# The Impact of the Internet Economy on the Performance of Market Services in Slovakia

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**Abstract:**

Over the last two decades, the Slovak economy has undergone several restructuring processes, which have modified its character to maximize the benefits of services. These processes have also contributed to changes in the creation, development, and delivery of services. Modern services have arisen as a result of new information and communication technologies (ICT) and the Internet. The concept of the Internet economy refers to the utilization of ICT in individual countries. This article aims to detect the attained level of the Internet economy in Slovakia, and how it affects the performance of market services. Despite the slow pace of development in the Internet economy in Slovakia, the survey results have confirmed its positive impact on the performance of market services.

**Keywords:** internet; internet economy; information and communication technologies; market services; indexes

**JEL classification:** L86; O33; O11

## 1. Introduction

The services sector has become one of the most significant and dynamic constituents of the Slovak economy over the last two decades. In 2014, it employed 60.9% of workers and accounted for 61.1% of value added creation. The value-added share of services increased, and reached 61.5% in 2015 (World Bank 2015). Research has shown that ICT integration and the availability of a skilled workforce provide a firm foundation for the development and competitiveness of services. Information and communication technologies (ICT) represent a considerable part of the global economy. They are considered as being a dynamic subsector, which provides substantial opportunities for both the public and private sectors of the economy. They stimulate economic growth and GDP creation, create highly skilled jobs, and make a country more competitive (Informatizácia 2014). The concept of the Internet economy (ONS 2015) is concerned with factors influencing the utilization of ICT in the economies of individual countries. Over the last two decades, the Internet economy has greatly contributed to GDP creation in Slovakia, and thus, it has received considerable attention in professional and scientific practice.

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The significance of the Internet economy has been proven by several studies published by institutions that measure its level through indices, such as the ICT Development Index (IDI), the Digital Economy and Society Index (DESI), the Networked Readiness Index (NRI), and the e-Intensity Index. The results indicate that countries with the highest GDP per capita are placed at the forefront of the ranking indices. This article aims to estimate the impact of the Internet economy on the performance of the Slovak economy. Furthermore, it examines its influence on the most dynamic sector of the economy, i.e. the services sector.

## 2. Literature review

### 2.1. The Internet economy in the context of digital economy

There is no uniformly accepted definition of the broad concept of the Internet economy. Several authors even highlight the differences between the concepts of the Internet economy and digital economy. In addition to these two concepts, some authors and institutions use the terms such as the new economy, network or web economy interchangeably. The diversity in the various definitions of the digital economy is triggered by the innovations in ICT, and by the application of concepts such the post-industrial society, knowledge economy, new economy, online economy and e-economy (Cohen *et al.* 2000, Moraes and Laurindo 2013). Several researchers claim that digital economy is more developed and more complex than the Internet economy. They also highlight that digital economy is not synonymous with either the concept of knowledge economy or network economy.

On the contrary, Esfangareh and Hojeghan (2011), Iacono and Orlikowski (2000) consider the concepts of the Internet economy and digital economy as identical. Tapscott (1996) claims that digital economy is based on the interconnectedness of human intelligence through networks. Whereas, Carlsson (2004) defines digital economy as the extensive usage of the Internet at a higher level of connectivity. Haltiwangen and Jarmin (2000) argue that digital economy includes hardware, software, product sales, online services, e-currency exchange, and online education. Esfangareh, Hojeghan (2011) and Moulton (2000) describe digital economy as a complex of digital technologies (devices, software, semiconductors and telecoms) and e-commerce. Imlah (2013) and Rouse (2016) define it as a system based upon digital technologies, which may or may not utilize the Internet. Benito, de Juan, Gómez and Mochón (2015) propose the most comprehensive definition of digital economy, and emphasize its heterogeneity. They perceive it as a complex web of diverse companies with different positions in the value chain of a country's economy. They describe it in two ways: firstly, digital economy is not just merely created by an ICT subsector; it consists of four homogeneous components: telecommunications, mobile or Internet content and services, software and IT services, and application software; secondly, digital economy is perceived as a heterogeneous subsector generating the performance of the economy with diverse characteristics.

