APPLICATION OF MULTIPLE REGRESSION ANALYSIS IN ORDER TO EXAMINE THE IMPACT OF SALARIES AND PENSIONS ON THE NUMBER OF EMPLOYEES IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

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Abstract: *The phenomenon of employment trends, and the factors that affect it, is an inexhaustible source of scientific analysis and proof of various theories. In this study, three parameters are taken into consideration - the average pension, the average net salary and the number of employees in the Federation of Bosnia and Herzegovina (FBiH) for the period from 1997 until today. This period can be considered as a representative because it covers more than 20 years. According to all indicators, if the number of employees follow the average net salary, as well as the average pension, it can be concluded that there is a harmonious growth which is not caused by any market imbalance. Every other scenario is not desirable for the economy as a whole. In this study, one of the statistical methods applied together with the mathematical function measures the impact of the average net salary and pension on the number of employees in the Federation of Bosnia and Herzegovina, based on availability of particular data. The higher value of the resulting coefficient demonstrates its greater influence on relations between employment and the average net salary as well as between employment and the average net pension. Additionally, all of the mathematical coefficients were tested by an appropriate statistical test which shows whether this coefficient is statistically significant or not. In case it is not, then there is no relationship between the analyzed variables. The aim of this study is to prove at what extent growth of both - the average net salary and the average pension, has an impact on the number of employees, and whether the growth is based on solid economic prosperity or it is case where inflation is increasing, pushing prices upwards. It is important to emphasize that it is possible that both parameters are represented, but this will also be shown by the resulting coefficient. If its impact value between high and low (balanced), then the combination of economic development and mild inflation is the answer to this question. The hypothesis of this study will be that the average pension and the average net salary have a medium impact on the number of employees, which ultimately shows that it is based on economic development and mild inflation.*

Keywords: *Mathematical function, regression, employment, net salary, pension, analysis.*

INTRODUCTION

Data analysis, which are not based on the statistical or mathematical methods, are not enough to obtain accurate and reliable data on the development of the economic parameters for the particular area.

This year's Global Competitiveness Report covers 138 countries. Amongst them, Bosnia and Herzegovina occupies 107th position, with a score of 3.8, as one of the worst ranked countries in Europe. From the Balkan region, Slovenia is best positioned, on the 56th place, followed by Macedonia on 68th, Croatia on 74th, Albania on 80th, Montenegro on 82nd and Serbia on 90th place. According to the stated data, Bosnia and Herzegovina is convincingly the worst ranked country in the region (Marjanović, 2009: 190). These results, after including more economic indicators, are not very favorable, moreover they may be based partly on speculative growth, which is the subject of this analysis.

Population migrations are the result of economic stagnation and living standards far below the EU average. Due to this facts, the number of working population who intends to relocate to Western European countries is growing. The first goal of the research is to predict the demographic trends expected by the year 2050, using demographic data from the last thirteen years (Obhođaš & Jaganjac, 2019: 171). This has a negative effect on the number of employees, as well as the average net salary and the average pension, especially if their growth is not aligned with inflation. In order to determine this occurrences in a scientific way, it is necessary to analyze them through the multiple regression model which will, based on mathematical function, express the overall influence of coefficients and other parameters.

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Instead of simple model $Y = f(x, \varepsilon)$, we will analyse multiple regression model $Y = f(x_1, x_2, ...Xk, \varepsilon)$. The inclusion of new independent variables in the regression model increases the complexity of analysis. Due to current level if IT infrastructure and resources, this process is considered a routine task.

We will focus our research on analysing linear regression and correlation with two independent variables. The analysis of models with a

larger number of independent variables is performed with same principle and with the use of a more complex mathematical model of linear algebra (Obhođaš *et al.,* 2019: 138).

RESEARCH METHODOLOGY

In this analysis, secondary data were used, which were additionally analyzed by applicable statistical methods, in the statistical package for data processing, which was analyzed, graphically and tabularly presented and theoretically interpreted by the author of this study.

