

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

IVO ŠPERANDA¹

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 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 Ltdⁱⁱ from Dubrovnik, a respectable and successful company whose main activity is maritime transport, but also deals with tourism (hotel industry and charter air transportⁱⁱⁱ) 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 (Earnings Before Interest & Tax), 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 |
| 10 | 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

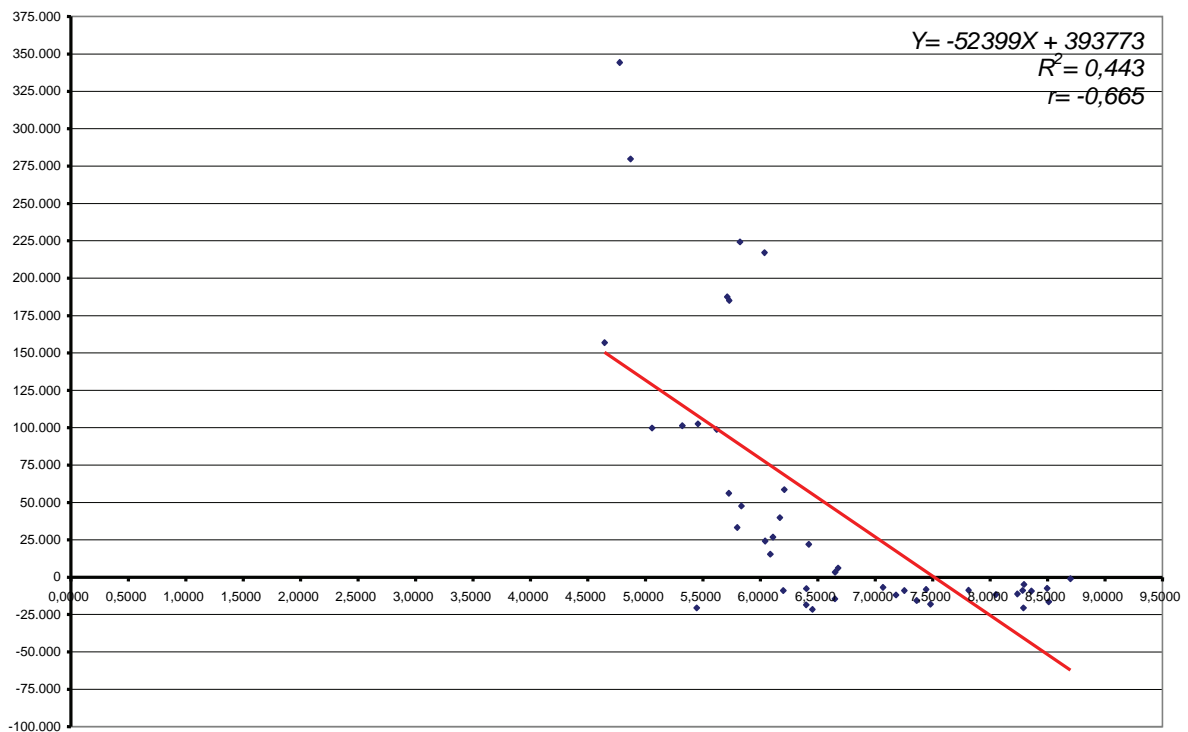
Given coefficients point out the following:

- 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:

