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The trend of a number of internet connections in Slovakia and selected European countries

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Abstract Nowadays we live in a time, when the number of internet connections are growing as users start sending information mostly via the internet. This article consists of statistics and information about the internet connections in Slovakia and through statistical methods we will calculate if the trend grows or rises in every district of Slovakia. The trend shows us, how important it is to adapt from postal services to new trends and take care about users who want to use postal services in this new way and to demonstrate that the number of internet connections are growing in every country. In this article we will compare statistical data between Slovakia and selected European countries. For more specific results, we should calculate the trend per citizen. The reason is, that we should compare countries where much more citizens live, than in Slovakia. This article focuses on the situation in the Slovak market. It could help to demonstrate how electronic communication and postal services could cooperate.

Keywords internet connection, trend, analysis, postal services, electronic communication

JEL L87, L86, C15

1. Introduction

We would like to present in this article, aspects that are useful for the next stage in postal services, but in internet services too. Throughout this article there will be theoretical bases about the general definition of internet services, types of connections and postal services. More important is the methodology which we applied to prove the correlation between amount of sent items by domestic service and amount of internet connections in Slovakia. We applied statistical methods to calculate the trend of the amount of internet connections in each region of Slovakia and the trend of amount of sent items by domestic service. Thanks to the trend we can predict next stage. Another calculation will prove if there is some positive effect or not. The most important calculation is about the correlation between sent items and internet connections. According to these results we can decide what to do in postal services, what to add or what to apply to make it better.

2. Theoretical bases

To get closer to the main topic of this article we will describe postal services as well as services provided via internet.

2.1. Postal services

Postal services are provided by postal operators in each country. We are going to focus on national postal operators which should provide special postal services. This postal service can be called "universal service" and it means that:

"It is an offer of postal services which serves the minimal needs of all postal service users in Slovakia and to ensure accessibility to access points of the public postal network and the contact points of the public postal network under the same conditions within a specified quality at a fair price. Every working day with at least one recess and daily delivery." [1]

Postal services topic is too big for this article, hence we should concentrate on two main services which is provided by the national postal operator. These are: [2]

Letter mail

Letter mail is the most popular service provided by postal operators in the selected area. Letter mail is a letter service communication or small article sent by this operator. You can send it within the domestic area or abroad. Letter mail has got some specifications which are different in every country. You can use it for sending letters, letters for the blind, direct mail (within Slovak Republic). Communications can be sent on any kind of physical media (paper, card, CD, DVD). There could be different quality standards of transit times, size and weight, but in Slovakia the specifica-

tions for letter mail are the following:

- **Letters within the Slovak Republic:**
  - 1st Class Letter - D+1 (delivery on the next working day after the day of posting),
  - 2nd Class Letter - D+2 (delivery on the second working day after the day of posting)
  - Letter for blind - D+4 (delivery on the fourth working day after the day of posting),
  - Direct mail - D+4 (delivery on the fourth working day after the day of posting),
- **Letters abroad**
  - assumed transit times of letters addressed abroad depend on the respective country of destination, for an expedite transit time, choose the "1st Class" Letter option [2]

Letter mail is a paid service, but every country has got different control devices which control if the price is regular for that market. There are many things which are important to set up for the right price for this service. Analysis of these topics is too large and it is not the main area to be characterised. There is one thing which is set up for letter mail and that is the method of payment. Here are some possible methods of payment for letter mail:

- cash,
- postage stamps,
- bank transfer,
- postage credit,
- franking machine.

There are also some special services which can be added to it. It is for example: Reply service, Withdrawal of an Item from the Post at posting, Withdrawal of an Item from the Post at delivery, return to Sender immediately, do not redirect, return to Sender after ... days, do not return these special services are provided for letter mail send in domestic service. For those letter mails, which are sent abroad there are these possibilities: Reply service (up to 50 g to all countries, above 50 g to shortlisted countries), Withdrawal of an Item from the Post at posting, do not redirect, Poste restante. [2]

Parcels

The next important item in the postal market, is parcel service. Parcel service is also a service which is provided by the postal operator in selected areas, but it is something different than letter mail. Parcel service is a service assigned to deliver things with value or without value. Receipts are included in the service for the management of the delivery of the parcel to the consignee. Every postal operator provides a parcel service with different rules and specifications. Slovak post has set up the follows specifications:

- In terms of delivery there are two types of parcels
  - Parcel to the address – parcels will be delivered by Slovak post to the address which is written on parcel
  - Parcel to the post – parcel will be delivered by Slovak post to the post office which dispatcher set up.
- Delivery term of parcels is D+2 (delivery on the second working day after the day of posting)
- Price of parcel includes
  - Track & Trace (T&T) – it is tool to check progress of your item,
  - Text message or e-mail notification – postal operator notify consignee through text message or e-mail about progress of item.
- Insurance of parcel is special service offered to this item. Insurance secures parcel and dispatcher.