A regression model is a mathematical function that describes the dependence of one (dependent) variable on one or more independent variables. The general form of the regression model is:(Marjanović, 2009: 190).

$$Y = f(X_1, X_2, \dots, X_k) + \varepsilon$$

(Y - dependent variable, X_1, X_2,…, X_k - independent variables, f () - some of the mathematical functions whose form depends on a specific example of interdependence of the studied phenomena, ε - stochastic variable that expresses non-systemic influences on the dependent variable).

The aim of regression analysis is to determine the direction, shape and strength of the relation between the analyzed phenomena. The direction of the connection can be both positive and negative. A positive relation means the direct proportionality of the variables in the regression model, ie the larger values of the independent variable correspond to the larger values of the dependent variable and vice versa. With a negative relation between the phenomena in the regression model, increasing the value of the independent variable decreases the value of the dependent variable.

The shape of the relationship is defined by the shape of the mathematical function that represents the deterministic part of the regression model. Thus there are linear and curvilinear models. The relation between variables in a linear model is represented by a linear function, whose graph is a straight line, and in curvilinear models the relation between variables has the form of some other mathematical function, whose graph is a curved line.

The strength of connection is determined by analyzing a random variable of the regression model. The random variable represents non-systemic influences, i.e. the influences of phenomena that are not included in the model. According to the number of variables included in the model, regression models are divided into simple and multiple. A simple regression

model has one dependent and one independent variable, and multiple models have one dependent and two or more independent variables.

RESULTS OF SECONDARY DATA ANALYSIS

Therefore, in the following section, the secondary data of three variables are presented, two of which are independent - average pension and the average net salary, and last one is dependent - the number of employees in the Federation of Bosnia and Herzegovina. The data were further analyzed using a multiple regression model.

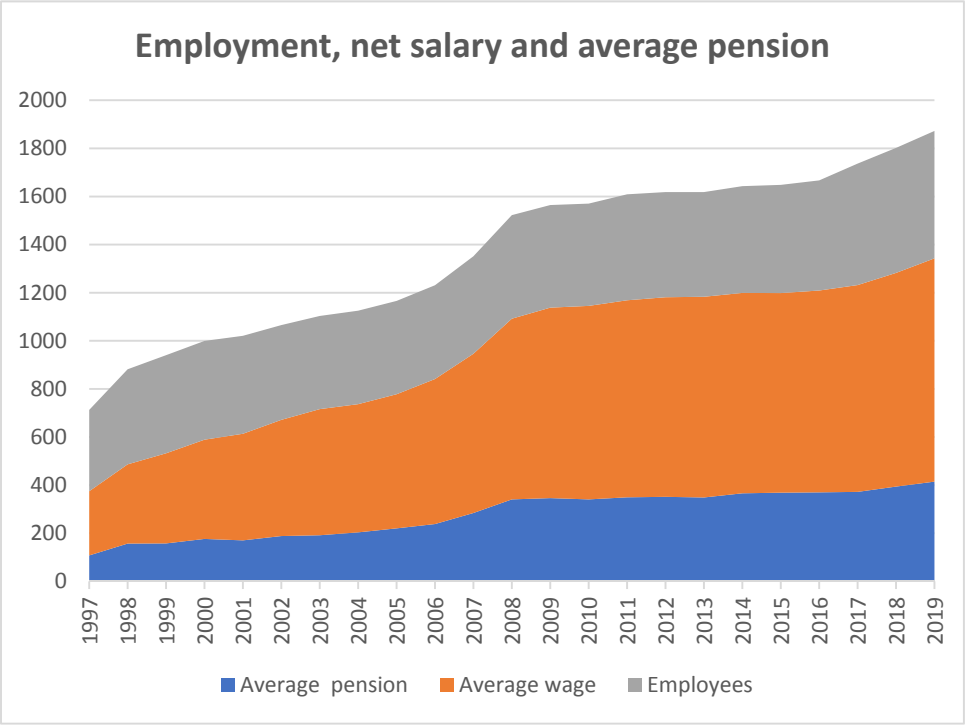
Table 1. Yearly overview of average pension, net salary and number of employees in FBiH