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

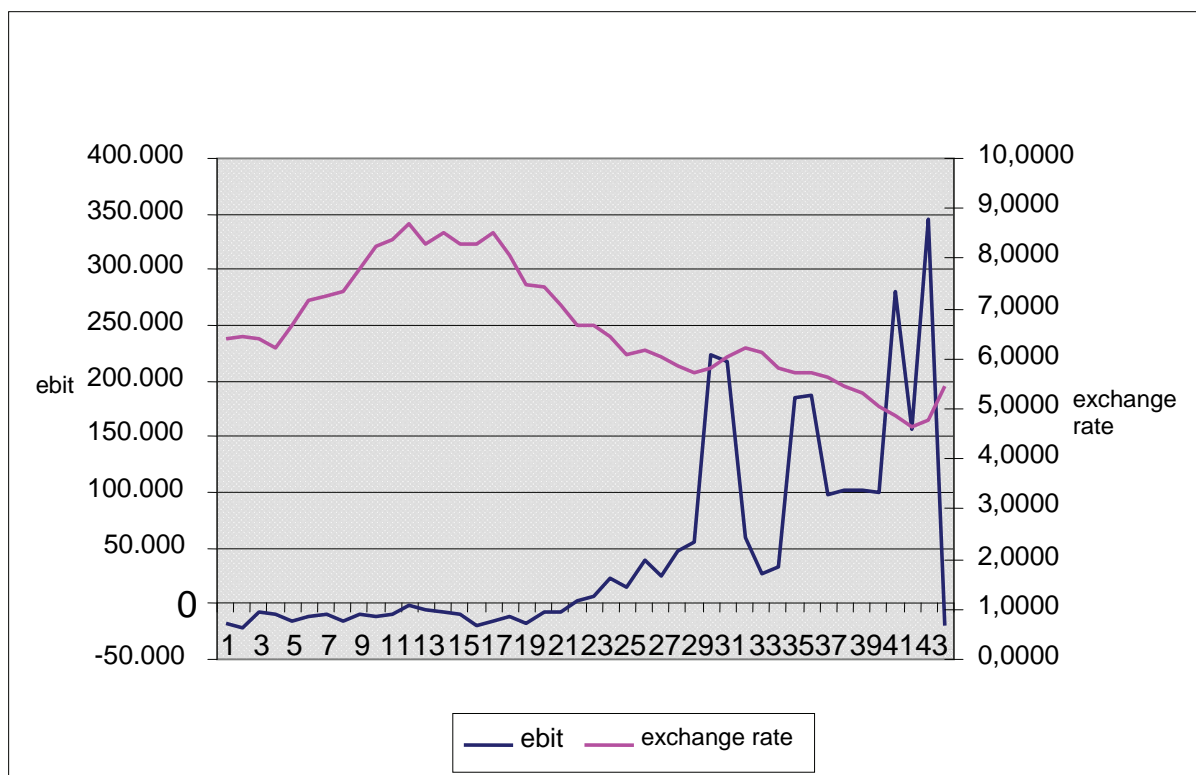
The size Y represents the dependent variable, i.e. value of EBIT that we want to protect against negative effects of changes of dollar exchange rate in relation to kuna. The size X represents the future changes of dollar and kuna exchange rates. Model A is obviously not good enough as there are relatively 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: $Y = a \times b^x$ 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

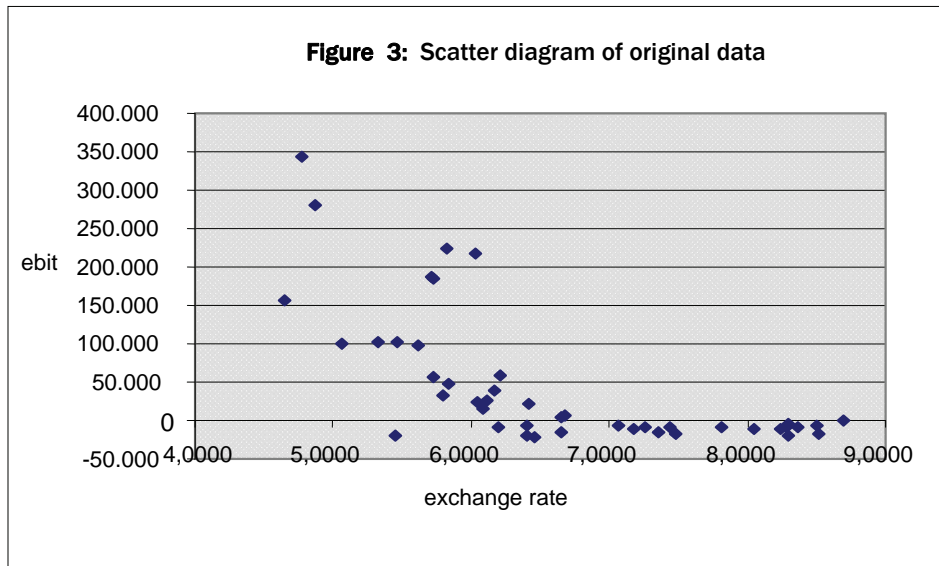
| n | EBIT (Y) in 000 kn | Currency (X) - | B Y | B X | log BY | log BX |
|----|--------------------|----------------|-----------|----------|----------|----------|
| 1 | -18.552 | 6,3991 | 100,0000 | 100,0000 | 2 | 2 |
| 2 | -21.501 | 6,4528 | 84,1041 | 100,8392 | 1,924817 | 2,003629 |
| 3 | -7.600 | 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 |

