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The Impact of Risk Aversion on Individual Investors' Investment Decision-Making Process

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Abstract

As the process of choosing between two or more investment options, the investment decision making process is determined, among others, by the investors' individual preferences. According to the normative models of decision-making investment, decision making is driven by the effort to maximise expected payoffs. The normative theory of utility does not incorporate the assumption of the investor's risk aversion, for a rational investor will always choose the alternative that will maximise individual utility in the conditions of certainty. However, in the conditions of uncertainty and risk, investors tend to show different levels of risk aversion. The application of cost-utility theory in the decision-making process affects the shape of an individual investor's utility function. The decision-making theory analyses a large number of various utility functions, but CARA and CRRA utility functions are regarded as the standard forms of expected utility.

Keywords

Risk aversion, utility function, investment decision making, CARA, CRRA.

Introduction

This introduction will show that the standard forms of expected utility, expressed through CARA and CRRA utility functions, establish different dynamics in investment decision-making. Funds allocation between risky and non-risky assets is established by the choice of the mathematical form of the utility function and implies a different structure of the investor's portfolio. In addition, portfolio structure is additionally determined by the individual risk aversion coefficient. Despite the fact that their decision is described by the same utility function, two investors with different coefficients of risk degree can have completely different portfolio structures.

Empirical research (e.g. MacCrimmon & Wehrung, 1986; Howard, 1988; McNamee & Celona, 1990) support the view that the attitude to risk is related to the value of wealth or the amount of assessed owned by the investor. These characteristics are in accordance with CRRA aversion, but not with the CARA aversion as well. However, CARA utility function (in the form of negative exponential function) is the most frequently used utility function in financial application.

Investment decision-making in the conditions of risk and certainty

Decision making is the process of choosing the avenue of action between several alternatives, in order to solve a particular problem. If it seems that there is only a single way of executing something, it is most likely to be wrong. The decision-making theory is the fundament of decision making. According to this theory, the decision makers always choose the alternative that will maximise the expected value (EV) (Craig & Russell, 2009, p. 146). When considering an alternative offering x monetary units with probability p , the expected value will be

$$EV = px \tag{1}$$

The analysis of formula (1) and the basics of the decision-making theory lead to a conclusion that the decision maker takes a neutral attitude to risk and always chooses the alternative yielding higher expected value. For instance, if there is a probability of certain gain amounting to \$49 and a risky alternative offering \$100 with a 50% probability, the individual will choose the risky alternative, for it provides the decision maker an expected value of \$50 (\$50 = \$100 × 0.5). However, it is hard to claim that there is risk-free asset yielding certain earnings, or that the investor's risk preference can be dismissed. The conditions (certainty, risk, uncertainty etc.) in which the decision is made feature as a major decision-making factor. In addition, there is a negative correlation between the degree of uncertainty and the degree of certainty when making decisions.

The discovery of the Sankt Petersburg Paradox, i.e. Bernoulli's Trial stating that individuals are willing to pay a low price to gamble led to abandoning the expected value concept. New concepts were introduced into the decision-making theory – risk minimisation models developed by Markowitz on the one hand and the principle of expected utility on the other.

The expected utility functions are viewed as a method for choosing the best alternative. The basic principle when choosing are risk aversion and desire to enlarge wealth. The conditions for adherence to these principles include the tenet that individuals know the final outcomes of the available investment opportunities, and the likelihood of these outcomes. Weighting the utility of the final outcome by their likelihood and summing thus obtained values for all identified alternatives produces the final investor's utility.

Empirical research, however, did not prove the validity of the expected utility theory. Actually, very often individuals do not behave in accordance with assumptions on which this theory is based. The two most significant paradoxes on which the unfeasibility of the theory in practice are the Allais paradox (Allais & Hagen, 1979) and the Ellsberg paradox (Ellsberg, 1961; Keynes, 1921). Analysing the essence of these paradoxes led to a conclusion that the above theories answer the question on how individuals should behave and make decisions, which is why they were termed "normative theories". Given that individuals are not perfectly rational, nor do they always act according to the normative theory axioms, Kahneman & Tversky (1979) introduced the theory of prospect into investment decision-making. This theory explains how individuals actually make decisions in various situations in accordance with risk preferences.

Considering the investor's utility function can also lead to a solution to the problem of maximising wealth and optimising the investor's securities portfolio. Depending on his risk preference, the investor *i* will choose a portfolio structure enabling him to maximise the utility function. Portfolio optimisation is achieved by investing in non-risky and risky assets. The investor determines the optimum proportion of individual types of financial assets in the portfolio for the forthcoming time period, and the obtained results of optimisation – risk and returns – are incorporated into the forthcoming period. If the cost of the risky assets in period *t* is marked *P_t*, the relative proportion of investor *i*'s risky assets in period *t* is marked *π_{i,t}*, and the number of shares in investor *i*'s in period *t* is marked *z_{i,t}*, the following relation applies:

$$\pi_{i,t}W_{i,t} = z_{i,t}P_t \tag{2}$$

The rate of return on risky assets can be calculated as:

$$R = 1 + r_f \tag{3}$$

where *r_f* is the non-risky rate of return. In this respect, one can establish the change in wealth and portfolio structure in the period *t+1* expressed in the number of shares:

$$W_{i,t+1} = RW_{i,t} + (P_t - RP_t)z_{i,t} \tag{4}$$

or the relative proportion of risky assets in the total portfolio value:

$$W_{i,t+1} = W_{i,t} [R + (r_{t+1} - r_f)\pi_{i,t}] \tag{5}$$

The investor seeks to maximise the expected utility function of his wealth in the period $t+1$ in comparison with period t , in accordance with the information on risk and returns he has at his disposal. That is:

$$\max E_{i,t} [U_i(W_{i,t+1})] \quad (6)$$

Bearing in mind the portfolio structure, return on investor i 's portfolio can be calculated as:

$$R_{p,t+1} = z_t R_{t+1} + (1 - z_t) r_{f,t+1} = r_{f,t+1} + z_t (R_{t+1} - r_{f,t+1}) \quad (7)$$

whereas the variance of the portfolio returns is

$$\sigma_{p,t}^2 = z_t^2 \sigma_t^2 \quad (8)$$

Portfolio optimisation implies establishing such a portfolio structure, i.e. proportion of risky assets, which will enable the investor to maximise expected utility. In this respect, it is necessary to consider the fundamental assumptions regarding the form of the investor's utility function and the possible distribution of return to securities portfolio. The form of the utility function is established by the degree of risk aversion. Both in theory and practice, the three most common shapes are square root, exponential and power utility function (Campbell & Viceira, 2001, p. 19).