Year	Average Pension	Average Net Salary	Number of Employees
1997	108.03	266.33	338.404
1998	157.12	329.12	395.445
1999	157.68	374.54	407.754
2000	176.11	412.72	410.808
2001	170.12	443.26	407.199
2002	188.53	482.71	394.132
2003	191.86	524.18	387.381
2004	203.24	533.52	388.310
2005	220.13	557.55	388.418
2006	237.97	603.21	389.601
2007	284.16	662.10	405.097
2008	340.39	751.30	430.745
2009	345.79	792.08	426.557
2010	340.59	804.37	425.563
2011	349.17	819.36	440.747
2012	351.34	829.92	437.332
2013	348.39	835.00	435.113
2014	366.21	833.00	443.587
2015	368.36	830.00	450.121
2016	369.84	839.00	457.974
2017	371.82	860.00	505.201
2018	394.11	888.00	519.799
2019	414.76	927.75	529.986

Source: Bureau for Statistics of FBiH

From the previous table it can be concluded that there is a growth of all three analyzed parameters from 1997 to the present. While the average net salary and pension recorded a steady increase in this period, the number of employees stagnated slightly or even decreased in particular periods. This was especially the case in the period of the world economic crisis, after year 2008, as well as in the period from 2001 to 2004. The following graph will show the development of all three analyzed variables, after which a regression analysis will be performed.

Graph 1. Yearly overview of average pension, net salary and number of employees in FBiH



Source: Bureau for Statistics of FBiH

One of the assumptions for the use of regression analysis is the existence of a linear relationship between the variables. It is necessary because the analysis begins with the calculation of simple correlation coefficient (bivariate correlations) for all pairs of variables, and all these calculations require a linear relationship between pairs of variables (Obhođaš *et al.,* 2015:85).

Table 2. Correlation between independent and dependent variables

Correlations				
		Number of Employees	Average Pension	Average Net Salary
Pearson Correlation	Employees	1.000	.834	.804
	Average Pension	.834	1.000	.990
	Average Net Salary	.804	.990	1.000
Sig. (1-tailed)	Employees	.	.000	.000
	Average Pension	.000	.	.000
	Average Net Salary	.000	.000	.
N	Employees	23	23	23
	Average Pension	23	23	23
	Average Net Salary	23	23	23

According to the correlation analysis, it can be concluded that there is a strong correlation between the movement of the number of employees and the average salary and the average pension. It can be concluded that the growth of the average pension and salary has a strong correlation with the number of employees. The correlation coefficient is 0.834 between employment and the average pension, while between the average salary and employment, it is slightly lower, and is 0.804. It is important to emphasize that both parameters are statistically significant, because p = 0.000 <0.05

Table 3. Mathematical model summary

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.850[a]	.722	.694	24.97821	.722	25.952	2	20	.000	1.407
a. Predictors: (Constant), Average Net Salary, Average pension										
b. Dependent Variable: Number of Employees										

By analyzing the model, one can conclude an extremely high correlation between the variables. The coefficient of determination is 0.722, which is also the representativeness of the model, so this model explains 72.2% of the variables, while the rest is influenced by some factors unknown to us.

The adjusted coefficient of determination is slightly lower, and it is 0.694. The standard error of the model is significantly smaller than the standard deviation (24,978 <45), which shows that with this model we reduce the deviation from the descriptive statistics. Durbin - Waston test shows a small negative autocorrelation, which is 1.407, since this test value is approximately 2, it can be concluded that the degree of autocorrelation is acceptable.

Table 4. Anova test model

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32383.978	2	16191.989	25.952	.000[b]
	Residual	12478.221	20	623.911		
	Total	44862.199	22			
a. Dependent Variable: Number of Employees						
b. Predictors: (Constant), Average net salary, Average pension						

The quotient of the square and the average of the residuals give the empirical value of the F test. Based on the sample size and the empirical value of the F test, we obtain a significance value, which in the case of multiple regression is 0.000. Anova test calculates the dependent and independent variables in order to determine the relationship between the mentioned variables. (Obhođaš *et al.,* 2019: 139).