By contrast, the OECD (2013b) defines the Internet economy as a broad spectrum of economic, social and cultural activities carried out over the Internet and ICT. It is the broadest understanding of the Internet economy. According to Reed (2011), the Internet includes three conceptual clouds: a cloud for transferring information, a source cloud for data storage, and a social cloud for creating and establishing contacts over the Internet and networking. A large proportion of the various types of economic activities, including production, sales, distribution or consumption, are made over the Internet. All economic activities that are carried out or supported by the Internet contribute to the value creation of the Internet economy.

Firstly, these activities are performed through the operations and usage of the Internet. Secondly, they involve Internet-based activities such as e-commerce, online marketing, and searching. BCG (2012) quantifies the Internet economy based on its performance through e-GDP, which includes revenue generated by the provision and usage of the Internet, Internet advertising, and Internet sales. The OECD (2013a) claims that the main pillars of the Internet economy include access to the Internet through high-speed infrastructure, digital content, and ICT related to innovations and sustainable growth, and the development of intelligent applications.

Thus, the Internet economy is primarily based upon the Internet and ICT. It involves a wide range of activities over the Internet and ICT. It forms part of the digital economy, which is perceived to be more complex and heterogeneous, and successful in penetrating diverse sections of the economy. Moreover, it relies on digital technologies using all kinds of networks, which may and may not use the Internet and ICT. At present, digital economy is becoming increasingly intertwined with traditional economy. Moreover, the development of more advanced information and communication technologies leads to gradual convergence between the Internet and the digital economy.

### 2.2. The impact of information and communication technology on market services

Services have become an increasingly important sector in the economies of the world. They represent the fastest growing sector of the national economy. They also generate the largest share of economic growth in both developed

and developing countries (OECD 2006). The services sector dominates the global economy and supports the development of new types of services (Paton and McLaughlin 2008). It generates 70% of global GDP and significantly influences GDP creation by other sectors. Therefore, it creates enormous potential for economic growth and profitability (Lin and Hsieh 2011, Rust and Miu 2006, Chiou, Perng and Tseng 2012).

The OECD in 2003 and 2004 called attention to the fact that the services sector employed more workers than the manufacturing industry. It also highlighted the high degree of heterogeneity of the services sector in terms of ICT intensity. This was confirmed by British studies which proved that the sector of financial intermediation was much more dependent on network technologies than other services sectors (Gretton, Gali and Parham 2004). Maliranta and Rouvinen (2004) realized that the impact of ICT on labour productivity in Finland was higher in the services sector than in the manufacturing sector. Arvanitis (2004) in Switzerland reported a similar result, claiming that employment in ICT-using services was much higher than in the manufacturing industry. This can be explained by the absence of desktop computer desks and employee Internet access (Morrar, Gallouj and Abdeljawad 2014).

Service innovations support the continuous growth of the services sector; hence their primary goal is to create new value and new business models. Moreover, rapid advancements in ICT have enabled large-scale innovations in the services sector (Kuo, Chi and Yeh 2013, Kubičková 2009). Research on their strategic roles has led to a conclusion that technological innovations have greatly facilitated business processes in the services sector (health care, financial, engineering, and consulting services). Thus, ICT has gained an important position in the services sector (Chae and Olson 2011). It forms an indispensable part of services and promotes customer satisfaction (Agarwal and Singhi 2010). Today's societies are built upon digital services and ICT that play a central role in both the economy and daily life. They are naturally embedded in socio-economic relationships, in which people and technological facilities have become interconnected (Brandt 2007).