1. Square root utility function

$$U_i(W_{i,t+1}) = aW_{i,t+1} - bW_{i,t+1}^2 \quad (9)$$

The issue of maximising the expected investor's utility with this shape of function comes down to maximising utility by applying Markowitz model of risk return. The investor seeks to achieve maximum returns for the given level of risk, i.e. to minimise the risk for the given level of return on the securities portfolio, so that it can be concluded that the relationship between risk and return in this model is linear. The assumption is that distribution of return corresponds to normal distribution, and risk aversion, measured by both absolute and relative measures, is characterised by the tendency of increase with the increase in the investor's wealth.

2. Exponential utility function

$$U_i(W_{i,t+1}) = -\exp(-\alpha W_{i,t+1}) \quad (10)$$

The application of this form of function in maximising expected investor's utility implies that the returns on the securities portfolio are normally distributed. The investors are characterised by constant absolute risk aversion $-\alpha$, whereas the relative aversion increases with the increase in wealth.

3. Power utility function

$$U_i(W_{i,t+1}) = \frac{W_{i,t+1}^{1-\gamma} - 1}{1-\gamma} \quad (11)$$

This shape of the utility function in maximising the expected investor's utility is characterised by decreasing absolute risk aversion and constant relative risk aversion $-\gamma$. The application in resolving the issue of portfolio optimisation and utility maximisation demands introducing logarithmic returns on available financial assets, which must meet the prerequisite of normal distribution.

In addition to these functions, their variants for different coefficient values of absolute and relative risk aversion are also used:

1. logarithmic function, as a variant of the power function for $\gamma = 1$,
2. adapted logarithmic function of the shape $U_i(W_i) = \ln(W_i + A)$, where A is constant,

3. function of the shape $U_i(W_i) = \sqrt{W_i}$ s a variant of the power function for $\gamma = 1/2$,
4. adjusted power function of the shape $U_i(W_i) = \frac{(W + A)^{1-\gamma}}{1-\gamma}$, where A is constant.

The investors' attitude to the risk of the above listed utility function is shown in Table 1.

Table 1 Classification of utility function according to the form of risk aversion

Utility function shape	Absolute risk aversion	Relative risk aversion
square root	increasing (IARA)	increasing (IRRA)
exponential	constant (CARA)	increasing (IRRA)
power / $\sqrt{W_i}$	decreasing (DARA)	constant (CRRA)
logarithmic	decreasing (DARA)	constant (CRRA)
adjusted logarithmic	decreasing (DARA)	increasing (IRRA)
adjusted power	decreasing (DARA)	increasing (IRRA)

Source: Levy, Levy, & Solomon, 2000

Studies of investment strategies maximising the expected utility of the investor's wealth (e. g. Merton, 1971; Karatzas, 1989) have investigated a large number of different utility functions. The more detailed theoretic research into utility functions can be found in the works of Pratt (1964), Thorp (1975), Ingersoll (1987) and Browne (1995). More recent body of research into this topic includes the work of Fei (2007), Ballestero et al. (Ballestero, Günther, Pla-Santamaria, & Stummer, 2007), and Palma & Prigent (2008). However, a special attention is attracted by a form of investor's preference called the *one-switch rule*. The investor's behaviour can be classified under this rule if "for every pair of alternatives whose ranking is not independent of wealth level, there exists a wealth level above which one alternative is preferred, below which the other is preferred" (Bell, 1988, p. 1416). The investor that adheres to this rule corresponds to the following utility function shape:

$$U_i(W_{i,t+1}) = W_{i,t+1} - be^{-cW_{i,t+1}} \tag{12}$$

where b and c are constant.

The concept and measures of risk aversion

Depending on the investors' attitude to risk, theory distinguishes between investors averse to risk, prone to risk and indifferent to risk.

Investor i , with wealth W at his disposal, can be characterised as averse to risk if he prefers a certain return on investing his capital, contrary to the expected return on investing in risky alternative, which can be equal or higher than the certain return. Such an investor regards the utility of certain returns as higher than the expected utility of uncertain return. This can be mathematically expressed as follows:

$$U(W_i) \geq EU(W_i + k) \tag{13}$$

where k is the expected return on investment in the risky alternatives. The investor is regarded as risk prone if

$$U(W_i) \leq EU(W_i + k) \tag{14}$$

and risk indifferent if

$$U(W_i) = EU(W_i + k) \tag{15}$$

As k is the return on risky investment, it can also be considered in the context of risk premium, especially if $k > 0$, where

$$k = E(k) + \varepsilon \tag{16}$$

and where ε is the random variable with the mean value of 0. To calculate the risk premium, it is necessary to define the certainty equivalent providing the investor with utility from the certain alternative, which is equal to expected utility from investing in risky alternative. Mathematically, the certainty equivalent of investor i for the given wealth level $W_i - C(W_i, k)$, can be defined as the certainty equivalent for utility U_i and expected returns on risky investment k of wealth W_i , if

$$U_i(C) = EU_i(W_i + k) \tag{17}$$

The risk premium - $p(W_i, k)$ is defined as $p(W_i, k) = W_i - C(W_i, k)$. If the investor is risk averse, it will be $C(W_i, k) = W_i$, i.e. $p \geq 0$.

Attitude to risk is determined by the investor's characteristics and affects the shape of his utility function: if the decision maker is risk averse, the utility function is concave; if he is risk prone, the utility function is convex, and if he is indifferent to risk, the utility function is linear.

As risk aversion significantly determines the investor's utility function, it is essential to measure the degree of risk aversion. The measure of absolute aversion to risk, determining the concavity of the utility function, was defined by Arrow (1970) and Pratt (1964). The absolute risk aversion (ARA) of investor i who disposes of wealth W is defined as the relation of the first and the second derivative of utility function with a negative number sign, i.e.

$$ARA(W_i) = -\frac{U''(W_i)}{U'(W_i)} \tag{18}$$

As $U''(W_i) \leq 0$, $ARA(W_i) \geq 0$ for every W_i if and only if $U(.)$ shows risk aversion, i.e. if it is concave. For the given preferences, ARA is invariable regardless of the shape of the expected utility function. It is determined based on the derivative of the utility function, and as such, it only shows "low" risk. ARA determines aversion to risk (concavity) when wealth is changed by 1 monetary unit.