In this case, the analysis showed that there is a compatibility of dependent and independent variables, and that it is statistically significant. So, based on the above, it can be concluded that the mentioned variables have a high degree of dependence. Therefore, the set hypothesis is also proven, ie. there is a significant relationship between dependent and independent variables, and the coefficient of determination is significant, because p = 0.000 <0.05.

Table 5. Coefficients of mathematical model

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	331.731	20.412		16.252	.000
	Average pension	.942	.406	1.983	2.318	.031
	Average net salary	1.256	.189	1.160	3.356	.010
a. Dependent Variable: Number of Employees						

Based on the previous table, it can be concluded that the multiple regression model, ie. the mathematical function looks like this:

y= 331.731 +0942X1 + 1,256X2

Parameters:

X1 – *Average pension,*

X2 – *Average net salary***,**

From the table it can be concluded that if, hypothetically, the coefficient of average salary and pension would be 0, then the number of employees in the Federation of Bosnia and Herzegovina would decrease 331.731 or 42% comparing with 2019. This data shows that the impact of the average salary and pension on the number of employees is extremely large.

According to the above mentioned facts, it can be concluded that there is a stronger impact of the average net salary on the number of employees than the average pension. The percentage mentioned (42%), shows that these two variables have a strong impact on the number of unemployed, but also that in addition to these two variables, there are other variables that affect the number of employees.

In addition, it can be concluded that the hypothesis set in this study is partially proven, and it means that employment is affected by the average salary and pension, but their impact is not the only one, there are many other factors that affect the number of employees. This analysis did not determine the impact of the inflation rate on the number of unemployed, which may be the basis for a new, next study, and therefore, the hypothesis is partially proven.

CONCLUSION

According to the data analyzed and examined so far, it can be concluded that all three analyzed variables have grown from 1997 until today. The two variables have a constant growth, while employment in two periods has stagnated and declined - in the periods after 2001 and after 2008. It is important to emphasize that it has been proven that both, the average pension and the average net salary, have an impact on the number of employees, and the coefficient showed that the impact of the average net salary is higher compared to the average pension. Interesting data from this analysis show that, if hypothetically, the coefficient of influence of the average salary and the average pension would be 0, in that case the number of employees would be lower by 42% compared to year 2019. The results of the analysis raise additional questions, which can and should be the subject of further analysis. Namely, inflation as a parameter that definitely has an impact on the movement of the average salary and pension was not taken into account in this analysis, so it would be interesting to see that particular coefficient in the mathematical function, and compare it with two independent variables in this model.

The objective of this research and this study was to prove the extent to which the growth of the average net salary and the average pension has an impact on the number of employees, and whether the growth is based on solid economic prosperity or is caused by inflation, which pushes prices slightly upwards. Mentioned requirements are fully met, it has been proven that pensions and salaries have an impact on the number of employees, but there is still room for additional research, when it comes to inflation, and its impact on employment in the Federation of Bosnia and Herzegovina.

References

Marjanović, Z. (2009). *Statistika*. Ekonomski fakultet Sveučilišta u Mostaru, Mostar.

Obhođaš, I, Jerković, D. & Iličić, L.(2019). *Uvod u tržišna istraživanja,* Sveučilište Vitez, 138-139.

Obhođaš, I. & Jaganjac, J. (2018). Mjerenje utjecaja makroekonomskih indikatora na konkurentnost Bosne i Hercegovine primjenom regresione analize, *Tranzicija,* 20(41), 2-3.

Obhođaš, I. & Jaganjac, J. (2019). The impact demograpfic trends in the Federation Bosnia and Herzegovina on higher education, labour market efficiency and Inovation. EMS REVIEW – *Journal of Economics and Market Communications*, 19(1), 171-183.

Obhođaš, I., Jerković, D. & Iličić, L. (2015). Primjena regresione analize u prognoziranju potražnje u mliječnoj industriji u Bosni i Hercegovini", *Tranzicija,* 17(36), 85.

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