Thus, investments in ICT have a considerable impact on the development of the services sector. Several studies have already examined the impact of ICT on economic growth and employment. The impact of ICT on economic performance also needs to be analyzed. It has been acknowledged that widespread usage of ICT increases economic efficiency and revives productivity growth (OECD 2003, Alwahaishi and Snášel 2013).

## 3. Methodology

The impact of the Internet economy on market services was identified through the analysis of its development in the Slovak Republic. The following research question was answered to meet the research objectives.

Research question: *How did the Internet economy, measured by indices such as IDI, NRI and DESI, develop in the Slovak Republic?*

Multiple indices were used to monitor the achieved level of the Internet economy. They included the ICT Development Index (IDI), the Digital Economy and Society Index (DESI), the Networked Readiness Index (NRI), the Global Competitiveness Index (GCI), and the Boston Consulting Group e-Intensity Index. In addition to these, the Electronic Governance Development Index (EGDI), the Competitive IT Sector Index (ITICI) were also applied. Each index is based upon a different methodology; thus, their comparisons are not relevant. The indicators, presented in Table 1, support the comparison of the selected indices.

Table 1. Indicators of IDI, NRI, DESI and e-Intensity

| Indicator | IDI | NRI | DESI | E-intensity index |
|---|---|---|---|---|
| ICT and Internet access | x | x | x | x |
| ICT and Internet usage | x | x | x | x |
| ICT skills | x | x | x | |
| ICT environment | | x | | |
| Impact of ICT | | x | | |
| Digital technologies integration | | | x | |
| Digital public services | | x | x | x |
| ICT costs | | | | x |

*Source*: Own processing.

The above-mentioned indices utilized the indicators on ICT and Internet access and use. The indicator on ICT skills, expect for the e-intensity index, was also monitored in all the selected indices. The compared indices included indicators such as the economic and social impact of ICT (NRI), the integration of digital technologies (DESI), ICT costs (E-intensity Index) and the digital public services indicator (NRI, DESI, e-intensity). However, data for the e-intensity index were not available, thus, the development of the Internet economy in Slovakia was

not monitored by this index.

The OECD claims that the Internet economy is built upon three pillars: Internet access, digital content and ICT, and the development of intelligent applications. The ICT Development Index was used to identify the relationships among the Internet economy, market services and economic performance in the Slovak Republic. It is a complex index consisting of three sub-indices (access, ICT intensity, and ICT skills). The IDI is one of the most widely used ICT development indicators, thus, it offers a larger and more accessible database than other indices. The correlation and regression analysis was used to determine the relationship between economic performance measured by GDP per capita and ICT development measured by IDI in the Slovak Republic.

Hypotheses 0 and hypotheses 1 were proposed to identify the above-mentioned relationship. Hypotheses 0 and 2 were used to determine the relationship between the development of the Internet economy and value added in the selected sectors of market services in Slovakia.

Hypothesis 0: *ICT development measured by the IDI does not affect GDP per capita growth in Slovakia.*

Hypothesis 1: *ICT development measured by the IDI affects GDP per capita growth in the Slovak Republic.*

Hypothesis 0: *The development of the Internet economy measured by the ICT Development Index does not affect the value added (H0.1 to H0.7)* [2] *in the selected sectors of market services in Slovakia.*

Hypothesis 2: *The development of the Internet economy measured by the ICT Development Index affects the value added (H2.1 to H2.7)* [3] *in the selected sectors of market services in Slovakia.*

The hypotheses were verified by the XLStat statistical package and the Microsoft Excel Spreadsheet Software. In the regression analysis, the equation for the regression line is as follows:

$$Y=b_0+b_1x \quad (1)$$

The Durbin–Watson d statistic was used to test the existence of autocorrelation. It is calculated by the relation (n> 15):

$$d=\frac{\sum(e_t-e_{t-1})^2}{\sum e_t^2} \quad (2)$$

The method by Cohen (1988) was applied in the correlation analysis:

Table 2. Effect size

| Effect size | R (correlation coefficient) |
|---|---|
| Very small | under 0,10 |
| Small | 0,11 – 0,30 |
| Medium | 0,31 – 0,50 |
| Large | 0,51 – 0,70 |
| Very large | 0,71 – 0,90 |
| Huge | 0,91 – 1,00 |

*Source*: Processing by Cohen (1988).