There is a correlation between the absolute risk aversion and risk premium, which can be presented as follows:

$$U_i(W_i - p) = EU_i(W_i + k) \tag{19}$$

Application of Taylor's formula and extending both sides of the equation by W_i results in

$$U_i(W_i) - U'(W_i)p \approx E[U_i(W_i) + U''(W_i)k + \frac{1}{2}U''(W_i)k^2] \tag{20}$$

$$\Rightarrow -U'(W_i)p \approx \frac{1}{2}U''(W_i)E(k)^2 \tag{21}$$

$$\Rightarrow p \approx \frac{1}{2}ARA(W_i)\sigma_k^2 \tag{22}$$

where σ_k^2 represents the variance of return on investment in risky alternative k . Inference can therefore be drawn that the risk premium for investing wealth W_i equals approximately to half of the value of ARA multiplied by variance of return on risky investment.

A significant role in the analysis of an individual's attitude to risk is also played by the absolute risk tolerance - RT, which can be defined as the inverse value of risk aversion, i.e.

$$RT = \frac{1}{ARA(W_i)} \tag{23}$$

If the value of absolute risk tolerance is higher, it can be said that the investor tolerates risk more in comparison with the investor characterised by lower risk tolerance, i.e. lower value of absolute risk tolerance indicators.

In addition to measures of absolute risk aversion, there are also relative measures of relative risk aversion (RRA), measuring the change in risk aversion if the investor's wealth is changed by 1%. The measure of relative risk aversion for the given level of wealth W_i is determined as follows:

$$RRA = -\frac{W_i U''(W_i)}{U'(W_i)} \tag{24}$$

The given formula illustrates that $RRA(W_i)$ is calculated as the product of the investor's absolute risk investor and the value of his wealth. Relative risk aversion to wealth may also be viewed as the elasticity of the marginal utility of the investor's wealth in relation to the change in wealth, as the elasticity of marginal utility is calculated as:

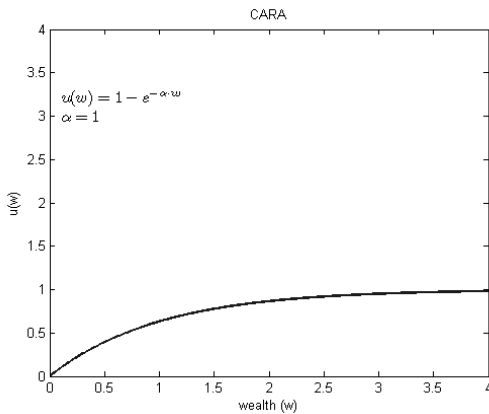
$$-\frac{\frac{dU'(W_i)}{U'(W_i)}}{\frac{dW_i}{W_i}} = -\frac{W_i U''(W_i)}{U'(W_i)} \tag{25}$$

The same way as in the case of absolute risk aversion, a correlation can be established between the relative risk aversion to risk and relative risk premium (p), and mathematically presented as follows:

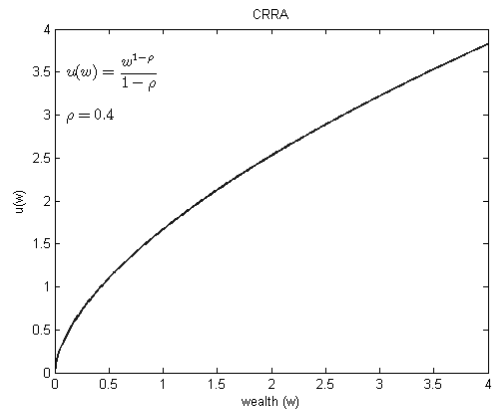
$$p' \approx \frac{1}{2} RRA(W_i) \sigma_k^2 \tag{26}$$

The investor's risk aversion can be changed with change in wealth. When a change in wealth occurs, the values of ARA and RRA also change. The decreasing value of absolute risk aversion in the case of increase in wealth is characterised through the absolute measure of risk aversion – DARA. The constant absolute risk aversion and increasing risk aversion are represent by variants of the absolute risk aversion, CARA and IARA respectively. Analogously, DRRA, CRRA and IRRA refer to the variants of the relative risk aversion denoting the conditions of decreasing, constant and increased relative risk aversion, respectively.

A special attention in this article will be devoted to constant risk aversion the utility function in the case of constant absolute and relative risk aversion, as well as movement of the first and second derivative of these measures is shown in Figure 1.



a)



b)

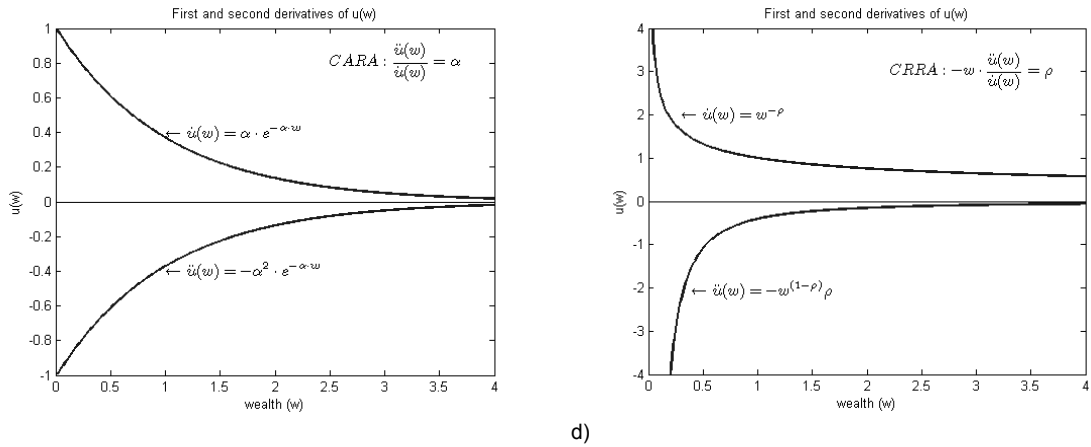


Figure 1 Constant absolute risk aversion (CARA, left-hand column) and constant relative risk aversion (CRRA, right-hand column).
Source: Authors

The CARA utility function and portfolio optimisation

The constant absolute risk aversion is characteristic of the exponential shape of the investor’s wealth utility function (Formula 10). If it is assumed that the change in the investor’s wealth in period $t+1$ is conditionally normal, that the maximisation of the investor’s expected wealth (Formula 6) is reduced to optimising the wealth certainty equivalent, that is,

$$\max_{z_{i,t}} [E_{i,t}(W_{i,t+1}) - (\alpha/2)\sigma^2_{i,t}(W_{i,t+1})] \tag{27}$$

where $\sigma^2_{i,t}$ denotes the conditional variance. As a consequence of such risk aversion, the value of share purchase or order $z_{i,t}$, is independent of the investor i ’s wealth value and constant for every value W_i . With such assumptions, the optimum order value of investor i in period t can be calculated as follows:

$$z_{i,t} = \frac{E_{i,t}(R_{t+1})}{\alpha_i \sigma^2_{i,t}(R_{t+1})} \tag{28}$$

where $R_{t+1} = P_{t+1} - RP_t$, and refers to return on risky assets in monetary units.