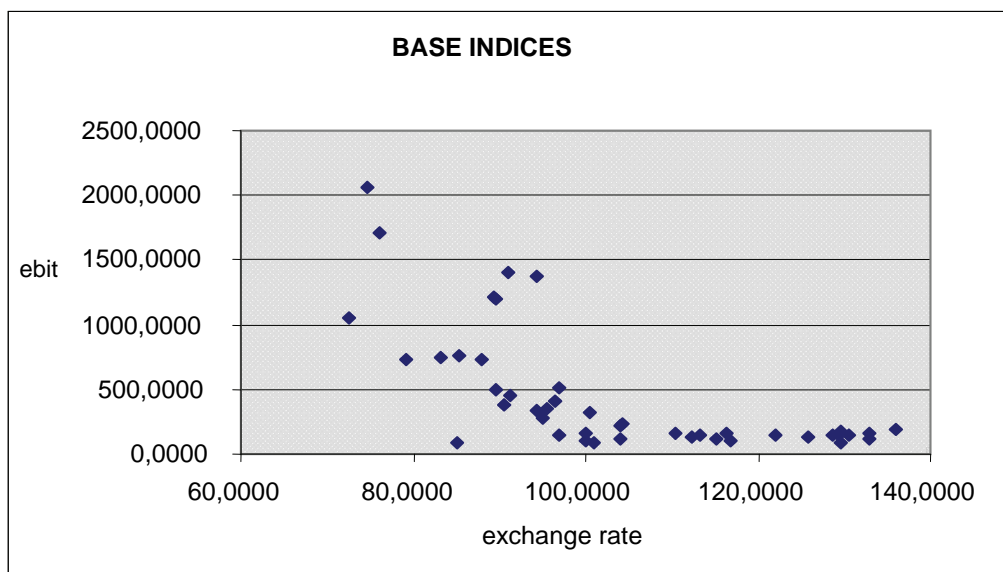
Source: author's calculation



Source: author's calculation

Previous tables contain the base of original and indexed data required for modeling.^{iv}