The examined market services sections based on SK NACE Revision 2 are listed in Table 3.

Table 3. Market services sections

| Sections | Market services |
|---|---|
| G | Wholesale, retail business, repair of motor vehicles and motorcycles |
| H | Transport and storage |
| I | Accommodation and catering services |
| J | Information and Communication |
| L | Real estate activities |
| M | Professional, scientific and technical activities |
| N | Administrative and support services |

*Source*: Own processing.

[2] Tags in hypothesis 0 by the selected sectors of market services: section G – H0.1, section H – H0.2, section I – H0.3, section J – H0.4, section L – H0.5, section M – H0.6, section N – H0.7.

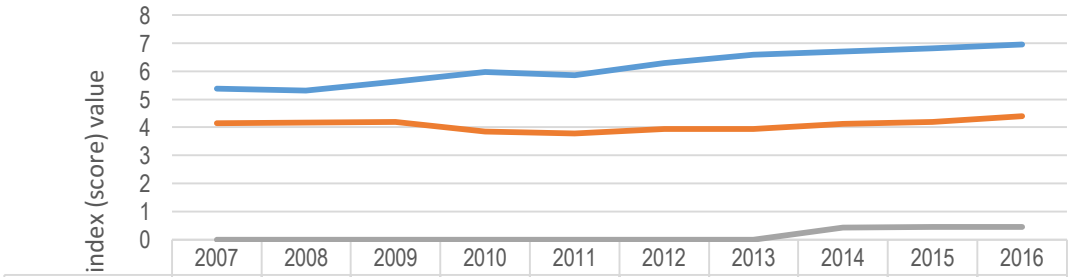
[3] Tags in hypothesis 2 by the selected sectors of market services: Hypothesis 2: section G – H2.1, section H – H2.2, section I – H2.3, section J – H2.4, section L – H2.5, section M – H2.6, section N – H2.7.

## 4. Results and discussion

Research question verification 1: *How did the Internet economy, measured by IDI, NRI, and DESI, develop in the Slovak Republic?*

The development of IDI, DESI and NRI is documented in Figure 1 and Figure 2. Data for the e-intensity index were not available, that is why, this index is not shown in the figures. The ICT Development Index score values range between 0 and 10; the higher the score values, the better the results in ICT development and use in Slovakia. The IDI score value accounted for 5.38 in 2007. It increased to 6.96 by 2016, *i.e.* by 1.58 points. The IDI score value, in comparison with the previous year, dropped by 0.1 points in 2011. However, there had been an increase in score values since 2012. In terms of IDI development, Slovakia witnessed considerable progress in ICT development, accessibility, usage, and skills. However, Slovakia moved down in the rankings of the examined countries, see Figure 2.

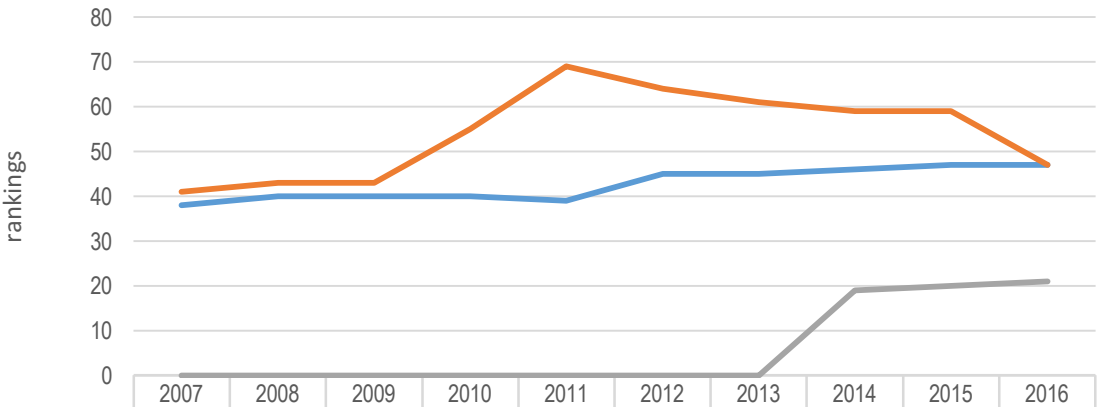
Figure 1. Indices based on score values in Slovakia for the years 2007-2016