According to this shape of the utility function, the value of the risky assets is assumed to remain constant regardless of the change in the investor’s wealth. From the empirical viewpoint, wealthier investors will be more willing to take over the risk than the less wealthy ones. If, for instance, a situation is viewed with possible gain or loss of 1,000 monetary units with equal probability, the investor whose total value is 1 million monetary units will be more likely to accept the game than the investor with 10,000 monetary units of wealth. In such circumstances, CARA cannot be regarded as the appropriate form of risk aversion. Regarding the absolute risk aversion, DARA can be regarded as the normal case of absolute risk aversion.

Despite the above, significant theoretical research into investment decision making is based on this form of risk aversion, due do simplifying the initial assumption on the normal distribution of return and constant absolute risk aversion, these assumptions allow deriving simple solutions to the problem of portfolio optimisation (e.g. Caballero, 1990; Svensson & Werner, 1993; Davis & Willen, 2000). Such an utility function, however, has serious shortcomings in terms of consistency with the stability of risk premium and interest rates in the long run. For this reason, CRRA function is applied in individual investors’ decision making process analysis much more frequently, as it does not depend on the value of the wealth.

CRRA utility function and portfolio optimisation

The largest number of studies in the area of decision making and utility function was mostly focussed on the shapes of utility function suitable to investors with a constant absolute risk aversion. A uniform and exact solution to the problem of maximising investor's utility in the case of constant relative risk aversion has not been established, but numerous approximate solutions have been suggested (Campbell & Viceira, 2001; Levy, Levy, & Solomon, 1994, 2000; Zschischang & Lux, 2001). The results of numerous experiments have shown that the investors mostly manifest the DARA risk aversion, whereas the number of those manifesting the CARA form of risk aversion is significantly lower (Levy, Levy, & Solomon, 2000). As the DARA form of risk preference corresponds to the CRRA form, it can be concluded that the utility functions incorporate this form of risk aversion more realistically than the CARA utility function.

The fundamental characteristic of the CRRA utility functions is that the relative proportion of risky financial assets in the investor's portfolio does not depend on the value of wealth. As for the constant relative risk aversion, this means that the relative proportion of risky financial assets will be independent of the size of wealth, i.e. $\pi_{i,t}$ in equation (5) does not depend on the value $W_{i,t}$. As a consequence of this correlation, the optimum number of securities classified as risky ($z_{i,t}$) will be proportional to the value of wealth ($W_{i,t}$), i.e.

$$z_{i,t} = \frac{\pi_{i,t} W_{i,t}}{P_t} \quad (29)$$

Considering the expected return and deviation of the returns from expected (Formulas 7 and 8), the solution to the investor's utility maximisation problem (Formula 6) equals establishing the relative proportion of risky assets in the investor's portfolio as follows (Chiarella & He, 2001):

$$\pi_{i,t} = \frac{E_{i,t}(R_{t+1}) - r_f}{\gamma_t \sigma_{i,t}^2 R_{t+1}} \quad (30)$$

Investors with the same level of wealth will have the same proportion of risky assets, whereas the value of wealth will change with the changes in prices and returns on risky assets.

The power shape of the utility function is used in portfolio optimisation (Formula 11), while the relative risk aversion coefficient γ may take on different values. Some of the studies completed by Schooley i Worden (1996) have a constant or decreasing RRA depending on the type of sample and measure of wealth. Friend and Blume (1975) have proved, with a significant degree of certainty, that households normally have a constant RRA in case of static portfolio, with the relative risk aversion coefficient taking on the value of 1, which is the threshold, but in most cases it is higher than 2. Due to the risky nature of investment, institutional investors tend to have a higher RRA coefficient than households. In his research, Bali (2008) arrived at the conclusion that the RRA coefficient value ranges between 1 and 5.

However, contrary to this research, Chou et al. (Chou, Engle, & Kane, 1992) find that the RRA coefficient may increase with an increase in wealth, and proposes using the square root utility function shape in resolving the issue of individual investors' portfolio.

Simulation results

The impact of the shape of the utility function on investment decision making was studied by means of numeric stimulation in this article. In addition, it is assumed that the investor only has initial wealth and wealth acquired through trading at his disposal, i.e. the investor does not have any external wealth at his disposal. In other words, the investor has a self-financing portfolio. Another no less significant assumption of the model is absence of possibility for short sale. In accordance with the above assumptions, we can say that the transactions are conducted on an idealised market with the following features (Merton, 1973):

- any quantity of assets can be bought or sold at any moment at unique market price,
- as the price spread equals zero, the selling price equals the purchase price,
- the investor has no influence on the price of the assets,

- there are not transaction costs or taxation,
- short sale is not allowed.

There is only a single risky and a single non-risky asset. The observed investor possesses initial wealth consisting of 1,000,000 dinars of risky cash and 1,000 shares of risky assets expressed through Belex15 market index. 3% annual earnings is paid on non-risky assets.

At any point of time T (one trading day), the investor must decide which portion of his wealth he will invest in risky assets. Some empirical research has shown that the portion invested in risky assets ranges between 30% and 60%. In our research we raised the limit to 90%.

The investor's aim is to maximise the value of his utility function $U(W_t)$, where W_t is the final wealth at the end of each trading period in the interval $[0, T]$ and $U(\cdot)$ represents the utility functions described above.