Parcel should be packed according to the rules which are specified. Packing rules are:

- Parcel can be posted in enclosed packaging or without packaging (for ex. tyre, suitcase, etc.).
- You can also use repackaging service in case the original addressing data, all labels and bands have been removed.
- In case the weight is over 3 kg, we recommend to cord up or put the shanks

Payment of postage is also set up. There are a few possibilities how to pay for parcel. Possibilities are follows:

- Cash,
- Bank transfer,
- Postal stamps,
- Postal machine,
- Postage credit.

For postal items it is common to add special services. These services are:

- Sender
  - Parcels within Slovak Republic – Insurance, Fragile Cumbersome, Cash on delivery (COD), Cancellation on posting, Cancellation on delivery, do not store, Store…day,
  - Parcels abroad – Cash on delivery, Fragile, Cumbersome, Insurance, return to sender immediately, return to Sender after…days, do not return, Redirect to Addressee after…days, do not redirect, Cancellation on posting/ delivery.

Both items which I have mentioned have a number of variables. I had to define some specifications about it. Then I can describe methods which could help us to set up the trend of the amount of sent items by domestic services. [2]

As we said in the beginning we should concentrate on postal services as services provided via internet. The reason is simple. Nowadays postal services are also provided via internet. Customers can use modern technology to save their time and they can save the environment too. We should define how we can offer this service via the internet from the beginning. Electronic communications service is a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals in networks, including telecommunications services and transmission services in networks used for radio and television broadcasting. [3]

Services provided via internet are nowadays popular and its

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offer increases every day. This service begins with connections.

2.2. Services provided via internet

The Internet is a "worldwide system of interconnected networks and computers", which can communicate with each other. [4]

Nowadays use of Internet is part of nearly every day for private and occupational purposes by its users. In the virtual environment of Internet there exists a lot of Internet websites. Website content itself is very important for the user. [5]

There are many types of connections and how to become a user. Internet providers offer for example these types of connections:

- Internet services provided via cable
  - Metal cable (DIAL-UP, ISDN, ADSL, CATV, DPL)
  - Optical cable.
- Wireless services
  - Fixed (WI-FI, FWA, VSAT)
  - Mobile (HSCSD, GPRS, EDGE, FLASH-OFDM, UTMS) [6]

According to these different types of connections and per the information based on research in Slovakia, which has been provided by the Regulatory authority for electronic communications and postal services the most frequent types of connections are: IDSN, Dial-up, xDSL, optical cable FTTx. There are lots of providers now offering electronical communication services that join you to the internet. In this article, we will calculate the trend of these internet connections. For better understanding we should define the digital economy index (DESI). [7]

Use of Internet services by Citizens in the EU

The DESI is a composite index that summarizes relevant indicators on Europe´s digital performance and tracks the evolution of EU member states in digital competitiveness. Specifically, use of the Internet. The use of Internet dimension accounts for the variety of activities performed by citizens already online. People in the EU engage in a range of online activities. They consume content, communicate, shop, use online banking services and much more. Such activities are captured in DESI (The digital economy and society index) on internet use. Denmark, Sweden and Belgium have the most active internet users, followed by Estonia, the Netherlands and Finland.

Mobile use of the internet in Europe really started to take off around 2010. Today 43% of the population (aged 16-74 years) use their mobile phone to access the internet when they are away from home or work. [8]

Use of Internet in Slovakia

Slovakia ranks 18th amongst EU countries. The use of internet by Slovaks is still growing and it is close to the EU average. Slovak Internet users engage in a broad range of online activities. They read news online (65%), listen to music, watch films and play games online (35%), use the Internet to communicate through social networks (69%), Voice or video calls via internet are particularly popular (55%). The uptake of online banking services amongst internet users is stagnating (48%) whilst online shopping is growing (61%).
[8]

3. Methodology

For the correct calculation of the trend, geometric means and correlation between the amount of internet connections and the amount of sent items by domestic service, we applied statistical methods.