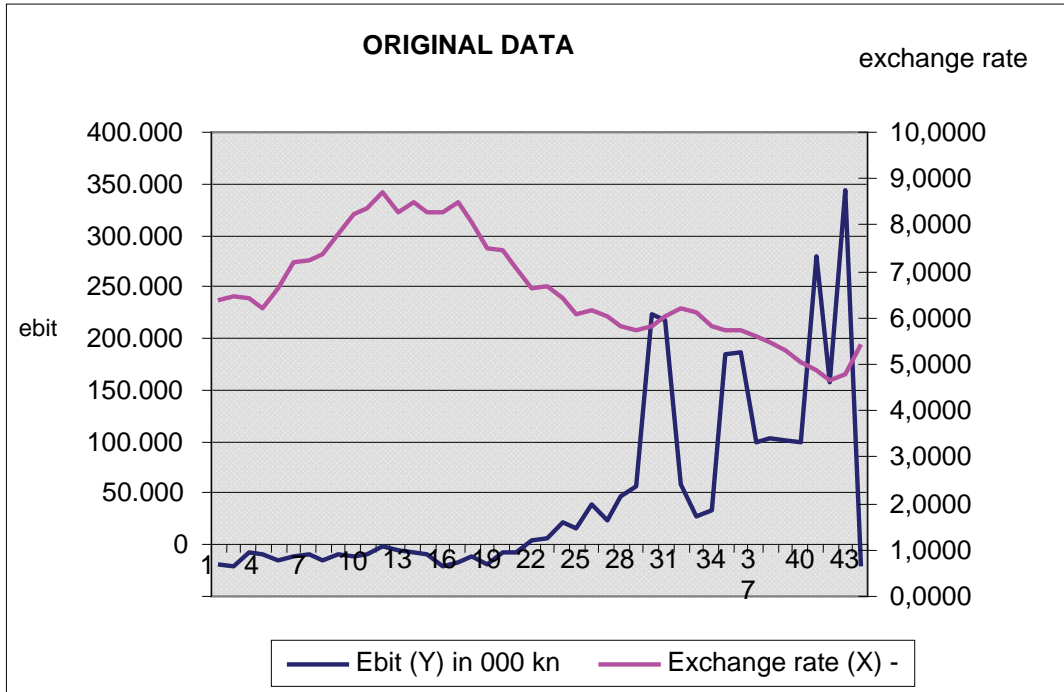
Fig. 4: Scatter diagram of indexed data



Source: author's calculation

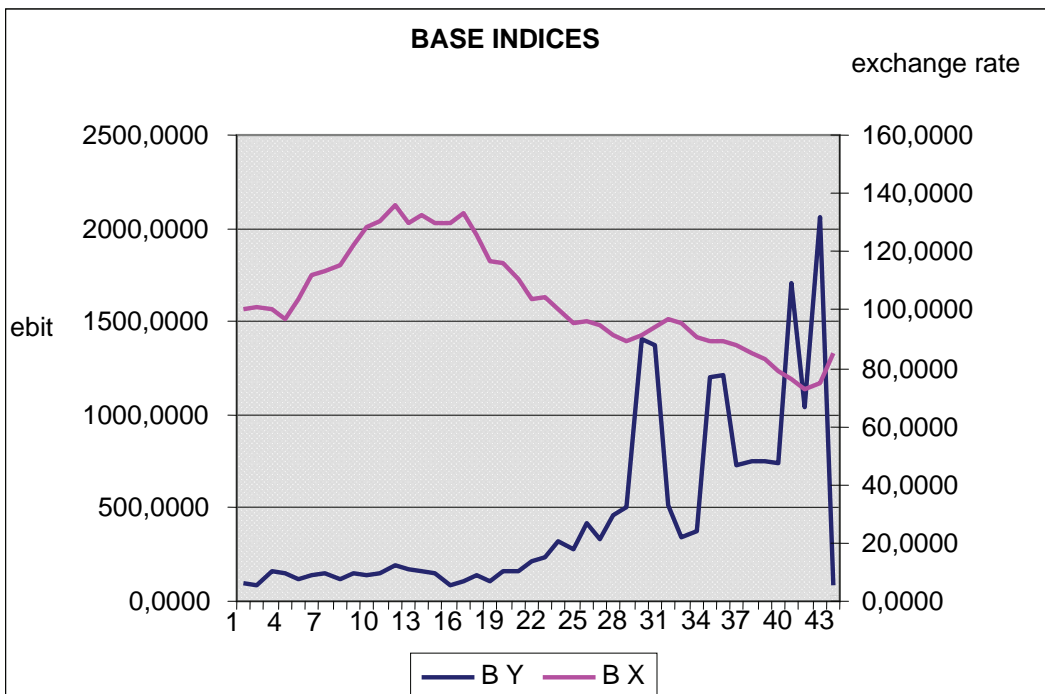
By comparing scatter diagram of original data (Fig. 3) and scatter diagram of indexed (Fig. 4) it can be concluded that the indexing process did not derange the rhythm of distribution.

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% | Upper 95,0% |
| Intercept | 10,54835 | 1,10555805 | 9,541199 | 4,5E-12 | 8,317243353 | 12,7794562 | 12,779456 |
| log BX | -4,028286 | 0,55013139 | -7,32241 | 5E-09 | -5,13849635 | -2,9180762 | -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

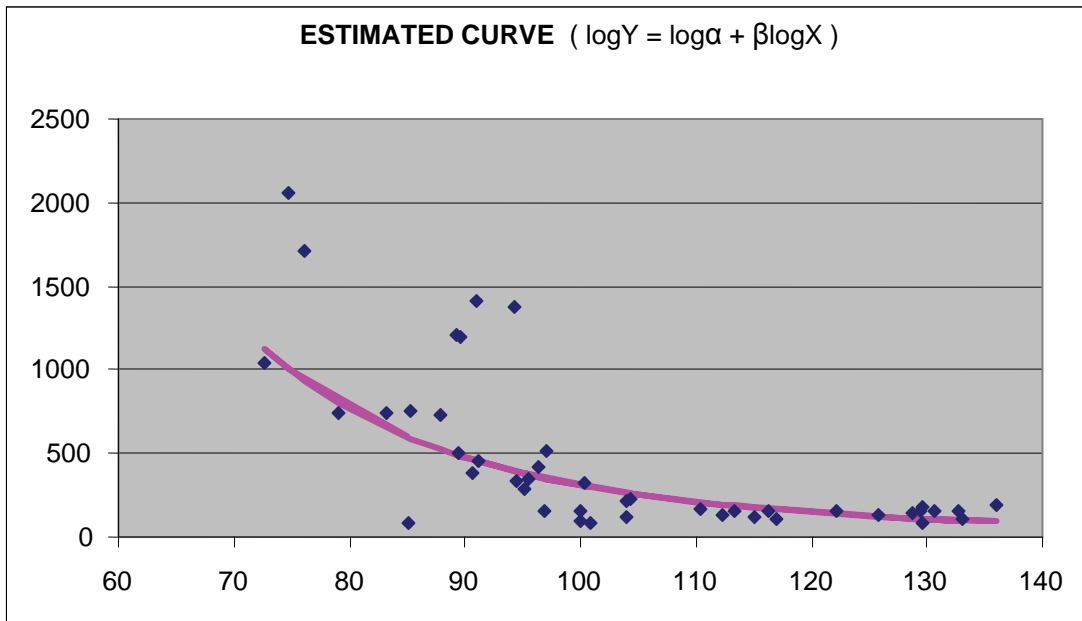
α= parameter

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 ($DW \leq 2$), 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:

