MONTENEGRIN JOURNAL OF ECONOMICS, Vol. 9, No. 4 (December 2013), 21-37

THE IMPORTANCE OF SUSTAINING AND IMPROVING COMPANY'S BUSINESS SUCCESS BY USING INDICATOR OF THE DEGREE OF HEDGING NECESSITY

IVO ŠPERANDA[1]

ABSTRACT

This paper considers influence of hedging regarded as a technique for protecting companies against unforeseeable events which might seriously influence company's business, primarily its financial stability and its business results The econometric model is thus created to test the impact of hedging on companies' EBIT and to determine the necessity of hedging usage. Regression method and model were used to assess the impact of change in dollar and kuna[i] exchange rates in relation to EBIT measure in 10 year period. Additionally the completely new analytic tool named Indicator of the degree of hedging necessity IZI has been introduced This paper shows huge efficacy of hedging as a protection tool, firstly evident through positive effects on EBIT and therefore on the company and the entire economy's improved competitiveness degree. In this paper the completely new indicator has been introduced and explained in order to assess the necessity of cash flow protection. Finally, it's obvious that hedging as a tool of protection, contributes a lot in achieving better operational and financial goals which leads to a higher degree of the company's competitiveness on the international market.

KEY WORDS*: hedging, necessity, model, EBIT, protecting*

JEL Classification: F37; G32; G17; C51
Received: May 17, 2013 / Accepted: November 21, 2013

1. INTRODUCTION

Companies having business activities abroad, and most of the modern ones have, are exposed to risk in different ways. Besides the political ones, there is a risk in foreign currencies exchange and in commodities and services price change.

Basically it is all about differences in spot and futures prices, i.e. current market prices and the prices in certain future. Bearing that in mind there are three basic and characteristic types of risk exposures: translation exposure, transaction exposure and finally economic exposure. Translation exposure relates to the change in accounting income in balance sheet as a result of exchange rate changes.

Transaction exposure relates to execution of certain transactions, while economic risk exposure includes changes (the negative ones) in expected and in projected future cash flows of a certain company, and therefore, most importantly in its economic value.

There are numerous ways to more or less manage the risk exposures in a company: classic insurance, swap businesses, diversification of business and investment portfolio, futures contracts and forward contracts.

This paper intends to demonstrate the possibilities of econometric modeling, i.e. measuring hedging necessity and its impact in companies.

It is important to mention that there is no, nor can there be, a unique and general hedging model and law for all companies. Every company, taking into account its own specificities creates its own hedging strategy and pursuantly its own model which pay respect to type of business, market share, market position and similar.

[1] University of Dubrovnik – Department of Economics and Business Economics, Lapadska obala 7, 20000 Dubrovnik, Croatia mail: ivo.speranda@unidu.hr

Just as every company needs to determine its optimal hedging strategy which depends on numerous specific and variable parameters, the measuring, that is defining the impact of protection or hedging is also specific for every company and it depends on current conditions under which the company operates.

The most common and the most widely used method of hedging impact assessment is regression method including its variations (linear, exponential).

Relation between hedging and company's competitiveness is well demonstrated in the paper of American scientists Christine Parlour (University of California) and Tingjun Liu-a (Arizona State University) under symptomatic title: „Hedging and Competition" (Parlour and Liu, 2008; 148-161) in which authors question the possibilities of direct hedging of company's cash flow and assume that it is being done in order to reduce the degree of risk in business, but simultaneously it increases the company's risk on financial markets as a result of using protection instruments, that is hedging (of options of different types and categories).

The purpose of this paper is, first of all, to analyze specific factors what might impact companies' business results i.e. cash flow, and to point out at the new analytical indicators of risk analysis of cash flow and the methods of protection in order to sustain and improve company's success by using mentioned |Z| indicator.

The goal of this paper is in performing and promoting hedging in general business operations by explaining and affirming the indicator of the degree of hedging necessity as an analytical tool.

And finally,the hypothesis, brought out in this paper,runs like this: *usage of the indicator of the degree of hedging necessity i.e. |Z| indicator will contribute to the adequate use of hedging as a protecting tool against risk significantly and thus the entire company's business success will be improved considerably.*

2. ASSESSMENT OF MODEL PARAMETERS

The term assessment of parameters of linear regression denotes calculation of value of parameter in a way that given direction represents approximation or relationship of phenomena in question.

In order to assess the parameters of regression model, one should firstly define the desirable model and its elements and assumptions.

Simple linear regression should be used to build a model which shows impact and necessity of hedging on forward markets for protection against sudden and unpredictable price movements on global market.

Data of the Atlantska plovidba Ltd[ii] from Dubrovnik, a respectable and successful company whose main activity is maritime transport, but also deals with tourism (hotel industry and charter air transport[iii]) are taken for the entry data.

The company obviously operates on international market and is thus exposed to currency risk, mostly to the risk related to the movements of the U.S. dollar as the most part of company's income is realized in that currency.

On the other hand, we can witness a high degree of dollar volatility which endangers the business success of the shipping company.

EBIT (**E**arnings **B**efore **I**nterest & **T**ax), representing business success of a company and its earning potential is taken here as a measure of business success.

3. MODEL ELEMENTS

Quartile EBIT information of Atlantska plovidba, in the period from 1998 to 2008 and appropriate averages of the U.S. dollar movements in relation to kuna are taken for the model purposes.

Independent variable

Table 1: Average quartile exchange rate USD/KN in the period from 1998 – 2008.

n	Currency (kn)
1	6,3991
2	6,4528
3	6,4011
4	6,2002
5	6,6498
6	7,1804
7	7,2545
8	7,3623
9	7,8124
10	8,2389
11	8,3593
12	8,7000
13	8,2948
14	8,4973
15	8,2837
16	8,2904
17	8,5109
18	8,0507
19	7,4812
20	7,4439
21	7,0687
22	6,6512
23	6,6771
24	6,4229
25	6,0876
26	6,1702
27	6,0431
28	5,8364
29	5,7265
30	5,8244
31	6,0366
32	6,2095
33	6,1092
34	5,7994
35	5,7300
36	5,7125
37	5,6204
38	5,4577
39	5,3211
40	5,0589
41	4,8699
42	4,6452
43	4,7777
44	5,4474

Source: *http://www.hnb.hr/tecajn/h080111.htm*

Dependent variable

Table 2: Quartile amounts of EBIT for the period of 1998 – 2008. (in 000 kn).