3.1. Trend analysis

A trend analysis is an aspect of technical analysis that tries to predict the future movement of a stock based model on past data. Trend analysis is based on the idea that what has happened in the past gives traders an idea of what will happen in the future. There are three main types of trends: short-, intermediate- and long-term. Although trend analysis is often used to predict future events, it could be used to estimate uncertain events in the past, such as how many ancient kings probably ruled between two dates, based on data such as the average years which other known kings reigned. In this case trend analysis help to predict the situation on postal markets and predict amount of sent items by domestic services next year. [2]

3.2. Geometric mean

It is very important when we want to say if a trend is increasing or decreasing. In mathematics, the geometric mean is a type of mean or average, which indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum). The geometric mean is defined as the nth root of the product of n numbers, i.e., for a set of numbers x_1, x_2, ..., x_n, the geometric mean is defined as

$$\bar{x}_g = \sqrt[n]{x_1 * x_2 * \dots x_n}; (x_i > 0; i = 0,1,2 \dots n) \qquad (1)$$

When we calculate geometric mean in case when there is a table of frequencies then geometric mean is defined as

$$\bar{x}_g = \sqrt[n]{x_1^{f_1} * x_2^{f_2} * \dots x_k^{f_k}}; \sum_{i=1}^{k} f_i = n \qquad (2)$$

Geometric mean is one of the statistical characteristics which expresses the average rate of change. This is the main reason why I applied this mean to show the average change of amount sent items. [9]

3.3. Regression analysis

Regression analysis is used when you want to predict a continuous dependent variable from several independent variables. If the dependent variable is dichotomous, then logistic regression should be used. (If the split between the two levels

of the dependent variable is close to 50-50, then both logistic and linear regression will end up giving you similar results.) The independent variables used in regression can be either continuous or dichotomous. Independent variables with more than two levels can also be used in regression analysis, but they first must be converted into variables that have only two levels. This is called dummy coding and will be discussed later. Usually, regression analysis is used with naturally-occurring variables, as opposed to experimentally manipulated variables, although you can use regression with experimentally manipulated variables. One point to keep in mind with regression analysis is that causal relationships among the variables cannot be determined. While the terminology is such that we say that X "predicts" Y, we cannot say that X "causes" Y. Regression has got more to the process. In this case I will discuss only one process of regression. Regression analysis also has an assumption of linearity. Linearity means that there is a straight-line relationship between the X and the Y. This assumption is important because regression analysis only tests for a linear relationship between the X and the Y. Any nonlinear relationship between the X and Y is ignored. You can test for linearity between an X and the Y by looking at a bivariate scatterplot (i.e., a graph with the X on one axis and the Y on the other). If the two variables are linearly related, the scatterplot will be oval. Regression analysis consist of smaller part which is important to calculate the result. Regression can be written as: [10]

$$\hat{y}_i = b_0 + b_1 * x_i \quad (1)$$

$\hat{y}_i$- (predictable) value of depends of variable Y,

x_i – value of undepends of variable X,

b_0- point estimate,

b_1 – point estimate.

We can see that there are two unknown values b_0 and b_1. Basically, b_0 means the amount in the beginning. This article is about the number of events and yearly audience. In this case, the independent value is the number of events. Result of b_0 shows the audience in case when there will not be any event. On the other hand, there is another unknown value b_1 which means how the audience would change when we add one event. B_1 is well known as regression coefficient. These two unknown values can be calculated as:

$$b_0 = \bar{y} - b_1 . \bar{x} \quad (2)$$

$$b_1 = \frac{cov\,xy}{s_x^2} \quad (3)$$

$\bar{x}$- average value of undepends value X

$\bar{y}$- average value of depends value Y

s_x^2- variance of value X

$cov\,xy$- covariance of throw values X and Y

As we can see there are still two values which should be calculated. Firstly is the variance and secondly the covariance. Variance can be calculated as:

$$s_x^2 = \frac{\sum(xi-\bar{x})^2}{n} \quad (4)$$

Covariance means the value of mixed variability which consists of two statistical values X and Y. It can be calculated as:

$$cov\,xy = \frac{\sum(xi-\bar{x})*(yi-\bar{y})}{n} \quad (5)$$

Thanks to the mentioned patterns we can calculate the regression which is shown in the results and discussion part of this paper. [10]

3.4. Correlation

Regression is good to know for the prediction of a trend but as we can see there are two values X and Y. Dependent and independent values. To discover their connectivity, we need a correlation. This correlation has got coefficients. Firstly there is the correlation coefficient and secondly there is the coefficient of determination.