$$y = \alpha \cdot x^\beta \quad (3)$$

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)

$$\begin{aligned} \log y &= \log \alpha + \beta \cdot \log x \\ -\beta \cdot \log x &= -\log y + \log \alpha \\ \beta \cdot \log x &= \log y - \log \alpha \end{aligned}$$

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

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:

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

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)

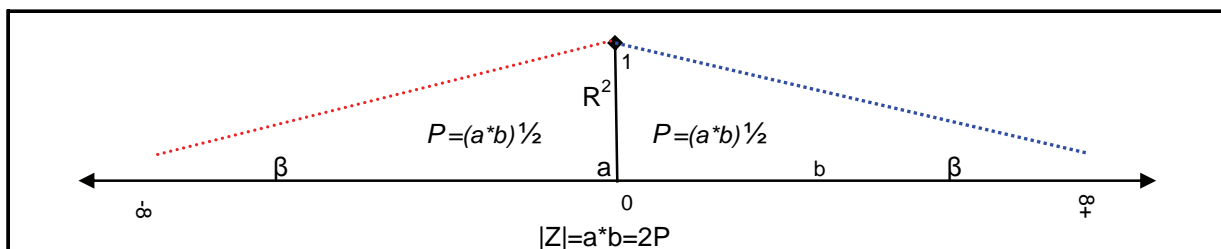
The meaning of symbols in the above relation is: IZI relates to the degree of hedging necessity; R^2 is the coefficient of determination or the ratio of explained and total deviations; β is coefficient of elasticity. Detailed mathematical explanation of the above relation, by using the relations number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

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

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 ($E_{y,x} = \beta$) 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: $E_{y,x} = \beta$ 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 plovdba are introduced into the general form of the model $y = \alpha \cdot x^\beta$ (Tab.10)

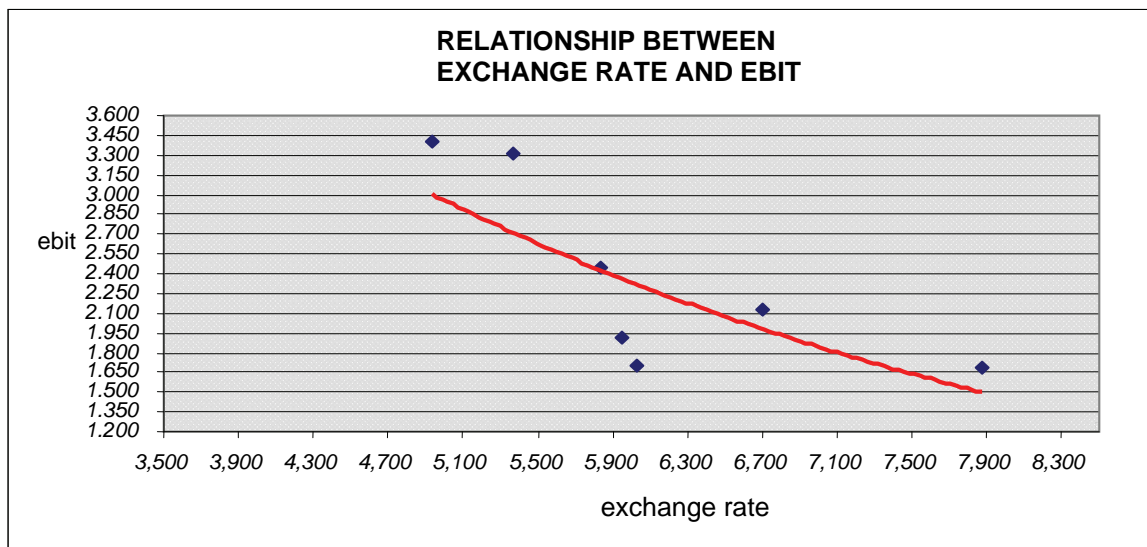
Table 10: Values of changes in exchange rate and EBIT

| 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 $R^2; E_{y,x}$, 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 Mifflin 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 Affairs*, 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 Mifflin 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