EBIT (000 kn)	n
-18.552	1
-21.501	2
-7.600	3
-9.023	4
-14.540	5
-11.818	6
-9.009	7
-15.619	8
-8.742	9
-11.250	10
-9.308	11
-1.066	12
-4.796	13
-7.502	14
-8.835	15
-20.587	16
-16.374	17
-11.601	18
-18.025	19
-8.186	20
-6.789	21
3.358	22
6.106	23
21.98	24
15.346	25
39.937	26
24.164	27
47.541	28
56.128	29
224.222	30
217.062	31
58.563	32
26.858	33
33.254	34
185.200	35
187.542	36
98.752	37
102.587	38
101.258	39
99.771	40
279.749	41
156.863	42
344.325	43
-20.569	44

Source: financial archives of Atlantska plovidba Ltd Dubrovnik

Basic assumption is that changes in exchange rate significantly affect the size of realized EBIT. For this model purposes, other influences on EBIT are neglected in order to be able to observe and measure only the effects of changes in exchange rate. Thus, the exchange rate is marked as independent variable (X) and the measure of EBIT as dependent one (Y).

Table 3: Movements of USD/KN exchange rates and amounts of quartile EBIT in the period of 1998–2008.

KN/$ EXCHANGE RATE AND EBIT FOR THE PERIOD OF 1998-2008. (quarterly)		
n	The exchange rate (X) – exchange rate is arithmetic mean of monthly averages for each quarter	EBIT (Y) u 000 kn
1	6,3991	-18.552
2	6,4528	-21.501
3	6,4011	-7.600
4	6,2002	-9.023
5	6,6498	-14.540
6	7,1804	-11.818
7	7,2545	-9.009
8	7,3623	-15.619
9	7,8124	-8.742
100	8,2389	-11.250
11	8,3593	-9.308
12	8,7000	-1.066
13	8,2948	-4.796
14	8,4973	-7.502
15	8,2837	-8.835
16	8,2904	-20.587
17	8,5109	-16.374
18	8,0507	-11.601
19	7,4812	-18.025
20	7,4439	-8.186
21	7,0687	-6.789
22	6,6512	3.358
23	6,6771	6.106
24	6,4229	21.981
25	6,0876	15.346
26	6,1702	39.937
27	6,0431	24.164
28	5,8364	47.541
29	5,7265	56.128
30	5,8244	224.222
31	6,0366	217.062
32	6,2095	58.563
33	6,1092	26.858
34	5,7994	33.254
35	5,7300	185.200
36	5,7125	187.542
37	5,6204	98.752
38	5,4577	102.587
39	5,3211	101.258
40	5,0589	99.771
41	4,8699	279.749
42	4,6452	156.863
43	4,7777	344.325
44	5,4474	-20.569

Source: http://www.hnb.hr/tecajn/h080111.htm and financial archives of AP Ltd.-Dubrovnik

Given data point out two things: firstly, changes in exchange rate affect the realized EBIT and therefore the financial business results, and secondly the business results are better if the dollar exchange rate is lower, which could have been concluded from the nature of the business activities of the observed company. By using statistic package within Microsoft Office the results are as follow:

- Correlation coefficient (r) = -0,665
- Coefficient of determination (R^2) = 0,443

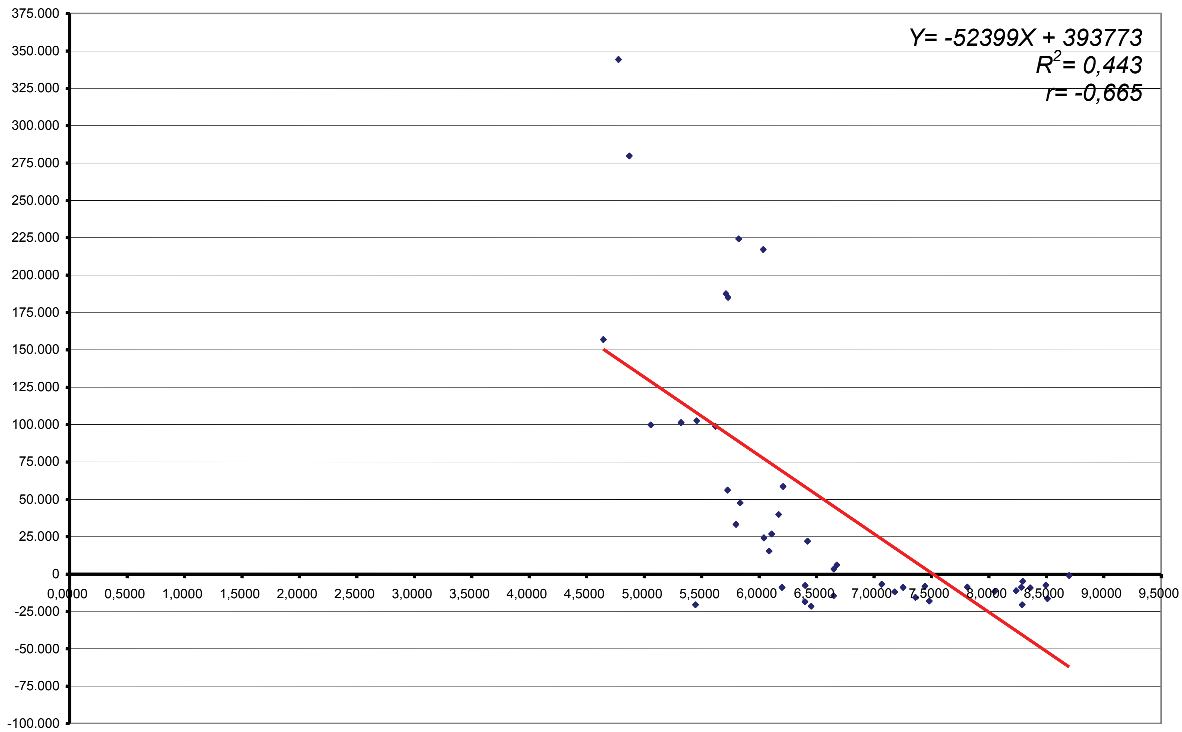
Given coefficients point out the following:

- Correlation coefficient (r) is negative in range from 0,5 to 0,8 which, according to Chaddock's scale (Chaddock,1925; 248;303) demonstrates significant, but negative correlation of observed phenomena, meaning that the increase of one variable (x) benefits from the linear fall of the other variable (y).
- Coefficient of determination (R^2) shows the existence of approximately 44 % of mutual factors among the observed sizes, or in other words: around 44 % of variation (changes) of EBIT is explained by the changes in the observed exchange rate. Moreover, this coefficient proves that hedging is the appropriate protection measure. Namely, if hedging is used and thus negative influences of exchange rate variation to the EBIT measure is annulled, such a protection would be efficient in the very size of coefficient of determination, as the risk is decreased for that size (44 %), i.e. its variant.