Generally, the investor's aim can be presented as

$$\begin{cases} \max_{\pi} E[U(W_t)] \\ 0.3 \leq \pi \leq 0.9 \end{cases} \tag{31}$$

where π is the optimum investment allocation, or the portion of wealth invested in risky assets. Approximating the expected utility function by means of order Taylor in the proximity of expected wealth (based on the approach presented in Juneau & Rockinger, 2006), we will get:

$$U(W_T) = \sum_{k=0}^{\infty} \left[\frac{U^{(k)}(\bar{W})(W_t - \bar{W})^k}{k!} \right] \tag{32}$$

Simplifying the procedure by introducing only the first two elements, we will get:

$$E[U(W_T)] \approx U(\bar{W}) + \frac{U^{(2)}(\bar{W})}{2!} \sigma^2(W_t). \tag{33}$$

The presented approach was applied on the chosen CARA and CRRA utility functions. More precisely, the negative exponential function for the chosen CARA utility function is:

$$U(W_T) = -e^{-\lambda W_t} \tag{34}$$

and the expected utility is approximated by means of:

$$E[U(W_T)] \approx -e^{-\lambda \mu_p} \left[1 + \frac{1}{2} \lambda^2 \sigma_p^2 \right]. \tag{35}$$

The problem of portfolio optimisation can then be presented as

$$\begin{cases} \max_{\pi} -e^{-\lambda \mu_p} \left[1 + \frac{1}{2} \lambda^2 \sigma_p^2 \right] \\ 0.3 \leq \pi \leq 0.9 \end{cases} \tag{36}$$

In the case of the CARA utility function, presented by means of power function shaped

$$U(W_T) = \begin{cases} \frac{W_t^{1-\lambda}}{1-\lambda} & , \lambda > 1. \\ \ln(W_T) & , \lambda = 1 \end{cases} \tag{37}$$

the expected utility is approximated by means of order Taylor

$$E[U(W_T)] \approx -e^{-\lambda \mu_p} \left[1 + \frac{1}{2} \lambda^2 \sigma_p^2 \right]. \tag{38}$$

In this case the objective of the investor's CRRA can be presented as

$$\begin{cases} \max_{\pi} \frac{\mu_p^{1-\lambda}}{1-\lambda} - \frac{\lambda}{2} \mu_p^{-\lambda-1} \sigma_p^2 \\ 0.3 \leq \pi \leq 0.9 \end{cases} \quad (39)$$

In Formulas (36) and (39), the return on portfolio (μ_p) and the portfolio's standard deviation (σ_p) are estimated by means of the simplest GARCH(1,1) model (Bollerslev, 1986):

$$\begin{aligned} r_t &= C + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_t^2) \\ \sigma_t^2 &= \gamma + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2. \end{aligned} \quad (40)$$

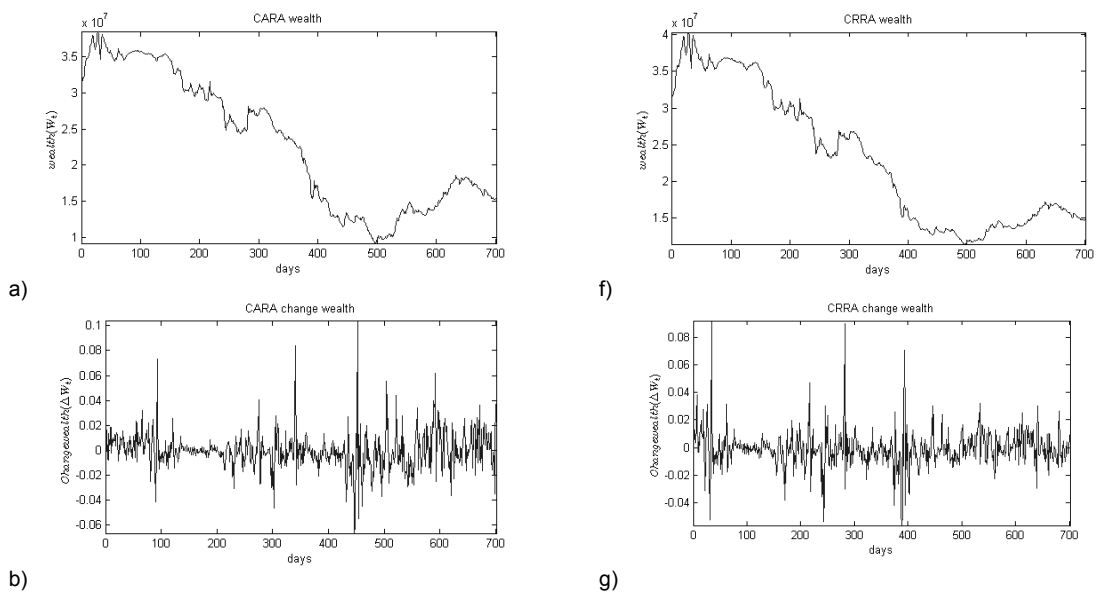
The trading simulation was performed on a 700-day Belex 15 series (01/04/2008 – 31/12/2010). The optimum portfolio for both functions is calculated numerically (Matlab, initial value $\pi_0 = 0.5$). The graphic presentation of simulation results is shown in Figure 2.

The CARA utility function implies that the investor's attitude to risk does not change despite the increase in wealth (Figure 2a,b,c,d,e). Thus, the optimum value invested in risky value remains constant. Consequently, the portion of wealth invested in risky assets decreases with increase in wealth and vice versa, increases with decrease in wealth (Figure 2c). According to limitations in simulation, when the proportion of risky assets reaches borderline values (Figure 2c), the value of order rebalancing the portfolio equals zero, i.e. there is no trading (Figure 2d). Such investor's behaviour leads to the amount of shares owned by the investor being higher in the periods of lower volatility than in other periods.

Unlike a CARA investor, the optimum funds allocation of a CRRA investor is relatively constant over time and does not depend on the investor's total wealth (Figure 2f,g,h,i,j). When the risk premium is positive ($(\mu-r_f)/\sigma$), a part of the wealth invested in risky assets increases (Figure 2h). In addition, the portion of wealth in risky assets tends to decrease with the increase in the aversion coefficient.

The coefficients of absolute and relative risk aversion were selected in such a manner that the change in the wealth of CARA and CRRA investors is approximately at the same level (Figure 2a,f). Over the observation period, the CARA investor had greater oscillations in the change of wealth (Figure 2b) and a higher level to risk exposure than the CRRA investor (Figure 2g).

The optimum investment strategy is dependent on the system's prehistory. All the calculations in our model are based on the historic series of price movements over the previous 300 days. Periods with high volatility result in decreased investment in risky assets.