Correlation coefficient is used to calculate how strong the correlation is between the dependent and independent values. The following rules apply.

1. *If the number of correlation coefficient is from 1 to 0,9 there is strong correlation,*
2. *If the number of correlation coefficient is from 0,9 to 0,8 there is correlation,*
3. *If the number of correlation coefficient is from 0,8 to 0,7 there is weak correlation,*
4. *If the number of correlation coefficient is lower than 0,7 there is no correlation.*

It can be calculated as:

$$r_{xy} = \frac{cov\,xy}{s_x * s_y} \quad (6)$$

Coefficient of determination is calculated to determine the correlation in percentage value. Calculation of this coefficient is similar as in correlation coefficient, but there is just a little difference. Coefficient of determination can be calculated as.

$$rxy^2 = \left(\frac{covxy}{s_x s_y}\right)^2 \quad (7)$$

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Thanks to the mentioned patterns the results will show the correlation between the number of events and audience during 5 years. [10]

4. Results

The main goal of this research is to calculate and interpret the trend of the amount of internet connections in Slovakia in each region, but also in Slovakia overall. For better comparison, we also add the trend analysis of the second value which is presented by the amount of sent items by domestic service. Next hypothesis is based on the fact that nowadays the internet is used more often as a transfer medium for people. According to this fact we expect that there should be a correlation between internet connections and sent items. Thanks to regression analysis and correlation indexes, we can now see the real result.

4.1. Results of trend analysis

The basic information which we used for our calculation consists of data made by the Regulatory authority for electronic communications and postal services. In the next table, we can see the number of internet connections from the last 9 years in each region of Slovakia.

Table 1 Amount of internet connections in Slovakia

Region / year	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Bratislava region	126 256, 00	154 086, 00	172 263, 00	203 265, 00	190 573, 00	202 961, 00	211 158, 00	234 080, 00	254 840, 00
Trnava region	60 102, 00	69 156, 00	83 292, 00	89 307, 00	100 168, 00	112 173, 00	119 110, 00	124 663, 00	125 974, 00
Trenčin region	56 058, 00	66 387, 00	82 690, 00	97 473, 00	100 531, 00	112 563, 00	119 388, 00	126 083, 00	139 631, 00
Nitra region	61 328, 00	74 810, 00	97 985, 00	100 192, 00	128 922, 00	132 104, 00	140 037, 00	146 865, 00	164 986, 00
Žilina region	66 797, 00	82 813, 00	103 353, 00	111 036, 00	122 344, 00	134 239, 00	144 201, 00	153 296, 00	162 714, 00
Banska Bystrica region	49 923, 00	59 380, 00	82 688, 00	94 791, 00	102 632, 00	112 145, 00	118 496, 00	131 104, 00	137 552, 00
Prešov region	48 002, 00	65 166, 00	90 316, 00	100 074, 00	109 763, 00	121 271, 00	123 905, 00	126 752, 00	140 032, 00
Košice region	72 695, 00	92 590, 00	113 981, 00	126 528, 00	136 460, 00	147 692, 00	160 397, 00	175 316, 00	174 130, 00

Based on this data we could calculate the trend which can be seen in next graph.

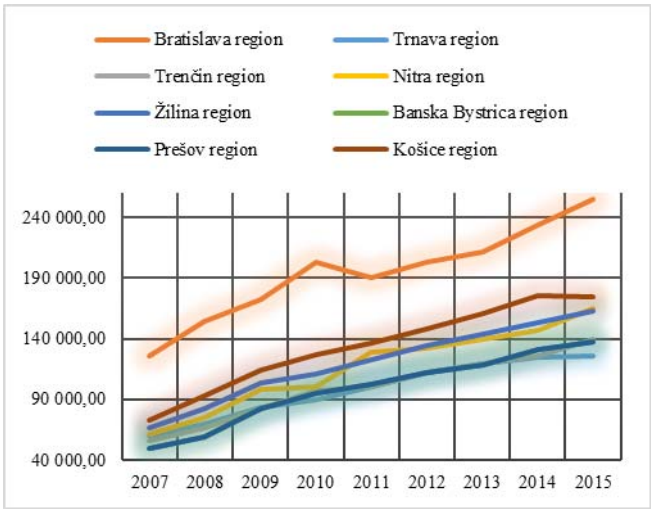

Figure 1 Result of trend analysis

In figure 1 is shown the calculated trend in each region of Slovakia. We can see all of the regions in Slovakia have got an increased trend in internet connections. The biggest region in this case is Bratislava. The result of this trend analysis is that in the next stage we can predict bigger interests in internet connections in every single region of Slovakia. We need to calculate the trend of internet connections in Slovakia overall which can be seen in next figure.