3.1 Basic Model or Model A

Graphically illustrated relations of movement changes in dollar exchange rate in relation to kuna and quartile changes of EBIT in the observed period are as follow:

Figure 1: The relation of exchange rate and EBIT in the period from 1998 to 2008



Source: author's calculation

On the grounds of one decade's historical data, the estimated regression model has the following form:

$$Y = -52.399\,X + 393.773 \quad (\text{MODEL } A) \qquad (1)$$

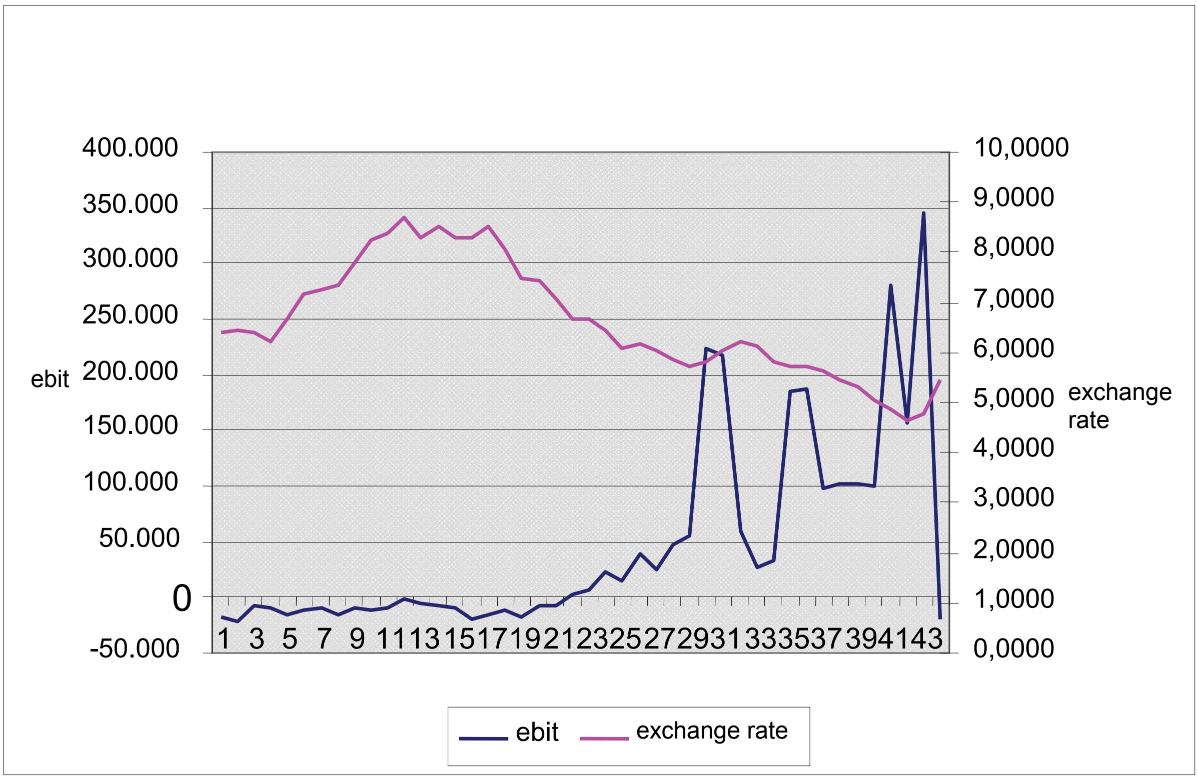
The size Y represents the dependent variable, i.e. value of EBIT that we want to protect against negative effects of changes of dollar exchange rate in relation to kuna. The size X represents the future changes of dollar and kuna exchange rates. Model *A* is obviously not good enough as there are relatively significant deviations of original data in relation to estimated direction (Fig. 1). In order for model to improve, it is necessary to arrange original data in a way that the relations among them are not changed.

3.2 Improved Model or Model B

Since the previous model does not entirely satisfy the original data, in the following model we will try to find the form of estimated curve, i.e. the model which, in satisfactory degree of deviation follows the scatter of original data.

In order to comply with that condition, the adequate exponential function of the general form: $Y = a \times b'$ should be found and the original data should be adequately arranged.

Figure 2: Movement of EBIT and dollar exchange rate



Source: author's calculation

The previous graph which illustrates simultaneous movement of dollar exchange rate and EBIT, demonstrates negative correlation of those two sizes, i.e. it is evident that EBIT increases when dollar exchange rate has a descending trend.