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| IDI (0-10) | 5,38 | 5,3 | 5,63 | 5,96 | 5,86 | 6,3 | 6,58 | 6,7 | 6,82 | 6,96 |
| NRI (1-7) | 4,15 | 4,17 | 4,19 | 3,86 | 3,79 | 3,94 | 3,95 | 4,12 | 4,2 | 4,4 |
| DESI (0-1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0,42 | 0,45 | 0,46 |

*Source*: Own processing. Data from ITU of the relevant year.

Figure 2. Indices based on the rankings for the years 2007–2016 in Slovakia




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| IDI | 38 | 40 | 40 | 40 | 39 | 45 | 45 | 46 | 47 | 47 |
| NRI | 41 | 43 | 43 | 55 | 69 | 64 | 61 | 59 | 59 | 47 |
| DESI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 20 | 21 |

*Source:* Own processing. Data from ITU of the relevant year.

There were fluctuations in the timeline of NRI score values and rankings in Slovakia in the period between 2007 and 2016. The ranking of Slovakia deteriorated in 2011, which was corrected in the forthcoming years, but the country did not reach its 2007 ranking (Figure 2). The NRI score value increased from 4.15 points in 2007 to 4.19 points in 2009, then its score value decreased to 3.79 points in 2011. There had been a slight increase in the score value of the index since 2012. The value of NRI increased only by 0.25 points from 2007 to 2016.

The Digital Economy and Society Index (DESI) is one of the newest indices examining the development of digital economy of the EU member states. Its first measurements were made in 2014. The DESI score values range between 0 and 1. The DESI score values demonstrated an overall increase in Slovakia throughout the monitored

period. The first measurements were made in 2014, when the index reached 0.42 points (Figure 1). Slovakia ranked 19th among the European countries in 2014 (Figure 2). In 2016, Slovakia, with a total score of 0.46, ranked 21st among the EU-28, thus, its ranking worsened.

Slovakia's score values, despite a slight increase, were lower than the EU-28 average (0.52) in 2016, and thus growing at a slower pace than the EU-28. Slovakia ranked among the slow internet speed economies, such as the Czech Republic, Latvia, Slovenia, Hungary, and Poland, in the EU-28. However, in some of the monitored categories such as human capital, Slovakia reached the EU-28 average. Slovakia demonstrated the greatest shortcomings in digital public services.

Slovakia demonstrated an increase in the indices values based on the rankings (Figure 2) and the score values (Figure 1) of the selected indices for the years 2007–2016. This increase was perceived as a significant prerequisite for the development of the digital economy in the Slovak Republic. The most notable growth was recorded in the ICT Development Index (IDI). Thus, Slovakia dedicated enough attention to the implementation of digital technologies and the development of the Internet economy. However, Slovakia's rankings dropped in the individual indices during the monitored period. Even though, the indices values increased, Slovakia's rankings dropped. Therefore, the rate of progress in ICT development was assessed as insufficient in the Slovak Republic. Nevertheless, Slovakia has great potential for a more effective deployment of information and communication technologies.

Verification of hypotheses 0 and 1:

Hypothesis 0: ICT development measured by IDI does not affect GDP per capita growth in the Slovak Republic.