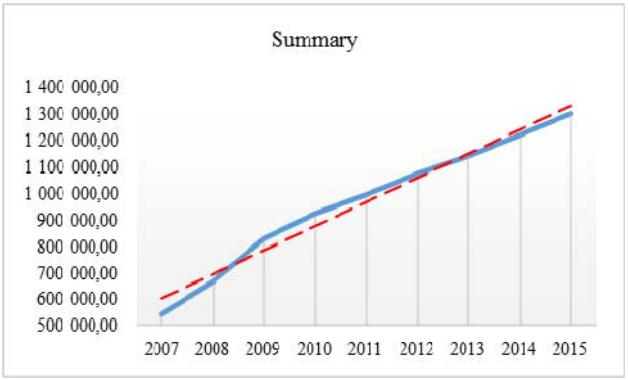

Figure 2 Result of internet connections in Slovakia

This result just proves our main thinking that there will be an increased style of trend, so there will be more interests in internet connections. Now we are getting closer to our main research goal. Firstly, we calculate the trend of the amount of sent items during the last nine years.

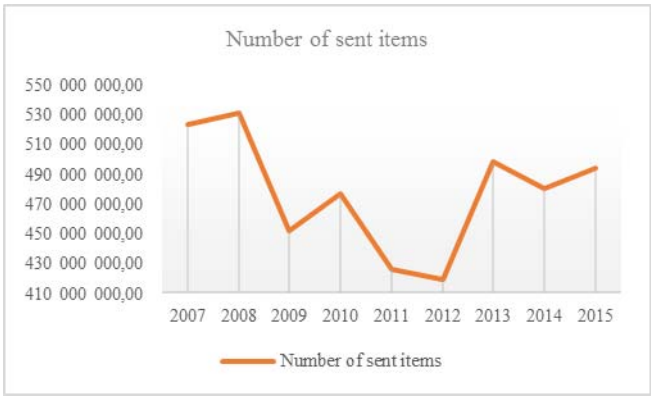

Figure 3 Result of the trend analysis - Number of sent items

This result is more complicated thanks to year 2012 where we can see a strong decreased trend, but in next 3 years we can see there is an increased trend and it is a positive sign for postal services.

4.2 Results of geometric mean

To prove that this is a positive effect for both services we decided to calculate geometric mean. Geometric mean presents number of changes. In the next two tables, there are results of geometric mean of internet connections and number of sent items.

Table 2 Geometric mean - Internet connections

Year	*Amount of internet connection in Slovakia*	X_n-X_{n-1}	X_1*X_2*.X_n
2007	541 161,00		
2008	664 388,00	1,23	
2009	826 568,00	1,24	1,5273976
2010	922 666,00	1,12	1,3887457
2011	991 393,00	1,07	1,1994089
2012	1 075 148,00	1,08	1,1652624
2013	1 136 692,00	1,06	1,1465604
2014	1 218 159,00	1,07	1,1330152
2015	1 299 859,00	1,07	1,1435455
		Geometric mean	**1,016908**

Geometric mean of internet connections is presented by 1,0169 value which means there is a positive change and our result for the trend analysis has just been proved to be better. In the same way we can say that the geometric mean is presented by 0,9988 value which means a positive effect too.

Table 3 Geometric mean – Number of sent items

Year	*Number of sent items*	X_n-X_{n-1}	X_1*X_2*.X_n
2007	523 031 470,00		
2008	531 112 510,00	1,01545039	
2009	451 440 804,00	0,849990907	0,8631236
2010	476 280 444,00	1,055023028	0,89676
2011	425 743 495,00	0,893892454	0,9430771
2012	418 642 574,00	0,983321129	0,8789833
2013	497 941 511,00	1,189419189	1,169581
2014	480 011 539,00	0,963991811	1,1465904
2015	493 492 002,00	1,028083623	0,9910642
		Geometric mean	**0,998879**

4.3. Results of correlation index and regression analysis

We have proved positive effects and increased trend in both the postal services and internet services. But now the main hypothesis is: "Is there any correlation between these two different services?" We calculated it based on statistical method of the regression and correlation index. In the next table, there can be found calculations which help us to achieve our results.