Table 4: Base indices of original data

n	EBIT (Y) in 000 kn	Currency (X) -	B Y	B X	log BY	log BX
1	-18.552	6,3991	100,0000	100,0000	2	2
2	-21.501	6,4528	84,1041	100,8392	1,924817	2,003629
3	-7.600	6,4011	159,0341	100,0313	2,20149	2,000136
4	-9.023	6,2002	151,3637	96,8918	2,180022	1,986287
5	-14.540	6,6498	121,6257	103,9177	2,085025	2,01669
6	-11.818	7,1804	136,2980	112,2095	2,134489	2,05003
7	-9.009	7,2545	151,4392	113,3675	2,180238	2,054489
8	-15.619	7,3623	115,8096	115,0521	2,063745	2,060895
9	-8.742	7,8124	152,8784	122,0859	2,184346	2,086666
10	-11.250	8,2389	139,3596	128,7509	2,144137	2,10975
11	-9.308	8,3593	149,8275	130,6324	2,175592	2,116051
12	-1.066	8,7000	194,2540	135,9566	2,28837	2,1334
13	-4.796	8,2948	174,1483	129,6245	2,240919	2,112687
14	-7.502	8,4973	159,5623	132,7890	2,20293	2,123162
15	-8.835	8,2837	152,3771	129,4510	2,18292	2,112105
16	-20.587	8,2904	89,0308	129,5557	1,94954	2,112457
17	-16.374	8,5109	111,7400	133,0015	2,048209	2,123857
18	-11.601	8,0507	137,4677	125,8099	2,138201	2,099715
19	-18.025	7,4812	102,8407	116,9102	2,012165	2,067852
20	-8.186	7,4439	155,8754	116,3273	2,192778	2,065682
21	-6.789	7,0687	163,4056	110,4640	2,213267	2,043221
22	3.358	6,6512	218,1005	103,9396	2,338657	2,016781
23	6.106	6,6771	232,9129	104,3444	2,367194	2,018469
24	21.981	6,4229	318,4832	100,3719	2,503087	2,001612
25	15.346	6,0876	282,7188	95,1321	2,451355	1,978327
26	39.937	6,1702	415,2706	96,4229	2,618331	1,98418
27	24.164	6,0431	330,2501	94,4367	2,518843	1,975141
28	47.541	5,8364	456,2581	91,2066	2,659211	1,960026
29	56.128	5,7265	502,5442	89,4891	2,701174	1,95177
30	224.222	5,8244	1408,6136	91,0190	3,148792	1,959132
31	217.062	6,0366	1370,0194	94,3351	3,136727	1,974674
32	58.563	6,2095	515,6695	97,0371	2,712371	1,986938
33	26.858	6,1092	344,7715	95,4697	2,537531	1,979865
34	33.254	5,7994	379,2475	90,6284	2,578923	1,957264
35	185.200	5,7300	1198,2751	89,5438	3,078557	1,952036
36	187.542	5,7125	1210,8991	89,2704	3,083108	1,950707
37	98.752	5,6204	732,2984	87,8311	2,864688	1,943648
38	102.587	5,4577	752,9700	85,2886	2,876778	1,930891
39	101.258	5,3211	745,8064	83,1539	2,872626	1,919883
40	99.771	5,0589	737,7911	79,0564	2,867933	1,897937
41	279.749	4,8699	1707,9183	76,1029	3,232467	1,881401
42	156.863	4,6452	1045,5315	72,5915	3,019337	1,860886
43	344.325	4,7777	2055,9994	74,6621	3,313023	1,8731
44	-20.569	5,4474	89,1279	85,1276	1,950013	1,93007
	47.029	6,6174				
	89038,58	1,130837				

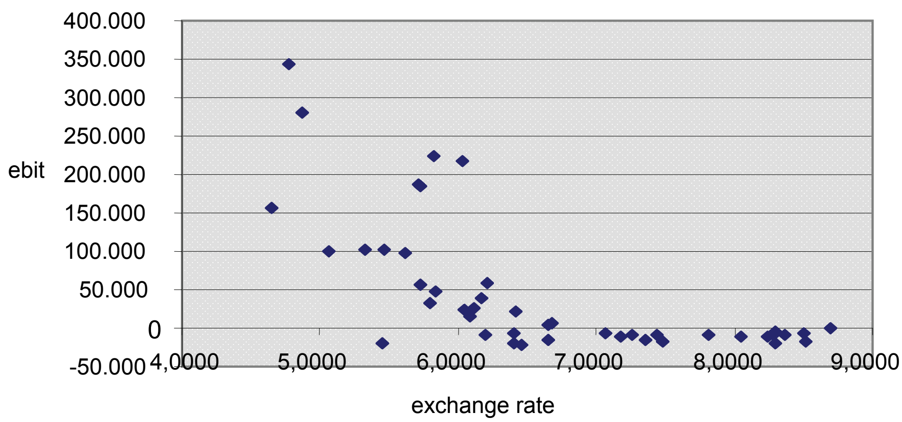
Source: author's calculation

Table 5: Analysis of indexed data

	EBIT (Y) u 000 kn	Tečaj (X)-	B Y	B X	log BY	log BX
Ebit (Y) u 000 kn	1					
Tečaj (X) –	-0,665491	1				
B Y	1	-0,66549	1			
B X	-0,665491	1	-0,66549	1		
log BY	0,9294671	-0,72627	0,929467	-0,72627	1	
log BX	-0,697284	0,996301	-0,69728	0,996301	**-0,74883**	1

Source: author's calculation

Figure 3: Scatter diagram of original data

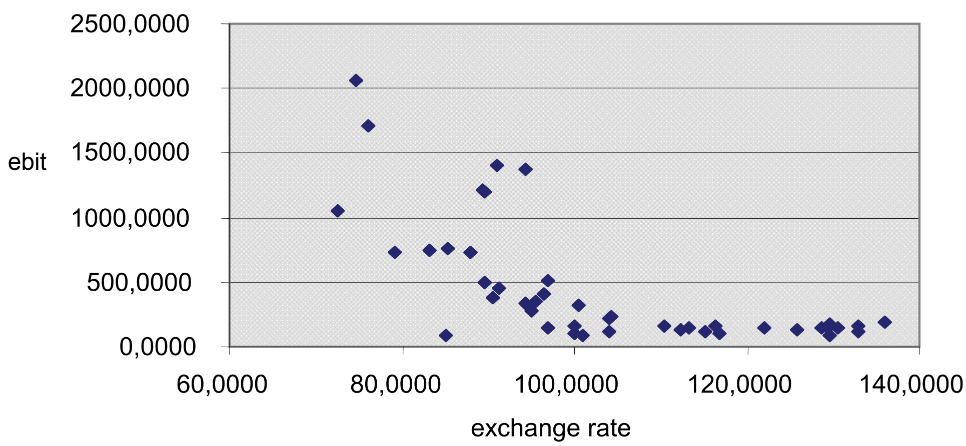


Source: author's calculation

Previous tables contain the base of original and indexed data required for modeling.[iv]