Hypothesis 1: ICT development measured by IDI affects GDP per capita growth in the Slovak Republic.

Table 4. GDP per capita and IDI development in Slovakia in the year 2007–2016

| Indicator | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| IDI score | 5,38 | 5,30 | 6,15 | 5,96 | 5,86 | 6,30 | 6,58 | 6,15 | 6,82 | 6,96 |
| GDP per capita (EUR) | 11,68 | 12,67 | 11,82 | 12,45 | 13,08 | 13,45 | 13,70 | 14,01 | 14,51 | 13,04 |

*Source*: Own processing. Data from ITU and Eurostat of the relevant year.

The IDI score values and GDP per capita increased year by year (Table 4.). The score value of the index increased from 5.38 in 2007 to 6.96 points in 2016 (an increase by 1.58 points). This indicated progress in ICT development in the Slovak Republic. While GDP per capita slightly decreased in 2009, the score values increased in 2010.

Table 5. Results of the regression and correlation model

| Indicator | Variables | R (correlation coefficient) | $R^2$ adjusted (determination coefficient) | p-value | Durbin-Watson test |
|---|---|---|---|---|---|
| GDP per capita | Dependent variable | – | – | – | – |
| IDI | Independent variable | 0,8875 | 0,2996 | 0,0588 | 1,80 |

*Source*: Own processing.

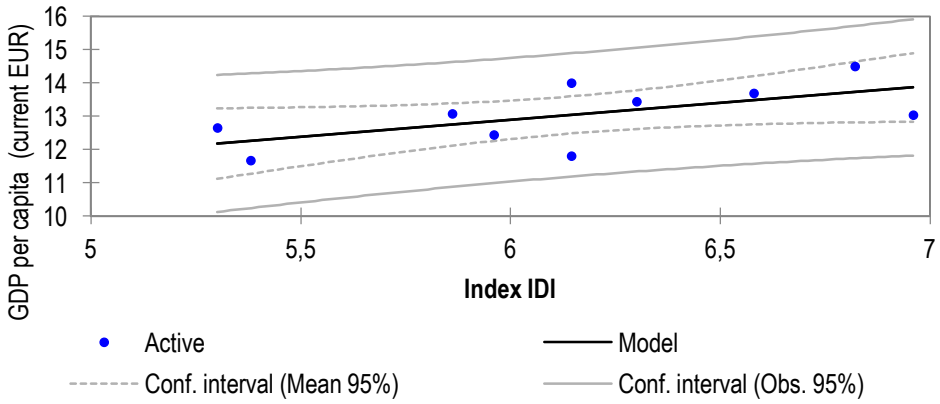
The IDI score values were defined as independent variables for each year, whereas GDP per capita was set as a dependent variable. The correlation analysis led to a correlation coefficient of 0.8875, which indicated a strong direct linear dependence between the IDI and GDP per capita.

Equation of the regression line:

$$\text{GDP per capita} = 6{,}79144 + 1{,}01703 * \text{IDI score} \quad (3)$$

The regression analysis was applied to determine the size and shape of dependence. The estimated model explained 29.96% of the data. The p-value of IDI was 0.0588, which indicated a statistically significant model at a significance level below 6%. Based on the p-value, the constant (0.0442) and the IDI variable parameter (0.0588) were estimated with 90% confidence. First-order autocorrelation was excluded by the Durbin-Watson test.

Figure 3. Relationship between the development of the Internet economy (IDI) and GDP per capita in 2007–2016, Slovakia




*Source:* Own processing.

Hypothesis 1 was verified, whereas, hypothesis 0 was rejected as a result of the regression and correlation analysis. A very large direct linear dependence was observed between ICT development and GDP per capita growth. The Internet economy measured by the IDI exerted a positive impact on the economy of Slovakia. Thus, the development of the Internet economy contributes to GDP per capita growth.