Table 4 Regression analysis

Year	*Number of sent items*	*Amount of internet connections*					
	yi	**xi**	**(xi - xav)**	**(xi-xav)^2**	**(yi - yav)**	**(yi - yav)^2**	**(xi-xav) *(yi-yav)**
2007	523 031 470,00	541 161,00	-42 842,78	178 796 014 718,83	45 509 653,44	2 071 128 556 633 430,00	-19 243 428 278 152,90
2008	531 112 510,00	664 388,00	-29 615,78	89 769 614 293,38	53 590 693,44	2 871 962 423 856 420,00	-16 056 617 298 007,70
2009	451 440 804,00	826 568,00	-13 435,78	18 888 593 013,38	-26 081 012,56	680 219 215 923 048,00	3 584 464 245 804,77
2010	476 280 444,00	922 666,00	-41 337,78	1 708 811 871,60	-1 241 372,56	1 541 005 821 686,60	51 315 582 840,99

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20	425	991 393,00	27	750	-51	2 680 994	-1 418
11	743		389,	169	778	583 110	167 955
	495,00		22	493,94	321,	510,00	378,79
					56		
20	418	1 075	111	12 353	-58	3 466 765	-6 544
12	642	148,00	144,	038	879	203 915	087 618
	574,00		22	133,38	242,	950,00	870,79
					56		
20	497	1 136	172	29 821	20	416 963	3 526
13	941	692,00	688,	222	419	921 204	240 731
	511,00		22	094,27	694,	474,00	932,09
					44		
20	480	1 218	254	64 594	2 489	6 198 717	632 775
14	011	159,00	155,	876	722,	850	961
	539,00		22	982,83	44	370,29	139,43
20	493	1 299	335	112	15	255 046	5 363
15	492	859,00	855,	798	970	823 129	670 181
	002,00		22	730	185,	944,00	373,98
				293,94	44		
Su	**4 297**	**8 676**	**0,00**	**509**	**0,00**	**12 450**	**-30 103**
m	**696**	**034,00**		**481**		**820 451**	**834 447**
ma	**349,00**			**070**		**445**	**318,90**
ry				**895,56**		**800,00**	

Table 4 consists of xi values and yi values which has been defined in 3rd chapter of this article. Our result is represented by linear regression model and by correlation index. In this case regression model is:

$$\mathbf{Yi} = 534\,482\,146{,}96 * xi - 59{,}09$$

Based on this result we can simulate different situations on what will happen if there will be any internet connections or on the other hand if there will be xxxx number of internet connections. Thanks to the correlation index we can see there is no connection between the amount of internet connections and numbers of sent items.

$$\mathbf{R_{xy}^2} = 14{,}29\%$$

This result is not enough to prove correlation between mentioned values. Our result is services provided via internet and postal services can be modern together and we should focus on a way where we can connect them and help each other to offer better services to customers.

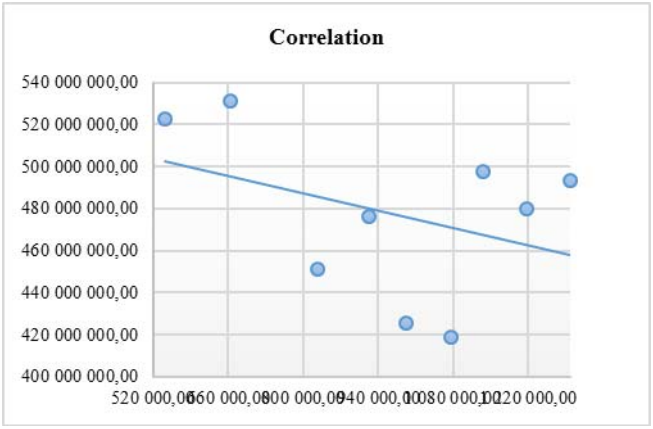

Figure 4 Correlation

For next research, we will create an interactive map where we can choose the relevant year and in the map, we can see the current internet connection in each region of Slovakia. This model can help us understand the predicted situation in upcoming years.

5. Conclusions

At the end of this article let us summarise our results: We have proved an increased trend in postal services and services provided via the internet too. We calculated geometric mean which proved our trend analysis and thanks to these results we can state that postal and electronic services should be developed together and postal operators should find ways how to offer these services to customers. It should help the companies, but the citizens too. Especially if you take into account the fact that our result proved 14,29% of correlation between these two values. It means that there is no negative effect on postal services if customers are interested in internet connections. They would send the same number of items even in the case that there would be a bigger amount of internet connections.

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