Fig. 4: Scatter diagram of indexed data

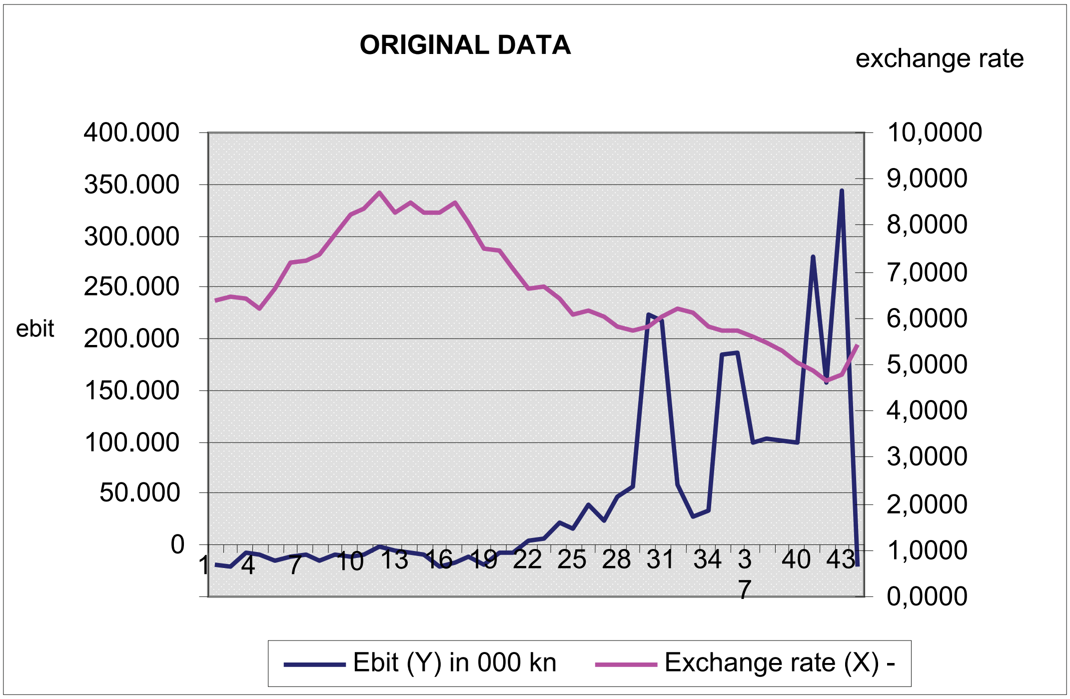
BASE INDICES



Source: author's calculation

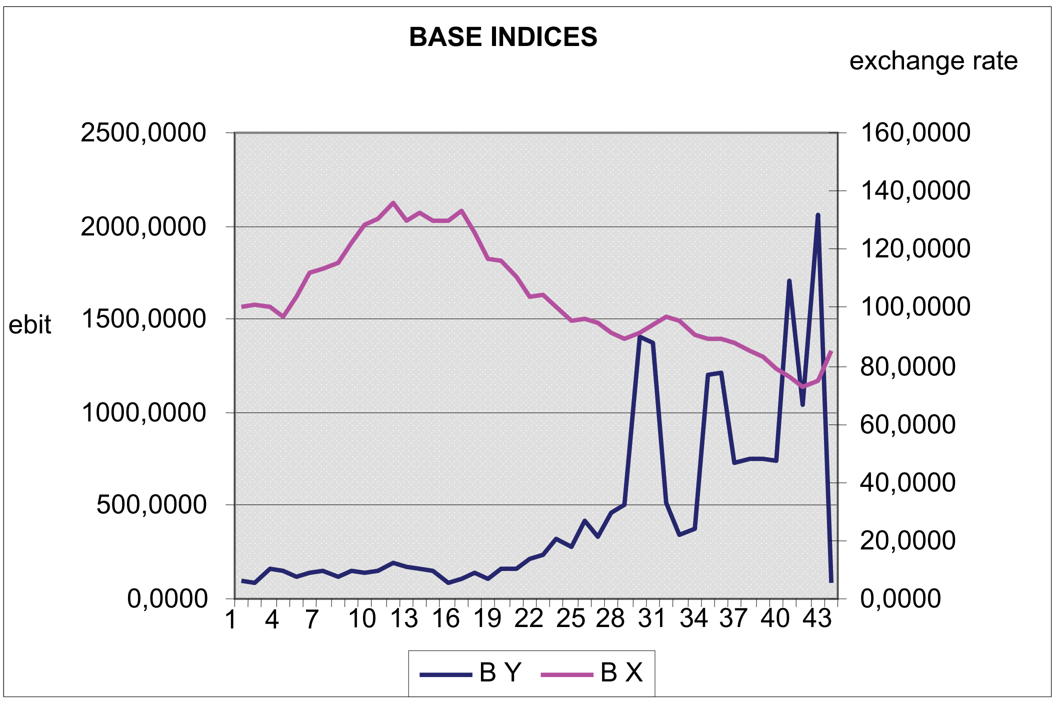
By comparing scatter diagram of original data (Fig. 3) and scatter diagram of indexed (Fig. 4) it can be concluded that the indexing process did not derange the rhythm of distribution.

Figure 5: Movement of curves of original data



Source: author's calculation

Fig. 6: Movement of curves of indexed data



Source: author's calculation

From the previous tables and graphs (Figs. 5 and 6) it is evident that essence and character of phenomenon has not slightly changed during conversion of original data into base indices because the relations between phenomena remained identical. This conclusion enables the construction of the regression model (Model *B*).

Table 6: Values of logarithmized data

log BY	log BX	Byc		B Y	B X
2	2	310,2968	2,491777	100	100
1,924817	2,003629	300,0249	2,477157	84,10414	100,8392
2,20149	2,000136	309,9064	2,491231	159,0341	100,0313
2,180022	1,986287	352,3854	2,547018	151,3637	96,89175
2,085025	2,01669	265,7948	2,424546	121,6257	103,9177
2,134489	2,05003	195,0937	2,290243	136,298	112,2095
2,180238	2,054489	187,1896	2,272282	151,4392	113,3675
2,063745	2,060895	176,391	2,246476	115,8096	115,0521
2,184346	2,086666	138,8876	2,142664	152,8784	122,0859
2,144137	2,10975	112,117	2,049671	139,3596	128,7509
2,175592	2,116051	105,7525	2,024291	149,8275	130,6324
2,28837	2,1334	90,03315	1,954402	194,254	135,9566
2,240919	2,112687	109,1043	2,037842	174,1483	129,6245
2,20293	2,123162	99,00229	1,995645	159,5623	132,789
2,18292	2,112105	109,6944	2,040184	152,3771	129,451
1,94954	2,112457	109,3377	2,03877	89,03083	129,5557
2,048209	2,123857	98,36655	1,992847	111,74	133,0015
2,138201	2,099715	123,0546	2,090098	137,4677	125,8099
2,012165	2,067852	165,3669	2,218448	102,8407	116,9102
2,192778	2,065682	168,7302	2,227193	155,8754	116,3273
2,213267	2,043221	207,8127	2,317672	163,4056	110,464
2,338657	2,016781	265,5695	2,424178	218,1005	103,9396
2,367194	2,018469	261,4441	2,417379	232,9129	104,3444
2,503087	2,001612	305,691	2,485283	318,4832	100,3719
2,451355	1,978327	379,3861	2,579081	282,7188	95,13213
2,618331	1,98418	359,3382	2,555503	415,2706	96,42293
2,518843	1,975141	390,7661	2,591917	330,2501	94,43672
2,659211	1,960026	449,5763	2,652803	456,2581	91,20658
2,701174	1,95177	485,3556	2,68606	502,5442	89,48915
3,148792	1,959132	453,3192	2,656404	1408,614	91,01905
3,136727	1,974674	392,4638	2,5938	1370,019	94,33514
2,712371	1,986938	350,2642	2,544396	515,6695	97,03708
2,537531	1,979865	374,0115	2,572885	344,7715	95,46968
2,578923	1,957264	461,2426	2,663929	379,2475	90,62837
3,078557	1,952036	484,1624	2,684991	1198,275	89,54384
3,083108	1,950707	490,165	2,690342	1210,899	89,27037
2,864688	1,943648	523,3328	2,718778	732,2984	87,8311
2,876778	1,930891	589,0729	2,770169	752,97	85,28856
2,872626	1,919883	652,3992	2,814513	745,8064	83,15388
2,867933	1,897937	799,6785	2,902915	737,7911	79,05643
3,232467	1,881401	932,2393	2,969527	1707,918	76,10289
3,019337	1,860886	1127,639	3,05217	1045,531	72,59146
3,313023	1,8731	1006,855	3,002967	2055,999	74,66206
1,950013	1,93007	593,5726	2,773474	89,12786	85,1276