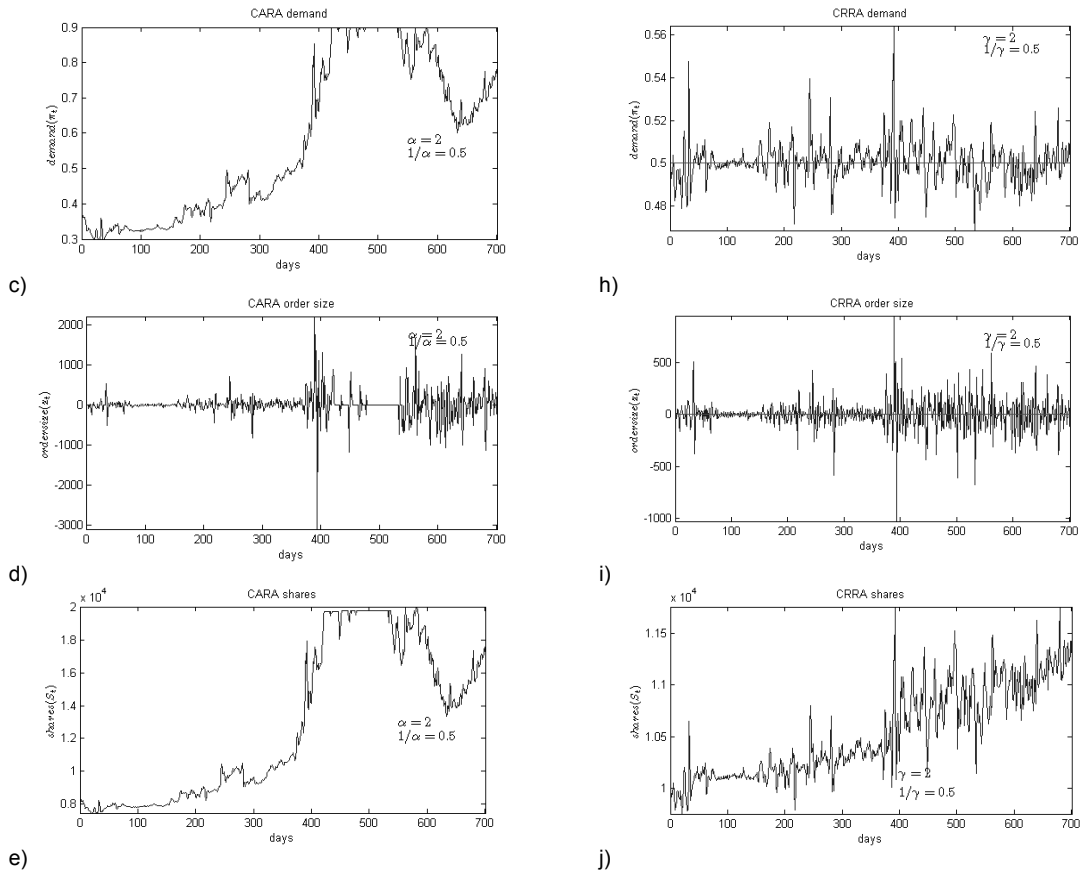


Figure 2 Graphic presentation of simulation results.
 Source: Authors

CARA investor: a) total wealth; b) relative change in wealth; c) proportion of wealth invested in risky assets; d) trading order size; e) amount of risky assets. CRRA investor: f) total wealth; g) relative change in wealth; h) proportion of wealth invested in risky assets; i) trading order size; j) amount of risky assets.

Conclusion

This article analyses utility functions with CARA and CRRA shape of risk aversion in individual investor’s decision making on portfolio optimisation. In addition to the theoretical concept of the utility functions and mathematical models of CARA and CRRA investors, we studied the behaviour of both types of investors. The conducted research is based on a numeric simulation of the dynamic of hypothetical investment on the Belex investment market, with CARA and CRRA utility functions. Despite the changes in the wealth of both types of investors being similar, portfolio optimisation or approach to funds allocation is completely different. CARA investors invest in risky assets relatively constantly, whereas CRRA investors invest in proportion with their wealth. This research also showed that the CRRA utility function in the shape of power function describes investors’ behaviour more realistically than the CARA. However, empirical investigation in the area of behavioural finance has shown that it is necessary to find a more appropriate functional form of utility that will incorporate the main behavioural digressions in the behaviour of real investors from the idealised model of rational investors. **SM**

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Will the Identified Improvements of Auditor's Report Meet the Requirements of Users and Provide Them with the Value, i.e. Benefit That they Seek?

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Abstract

In this article, the authors attempted to answer the question - is there currently a need to make changes in the field of auditor's reports, that is, in the field of auditor's reporting, in an effort to increase the explanatory quality of auditor's reports as a result of auditor verifying financial statements due to the ever-increasing demands coming from the users of information from auditor's reports – for their financial decisions. The authors of this article assess spoken premises and declare their opinions: will the changes proposed by the IAASB meet the requirements and needs of users of information from auditor's reports on a qualitative as well as quantitative shift in information base? A well-performed audit is supposed to be accompanied by an informative auditor's report, which supplies a value, i.e. benefit to interested parties. The changes of auditor's reports may result in the strengthening of transparency of financial reporting, and also in increasing the amount of "right" decisions of the users based on "modernised" auditor's reports. As the reactions requiring changes are amplified gradually, stakeholders realize that now is the time to lay the groundwork for future auditor's reporting with respect to meaningful and workable global solutions based on the scope of an audit under the current ISAs – International Standards on Auditing. It is obvious that the users of auditor's reports would certainly appreciate these potential changes in the field of auditor's reporting, which represents a probable answer to the question above.

Keywords

Audit, auditor's report, standards of auditing, reporting, financial statements.

Introduction

As well as a comparability of financial statements a constant need of ensuring transparency is caused by vast changes constantly influencing economic practices in the relevant economic environment. The users of information presented in financial statements often use the financial information to make strategic decisions that affect the viability of economic entities for several years.

The global economic and financial crisis partly undermined confidence in existing financial and capital markets with all their specifications as well as financial instruments. An audit represents one of those instruments. Qualitative aspects of audit are a means by which it is possible to increase the confidence of users of financial information within strategic decision-making, but also to contribute to ensure a financial stability of the economic environment.

A process of amending and revising the International Standards on Auditing, in accordance with an audit performed, may contribute to performing the audit based on qualitative bases. A result of this controlled process is to issue an auditor's report. An auditor expresses her/his opinion to provide required information to relevant users, but also to enhance their confidence to use this information for their decisions.

Nowadays, we increasingly often take notice of a need to revise the auditor's report in order to contribute to increasing its clarity as well as explanatory quality coming from the users of information from auditor's reporting.

