b>0.6625</b>	271.72	0.2849
Cyprus	-0.1509	0.0074	<b>-968.44</b>	<b>0.5611</b>
Czech Republic	<b>0.4271</b>	<b>0.6157</b>	-13.18	0.0022
Estonia	-0.0414	0.0017	800.21	0.4397
France	0.2172	0.1823	-316.13	0.1422
Germany	0.3225	0.0814	-396.94	0.1322
Hungary	<b>0.9537</b>	<b>0.5205</b>	<b>293.72</b>	<b>0.5432</b>
Ireland	<b>0.8070</b>	<b>0.4345</b>	<b>1043.47</b>	<b>0.4924</b>
Italy	0.5446	0.3070	<b>-837.91</b>	<b>0.5518</b>
Lithuania	0.5870	0.0610	-6.66	0.0001
Netherlands	0.7604	0.2488	-938.56	0.1621
Norway	-0.1137	0.0479	<b>-3843.82</b>	<b>0.5346</b>
Poland	0.2335	0.2343	244.13	0.3577
Romania	<b>1.2919</b>	<b>0.6115</b>	<b>393.89</b>	<b>0.5660</b>
Slovakia	0.3061	0.1701	71.63	0.0771
Spain	<b>0.7065</b>	<b>0.4748</b>	-487.88	0.3723
Sweden	0.0893	0.0064	-501.33	0.0752
United Kingdom	<b>0.8877</b>	<b>0.5230</b>	<b>1341.76</b>	<b>0.6915</b>

*Note: Coefficients marked in bold are significant at  $p < 0.05$*

*Source: Authors' calculations based on the World Bank and Eurostat data*

#### 4. CONCLUSION

The results of the correlation analysis using the Spearman rank correlation method made it possible to confirm the existence of a direct correlation with the high strength of the relationship between GDP per capita and digitization indicators (share of population who used a mobile phone or the Internet to access a financial institution account, share of population who made or received digital payments, individuals using the Internet for ordering goods or services). Besides, a moderate direct relationship was confirmed between the indicators of GDP per capita and the share of enterprises' turnover on e-commerce. Thus, FinTech development contributes to economic growth by increasing GDP generated in the financial sector, and indirectly by

increasing e-commerce turnover and real sector financing, in particular by creating more favorable lending conditions for small and medium-sized businesses. The regression analysis allowed us to draw the following conclusions. First, a statistically significant regression dependence of economic growth rates on the value of mobile and internet banking is found in only a small number of countries. Therefore, the development of digital banking cannot be considered an unambiguous factor in GDP growth rate or GDP per capita growth, but it is necessary to take into account other country-specific parameters. Second, there is a moderate direct impact of the share of enterprises' turnover on e-commerce on the GDP growth. At the same time, a clear pattern of the impact of the share of enterprises' turnover on e-commerce on GDP per capita was not found.

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# Economic and Social Development

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Altay Ismayilov, Khatai Aliyev, Manuel Benazic



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