Source: author's calculation

Table 7: Regression analysis indices

Summary Output - Regression Statistics	
Multiple R	0,748832799
R Square	0,560750561
Adjusted R Square	0,550292241
Standard Error	0,270157928
Observations	44

Source: author's calculation

Table 8: Statistical analysis of model data /ANOVA/

ANOVA	df	SS	MS	F	Significance F			
Regression	1	3,91330075	3,913301	53,6177	5,0449E-09			
Residual	42	3,06538286	0,072985					
Total	43	6,9786836						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	10,54835	1,10555805	9,541199	4,5E-12	8,317243353	12,7794562	8,31724335	12,779456
log BX	-4,028286	0,55013139	-7,32241	5E-09	-5,13849635	-2,9180762	-5,13849635	-2,918076

Source: author's calculation

The value of estimated parameters can be determined upon previous analysis.

Regression (MODEL *B*)

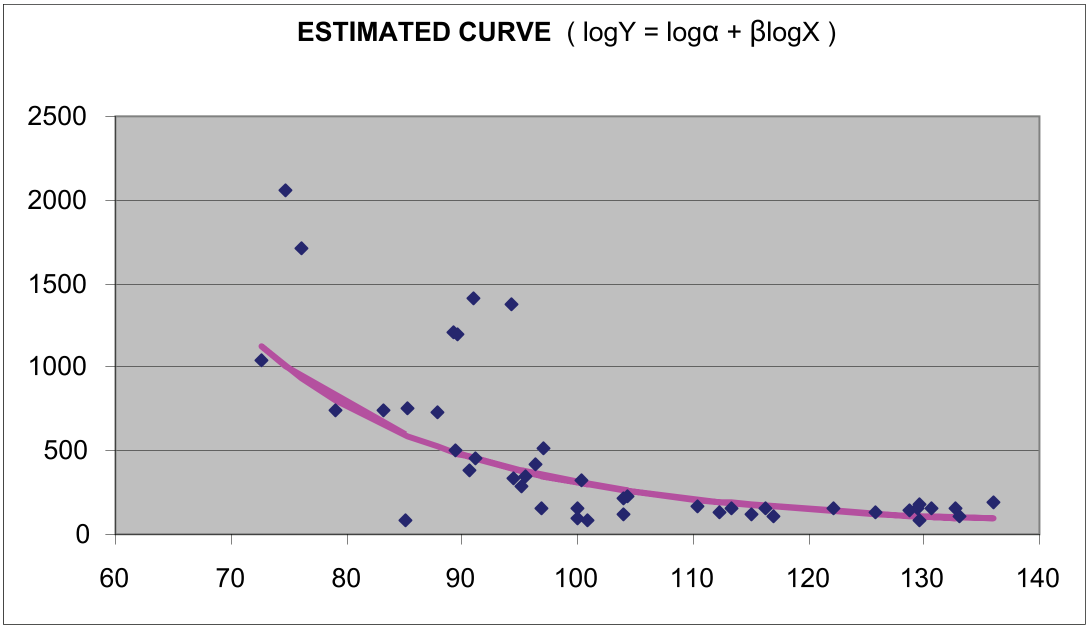
$$Y = \alpha \cdot x^{\beta}$$
$$\log Y = \log \alpha + \beta \cdot \log x \quad (2)$$

Where:
Y=values of EBIT
x= USD/KN exchange rate
α= parameter
β= parameter

Value of parameters is expressed as follows:

- $\alpha = 35346774650$
- $\beta = -4{,}02828627$

Figure 7: Interdependence of base indices of exchange rate (x) and EBIT value (y)



Source: author's calculation

The model is built on the grounds of base indices of original data in order to avoid inevitable negative data in the values of dependent variable (EBIT).

From the exponential the model was transformed into logarithmic-linear form (log y) in order to assess model parameters.

Explanation for such a model is: *when index of change in exchange rate changes (increases) for 1 %, the value of base index of EBIT changes (decreases) for 4,03 %.* Coefficient β represents the assessment of movement of dependent variable and, at the same time is the coefficient of elasticity according to the rule that elasticity of homogeneous exponential function is always equal to the exponent's value. (Martić,1987; 96-105) So, β demonstrates as well how much financial results of a certain company depend on changes in exchange rates. Since coefficients of elasticity are always absolute numbers, it means that the numbers can be compared and ranked.

Table 9: Results of the DW test

Durbin-Watson Statistic =		0,91176453	DW
1,475	1,566		
0,911765	<	1,475	

Source: author's calculation

Since there is a time sequence in this model, the apparition of autocorrelation, which in this case is around 0,91176 was expected. Since the values of DW test are in the range of 0 to 4, and the size of indicator is less than 2 (DW≤2), the presence of autocorrelation is obvious, but can be tolerated.