1. Independent auditor's report

The purpose of an audit of financial statements is to enable the auditor to express an opinion whether the financial statements are prepared in accordance with a relevant applicable financial reporting framework in all material respects. The auditor provides this opinion to interested parties, i.e. users, in the form of a written report. This is the final phase of the audit and represents an issue of auditor's report based on audited financial statements audit, i.e. evidence that the auditor obtained within the verification of the financial statements.

The auditor's report is a form of communication between the auditor and users of the report, accompanied by the auditor's opinion. (Kareš, 2004, p. 104)

Auditor's opinion is an essential and the most important part of the auditor's report representing the means of communication between the auditor and entity using information presented by the report for her/his needs and purposes. The auditor's report informs about (Ricchiute, 1994, p. 84):

- what was the subject of verification by an independent auditor (Kareš, Auditorstvo, 2010, p. 272),
- what is the responsibility of management and the auditor,
- what are the duties of the audit,
- what is the opinion of the independent auditor.

In general, it is possible to conclude that the independent auditor's report, describing the audit subject, the audit itself, the responsibility of management and the auditor, is short as well as standardized.

1.1. Clarity of Report on Financial Statements

The lingering global financial crisis has affected many areas of economic and financial life. The crisis has been a reason for increased interest of the institutional investors as well as financial analysts not only in audited entity, but also in a process of audit itself in order to obtain further information about the audited entity and its financial statements representing the subject of verification by an independent auditor.

The primary objective of an auditor is to perform an audit accompanied by issuing the auditor's report bringing benefits to interested parties.

An audit is performed in the context of ISA - International Standards on Auditing (hereinafter referred to as "ISA"). Within the International Standards on Auditing, the following standards deal with issues of the auditor's report:

- *ISA 700 Forming an opinion and reporting on financial statements* – effective for an audit as an assurance service on the highest level of assurance. This standard deals with the auditor's responsibility for forming the auditor's opinion. An auditor applies the ISA 700 – standard on auditing for a standard (unmodified) report.
- *ISA 705 Modifications to the opinion in the independent auditor's report* – effective for modified types of the reports. This standard is applied when an auditor concludes that it is necessary to modify an opinion on financial statements in accordance with ISA.
- *ISA 706 Emphasis of matter paragraphs and other matter paragraphs in the independent auditor's report*. It is effective for modified types of the reports.

ISA 705 describes the circumstances that may require a modification to the auditor's report. We distinguish the facts that:

- a) **do not affect the auditor's opinion** – an auditor includes an emphasis of matter paragraph affecting financial statements in the auditor's report. Having included the emphasis of matter paragraph, a material fact in relation to financial statements is highlighted. The report may also be modified by including the paragraph in terms of a material uncertainty which settlement is determined by upcoming events and which may affect financial statements.

- b) affect the auditor's opinion** – an auditor expresses an unmodified opinion when the auditor is able to obtain sufficient appropriate audit evidence or agrees with management in questions of a correct application of accounting principles and methods. If the auditor is unable to obtain sufficient appropriate audit evidence, the auditor expresses a qualified opinion or disclaims an opinion. If there is a disagreement with the management, the auditor expresses a qualified or adverse opinion.

The auditor obtains relevant evidence constituting a basis for forming an opinion presented in the auditor's report in each phase of the audit. The auditor issues the report based on the all obtained facts, which are evaluated both individually and together, while the auditor may not withhold any of the obtained facts, as it could significantly affect the conclusions of auditor's report about the conduct as well as results of the audit process. (Ministry of Finance of the Slovak Republic, 2007)

2. Challenges of users of auditor's reports in the field of auditor's report and auditor's reporting respectively

The auditor's report is supposed to describe the auditor's work in detail. The need to improve as well as **to increase the clarity of both auditor's report and auditor's reporting** is therefore supported extensively.

The International Auditing and Assurance Standards Board (hereinafter referred to as IAASB) seeks to increase a contribution of auditor's reporting due to the demands for:

- ensuring a transparency of important facts of financial reporting and
- performing the audit process.

Given the fact that not all subjects understand the content of auditor's report, the IAASB concluded **a necessary revision of the independent auditor's report** seeking to perform the audit that may contribute to eliminating financial instability arising from the global financial crisis.

Never-ending challenges from the users of financial information related to improving and increasing the clarity of auditor's report prompted the IAASB to emphasize the assumptions of "future auditor's reports" focusing on "meaningful and workable global solutions based on the scope of an audit under the current ISAs" (IFAC, 2012).

The IAASB revealed potential opportunities to improve the auditor's reports based on the investigations carried out, while some consultations with the users of financial information are necessary. Those consultations allow obtaining information necessary "for proposals of the IAASB's standards that serves the public interest" (IFAC, 2012), as auditing is a profession acting in the public interest.

3. Harmonization of a report on audited financial statements

The information needs of the users of audited financial statements increase constantly, so **a change of the content of auditor's reports** is requisite. An emphasis on the change of the content of auditor's report is set especially by financial investors as well as analysts using the auditor's report as a possible guide for orientation through financial statements as well as in the most subjective questions in financial statements on various financial ratios and analyses.

Also the lingering economic and financial crisis highlights a necessity of the content change of auditor's reports, that is, auditor's reporting from the public sector as well as an irreplaceable correlative relationship between the private and public sector. The changes of auditor's reports may result in the strengthening of transparency of financial reporting in both sectors.

Due to the urgent harmonization process, there are currently extensive changes in the field of ISA – International Standards on Auditing in accordance with the audit of financial statements is performed and the auditor's report is issued.

It is essential to ensure a transparency and notable comparability of auditor's reports of individual countries, while the IAASB admits possible differences in auditor's reports of individual countries because of existing variations in national laws and regulations.

The IAASB set as its main objective to obtain various opinions of users of financial information with regard to equality of international consistency of national flexibility.

Not only the current changes in the field of auditor's report, but also long-term considerations as well as efforts to improve auditor's reports are required due to the growing information needs of users and the potential information gaps¹.

The changes of auditor's reports are supposed to improve the abilities of users of financial information to make more relevant and adequate decisions. Therefore, the attention is paid to a presentation of information about a relevant accounting entity to the users of financial statements through a way providing a clear and complete view of:

- accounting entity,
- its operating nature, and
- financial results, which have to be prepared in accordance with a valid framework for financial reporting in order to achieve a fair presentation.