Verification of hypotheses 0 and 2:

*Hypothesis 0: The development of the Internet economy measured by the ICT Development Index does not affect the value added (H0.1 to H0.7) [4] in the selected sectors of market services in Slovakia;*

*Hypothesis 2: The development of the Internet economy measured by the ICT Development Index affects the value added (H2.1 to H2.7) [5] in the selected sectors of market services in Slovakia.*

The relationship between the development of the Internet economy and value added in the selected services sections is as follows:

- in section G, medium direct linear dependence. The model is statistically insignificant;
- in section H, large direct linear dependence. The model is statistically significant;
- in Section I, very large direct linear dependence. The model is statistically significant;
- in section J, large direct linear dependence. The model is statistically significant;
- in section L, very large direct linear dependence. The model is statistically significant;
- in section M, medium direct linear dependence. The model is statistically insignificant;
- in section N, large direct linear dependence. The model is statistically significant.

Table 6. Coefficients of the regressive and correlation analysis

| Section NACE Rev. 2 | Type | R Correlation coefficient | $R^2$ adjusted determination coefficient | p-value | Verified hypothesis |
|---|---|---|---|---|---|
| G | Wholesale, retail business, repair of motor vehicles and motorcycles | +0,3630 | -0,0130 | 0,3769 | H0.1 |
| H | Transport and storage | +0,6723 | 0,3607 | 0,0678 | H2.2 |
| I | Accommodation and catering services | +0,7911 | 0,5636 | 0,0194 | H2.3 |
| J | Information and Communication | +0,6342 | 0,3026 | 0,0912 | H2.4 |
| L | Real estate activities | +0,8085 | 0,5960 | 0,0151 | H2.5 |
| M | Professional, scientific and technical activities | +0,3679 | -0,0088 | 0,3700 | H0.6 |
| N | Administrative and support services | +0,7019 | 0,4081 | 0,0523 | H2.7 |

*Source*: Own processing.

[4] Tags of hypothesis 0 by the selected sectors of market services: section G – H0.1, section H – H0.2, section I – H0.3, section J – H0.4, section L – H0.5, section M – H0.6, section N – H0.7.

[5] Tags of hypothesis 2 by the selected sectors of market services: Hypothesis 2: section G – H2.1, section H – H2.2, section I – H2.3, section J – H2.4, section L – H2.5, section M – H2.6, section N – H2.7.

The correlation coefficient indicates a direct linear dependence between the Internet economy and the value added in the selected sections of market services G, H, I, J, L, M, N. The determination coefficient shows low variability in sections G and M, and the models are statistically insignificant; however, the correlation coefficient and the regression line indicate direct linear dependence in both sections. Based on these findings, the hypothesis 2 is verified and the hypothesis 0 is rejected. Despite the heterogeneity of the services sector, and irrespective of the direction (intermediate or final consumption) of services, the achieved results have confirmed that the Internet economy has a positive impact on the performance of market services. Hence, the development of the Internet economy affects the growth of the value added in services.

## Conclusion

Research on the impact of the Internet economy on market services in Slovakia has revealed several findings. Firstly, despite an increase in the score values of the monitored indices, Slovakia ranked among slowly developing Internet economies. Secondly, despite a moderate growth, Slovakia's score values were lower than the EU-28 average in 2016. It also grew at a slower pace than the EU 28 average in 2016.

Nevertheless, the development of the Internet economy measured by the IDI positively influences GDP per capita growth in Slovakia. Thus, the development of the Internet economy stipulates GDP per capita growth. The verification of the first hypothesis has confirmed that there is a strong direct linear dependence among the indicators.

Testing has confirmed a direct linear relationship between the development of the Internet economy and the value added in market services. At the same time, the analysis has shown that the development of the Internet economy positively influences value-added growth in market services. It is therefore important for service companies to use ICT in the design of their business processes to a greater extent than has been the case so far.

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