Coefficient of determination is 0,5608, which point to the fact that more than 56 % of variations of dependent variable is explained by the changes of independent variable. In other words, the changes in exchange rate caused the 56 % of changes in the EBIT values.

It can be concluded that the changes in exchange rate affect the financial results (Cash-Flow), i.e. EBIT. How and how much? It is the indicator β that answers those questions, while coefficient of determination answers the question about the size of protection, i.e. whether hedging is successful.

General form of the model expressed as:

$$y = \alpha \cdot x^{\beta} \qquad (3)$$

answers the above questions, but each company needs to do its own calculation in order to get quality parameters and reliable answers.

Coefficient of determination (R^2) is squared coefficient of correlation (r) and it indicates model quality. In this concrete case we are dealing with the profit and loss account, i.e. cash flow and analysis of the way one size ($/Kn) affects the other (EBIT). Since EBIT is composite measure influenced by large number of factors (price policy, investment policy, company's size, activities, market share, human resources, technical equipment, tax policy etc.) value of coefficient of determination $R^2 \geq 0{,}33$ can be acceptable, i.e. that $r \geq 0{,}57$ which denotes the relationship between variables is at least of middle strength.[v]

This individual model is used to determine the value of base parameters R^2 and β which demonstrate strength and quality of protection, i.e. hedging.

Mathematical form of parameters is: β is both exponent in model function and coefficient of elasticity[vi], i.e. $E_{y,x} = \beta$

Mathematically, β is expressed as: $y = \alpha \cdot x^{\beta} \, / \log$ (4)

$$\log y = \log \alpha + \beta \cdot \log x$$

$$-\beta \cdot \log x = -\log y + \log \alpha$$

$$\beta \cdot \log x = \log y - \log \alpha$$

$$\beta = \frac{\log y - \log \alpha}{\log x} \qquad (5)$$

R^2 is in fact the squared coefficient of correlation, i.e. ratio of the sum of the square of deviation explained by regression and sum of squared of total deviations[vii], or in mathematical formula:

$$R^2 = \frac{\sum_{i=1}^{n} (\hat{y}_i - \bar{y})^2}{\sum_{i=1}^{n} (y_i - \bar{y})^2}, 0 \leq R^2 \leq 1 \qquad (6)$$

4. INDICATOR OF THE DEGREE OF HEDGING NECESSITY |Z|

Previous example showed the meaning of coefficient of determination and coefficient of elasticity. Both indicators demonstrate the relationship between the observed variables and the way and to which extent the independent variable affects the dependent one.

Product of those two coefficients demonstrates how important it is to protect (to hedge) the dependent variable against the changes in independent variable, in this concrete case to protect the EBIT against changes in exchange rate.

Consequently: $|Z| = R^2 \times \beta$ *(7)*

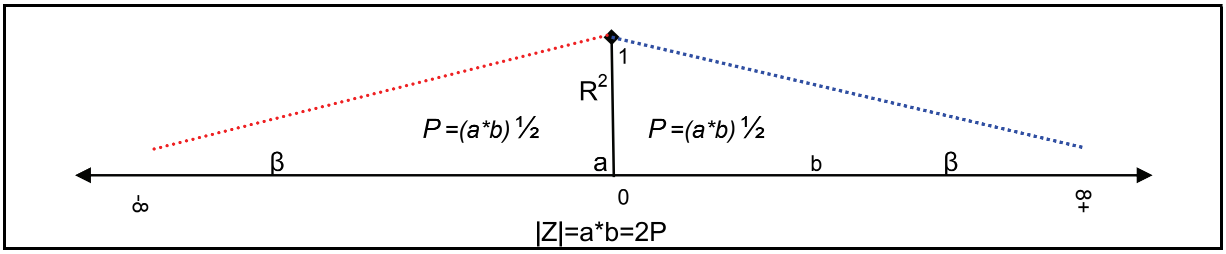
The meaning of symbols in the above relation is: IZI relates to the degree of hedging necessity; R^2 is the coefficient of determination or the ratio of explained and total deviations; β is coefficient of elasticity. Detailed mathematical explanation of the above relation, by using the relations number (*5*)and (*6)* is:

$$\frac{\sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2} \cdot \frac{(\log y - \log \alpha)}{\log x} = |Z| \qquad (8)$$

Indicator IZI is synthetic absolute indicator representing the product of quotient of sum of squares of deviations of estimated values in relation to arithmetic mean and sum of squares of deviation of original results in relation to arithmetic mean of regression model and coefficient of elasticity of homogeneous function, as it is obvious that Y increases / decreases when X increases / decreases, even more intensively when β is bigger.

Coefficient of elasticity value, i.e. β, can become any real number, and coefficient of determination ranges from 0 to 1. Graphic illustration of that relationship would be as in figure 8.

Figure 8: The relationship of coefficient of elasticity ($E_{y,x}$= β) and coefficient of determination (R^2)



Source: author's calculation

So, the value of the indicator IZI is equal to double value of surface (P) of right-angled triangle closed by sides *a* (R^2) and *b* (β) which is correct, as it is an absolute indicator. R^2 is evidently a "corrective" factor, ranging from 0 to 1, it "corrects" the value β. So, coefficient of elasticity is "corrected" by the degree of model reliability.

The bigger absolute amount IZI is, the necessity of hedging is bigger as well, because this indicator shows how strongly the dependent variable reacts to the change of independent one and how important the changes of independent variable are to the changes of the dependent one.

The notation β is taken in this relation because it is expressed like: $E_{y,x}$ = β as already stated on the page 14.

The importance of usage of indicator IZI can be shown by the following examples.

The values of model indicators of determination R^2 and coefficient of elasticity $E_{y,x}$ are:

- R^2 = 0,561
- $E_{y,x}$ = -4,0283

Here are the obtained values in a case when data of some other company[viii] of similar branch like Atlantska plovidba are introduced into the general form of the model $y = \alpha \cdot x^{\beta}$ (Tab.10)

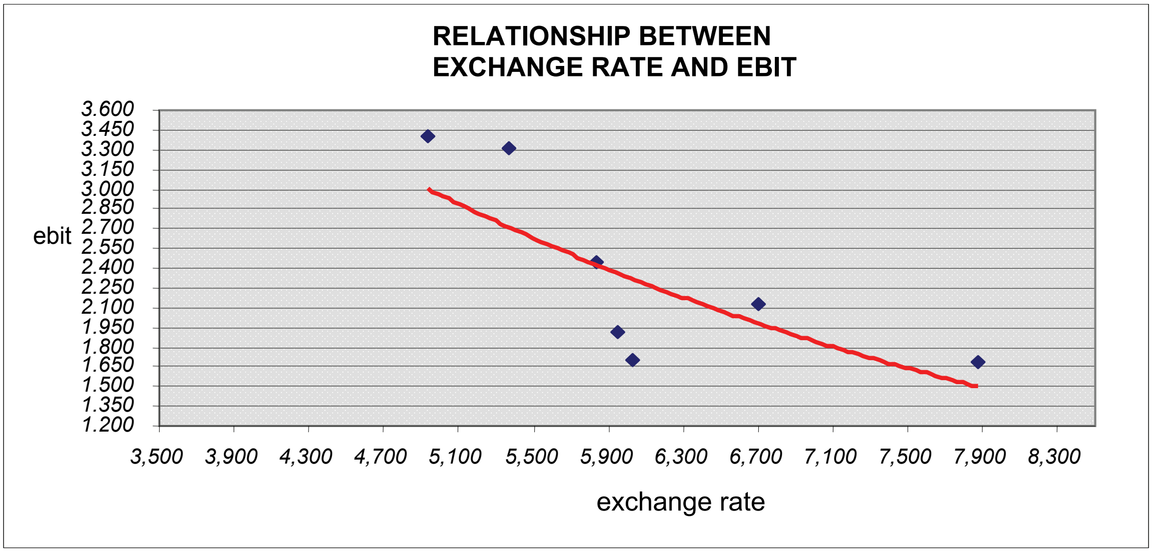
Table 10: Values of changes in exchange rate and EBIT

n	year	Exchange rate Kn/$	EBIT (000)
1	2002	7,872	1.680
2	2003	6,704	2.125
3	2004	6,031	1.705
4	2005	5,950	1.908
5	2006	5,839	2.450
6	2007	5,366	3.313
7	2008	4,934	3.402

Source: author's calculation

General form of the model illustrates the relationship of the observed sizes, in this case the change in dollar exchange rate in relation to kuna and the movement of EBIT.

Figure 9: The relationship of value of exchange rate and EBIT



Source: author's calculation

Values of estimated parameters:

- $R^2 = 0{,}716$
- $E_{y,x} = -1{,}9209$

The necessity and impact of hedging cannot be determined only based upon the calculated parameters R^2;Ey,x, i.e. β, because in the first case β is bigger and R^2 smaller, and in the other case it is opposite.

That is why IZI indicates to the level of hedging necessity of EBIT which is in the example I (Tab. 11) significantly bigger, obviously by being strongly influenced by the coefficient of elasticity which is double its size.

Table 11: Values of parameters of IZI indicator

Example	R^2	β	|Z|
I	0,561	-4,0283	2,260
II	0,716	-1,9209	1,375

Source: author's calculation

IZI indicator regarded as an indicator of hedging necessity, being the weighted composite indicator in which the coefficient of elasticity is weighted by the coefficient of determination size, is not very worthy unless it is followed by the measure of protection of "threatened" or risky item, or in other words unless it is followed by hedging.

As already stated numerous times, each company needs to calculate adequate parameters of model and accordingly build a calculation of indicator IZI. Which variables will be taken into consideration depends on many factors such as: company's size, business branch, market situation, development policy, fiscal policy, macroeconomic movements etc.

5. CONCLUSION

This paper demonstrates the necessity of detailed business analysis in a given time frame of each company. Such an analysis determines the degree of sensitivity of cash flow, i.e. of financial results to cardinal exogenous variable change and defines an adequate econometric model and an indicator of hedging necessity. Econometric model and appropriate indicators |Z| indicate the direction of protection (meaning: what and against what to protect) and it provides an optimal hedging strategy.

Given model and indicator can be useful like an instruction to practical usage in the analysis of business activities as a thorough preparation for selection of adequate protection strategy of cash flow. Theoretically, regression model and indicator IZI represent a benefit to sophisticated techniques of business analysis in modern business.

This paper confirms the thesis that using hedging in regular business of modern companies contributes to better business and insurance of cash flows which grant normal business, development and higher degree of competitiveness, thus, it can be undoubted concluded that the introductory hypothesis is attested and validated.

LITERATURE AND DATA SOURCES

Chaddock, R. E. (1925), *Principles and Methods of Statistics*"(1st Edition), Houghton Miffin Company,The Riverside Press, Cambridge.

Cvitanić, J. and Zapatero, F. (2004), *Introduction to the Economics and Mathematics for Financial Markets*, Student Manual, MIT Press.

Eun, C. S. and Resnick, B.G. (2007),*International Financial Management* (3rd edit.), McGraw – Hill.

Kmenta, J. (1997), *Počela ekonometrije*" (II izdanje), – Mate, Zagreb.

Krugman, P. (1994), "Competitiveness-A Dangerous Obsession", *Foreign Affaiirs*, March/April, Vol. 73, No. 2, 28-44.

Martić, Lj. (1987), *Matematičke metode za ekonomske analize* (I), Udžbenici Sveučilišta u Zagrebu, NN.

Parlour, C. A. and Liu, T (2008), "Hedging & Competition", *Journal of Financial Economics*, 3, December.

http://www.hnb.hr/tecajn/h080111.htm

http://www.pkarchive.org/global/pop.html

Financial Archive of Atlantska Polovidba Ltd.- Dubrovnik, Put Sv.Mihajla 1, Dubrovnik, Croatia, EU

Notes

---

[i] Kuna (HRK) is Croatian currency

[ii] By courtesy of the authorized in Atlantska plovidba Ltd – Dubrovnik, the author got plenty of valuable information and the approval for their publishing.

[iii] Atlantska plovidba Ltd. no longer owns a company for air transport since October 2011.

[iv] Available tools of Microsoft Office package are used in this paper for the statistical analysis.

[v] See: Chaddock R.E.: „Principles and Methods of Statistics“ (1st Edition)- Houghton Miffin Company,The Riverside Press Cambridge, 1925. p.248; p.303

[vi] Proof can be found by looking at: Martić Lj.: “Matematičke metode za ekonomske analize (I)“- Udžbenici Sveučilišta u Zagrebu, NN,1987. p.100.

[vii] See, for an exemple: Kmenta J.: “Počela ekonometrije“ (II izdanje)-Mate d.o.o., Zagreb, 1997.p.240-242.

[viii] In this case the author did not get the company’s approval to publish its name along the data