3.1. IAASB's opinion in the context of improving auditor's reports

The IAASB's efforts to change auditor's reports are determined by obtaining sufficient opinions of the users of reports in order to implement changes not only at the national but also international level. The IAASB is governed by the context of principles in which it seeks to:

- propose changes that will be beneficial to the users in making decisions,
- increase the abilities of users to orientate as well as to understand the context of financial reports,
- achieve a transparency in:
 - ✓ audited financial statements,
 - ✓ audit process performed in the context of ISA,
- maintain the current range of performing audit in accordance with ISA,
- maintain a particular distribution of responsibilities of management and those charged with governance,
- preserve a need to adapt, or specify requirements of individual national systems of financial reporting coming from national makers of standards,
- appropriately apply the revised standard on auditor's report, respectively auditor's reporting. (IFAC, 2012)

The IAASB proceeded to suggest a number of **possible improvements of auditor's reports** based on the investigations and subsequent findings. Having added a section entitled "**Auditor Commentary**" (IFAC, 2012) into auditor's reports represents one of those possible improvements. The section would include additional information at the auditor's discretion in order to help the users of financial information to understand the content of financial statements. Such information would be required mainly for public interest entities (at least for listed companies), or would be also provided for other subjects, and at the independent auditor's discretion.

Another possibility is to extend the auditor's report with a conclusion:

- regarding a question of assessing a going concern in preparing financial statements,
- whether uncertainties that could be significant were identified in assessing a going concern, and
- whether a significant difference was identified between the audited financial statements and specific information found by the auditor.

More transparent audit highlighting and clarifying **responsibilities** of not only the auditor in charge of the audit, but also management and those charged with governance in the context of ISA may contribute to the improvements of an auditor's report, too.

¹ The expression meaning "information gaps" lies in a difference between what the users consider to be important when making investment decisions or decisions relating to a management of entrusted property ("fiduciary decisions") and what is provided to them through the audit of financial statements, auditor's report as well as other publicly available information.

3.2. A necessity of cooperation

There is a necessity of cooperation among all interested subjects so that the IAASB could put its plans into practice regarding the improvements of auditor's report. The IAASB needs to gain the impression that the forthcoming changes relating auditor's reports will be not only useful for the users, but also beneficial as well as represent a tool for increasing the reliability of financial information used by the users in making decisions. Based on information gathered from the interested subjects, it is possible to:

- increase the contribution of auditor's reports, and
- identify the potential obstacles of the proposed improvements of auditor's reports regarding the process of their global adoption and implementation.

The required information may be gathered through consultations with interested subjects and finally come to a conclusion as to whether the changes or improvements of auditor's reports cover all audits performed in the context of ISA. The information gathered through consultations is used to support the activities of the IAASB in order to improve auditor's reports, that is, auditor's reporting.

4. Elements of auditor's reports

Existing differences in audit regulations represent a potential barrier in the efforts of the IAASB to improve auditor's reports. However, this is not an insurmountable obstacle. The IAASB set **the initial elements of auditor's reports** to be accepted in individual member countries, and possible modifications of the report for national needs were accepted. Thus, the IAASB would:

- establish a uniform basis for auditor's reporting,
- ensure a transparency and comparability of reports of individual jurisdictions, and
- create a possibility to apply some elements for certain accounting entities.

At the same time, the IAASB believes that it is necessary and important to determine a precise sequence of elements in auditor's report prepared in the context of the revised ISA despite different types of accounting entities as well as various jurisdictions, unless the laws or regulations provide otherwise.

The most important element of an auditor's report is **the auditor's opinion** on audited financial statements by which the auditor provides an assurance to the shareholders as well as creditors that the information presented in financial statements is true and fair.

The users of information from auditor's reports currently pay attention to the location of the auditor's opinion in the independent auditor's report. Based on the consultations with interested subjects, the IAASB came to a conclusion that "the "pass/fail" nature of the audit opinion has value and is currently the focal point for readers of auditor's report." (IFAC, 2012)

Based on these findings, the IAASB proposes that:

- the auditor's opinion should be presented as the first element in the auditor's report,
- the auditor's opinion should be accompanied by a description of the financial statements, and
- the auditor's opinion should refer to the notes, representing an integral part of financial statements, because they contain additional explanatory information to the financial statements.

The reference to the notes is "considered to be more appropriate compared to the current general reference to "other explanatory information" reflecting the importance of notes as well as growing emphasis on the auditor's responsibility for the disclosed information as a part of the audit of financial statements as a whole".

The auditor's opinion may be formulated as a bare auditor's statement not taking into account the particularities of specific audited financial statements and annual report, i. e. **a standard phrase** or **a short report** involving a standard phrase together with emphasizing the particularities of audited financial statements and the particularities of their verification.

International organizations have constantly approach to a standardization of wording of auditor's reports in order to ensure a clear understanding of the auditor's opinion, which is a part of the auditor's report. The auditor issues:

- **an unmodified report** containing an unqualified opinion if according to the auditor's judgment, the financial statements give a true and fair view on a financial situation and a profit or a loss of accounting entity,
- **a modified report** with assessing the facts, that:
 - ✓ do not affect the auditor's opinion,
 - ✓ affect the auditor's opinion.

The auditor may emphasize the facts which do not affect the auditor's opinion in some cases. The auditor issues a report with *an unqualified opinion with an emphasis of matters* relating to a current-concern principle in such cases. The auditor emphasizes significant facts, which are supposed to be a part of the notes to the financial statements.

The facts, that affect the auditor's opinion, leading to express **a qualified opinion**, when the auditor: (a) having obtained sufficient appropriate audit evidence, concludes that misstatements, individually or in the aggregate, are material, but not pervasive, to the financial statements, or (b) is unable to obtain sufficient appropriate audit evidence on which to base the opinion, but the concludes that the possible effects on the financial statements of undetected misstatements, if any, could be material but not pervasive.

The auditor expresses **an adverse opinion** when, having obtained sufficient appropriate audit evidence, concludes that misstatements, individually or in the aggregate, are both material and pervasive to the financial statements.

The auditor **disclaims an opinion** when it is impossible to obtain sufficient appropriate audit evidence on which to base the opinion, and it is concluded that the possible effects on the financial statements of undetected misstatements, if any, could be both material and pervasive. The auditor disclaims an opinion when, in extremely rare circumstances involving multiple uncertainties, it is concluded that, notwithstanding having obtained sufficient appropriate audit evidence regarding each of the individual uncertainties, it is not possible to form an opinion on the financial statements due to the potential interaction of the uncertainties and their possible cumulative effect on the financial statements.

If the auditor issues a report with modified opinion in the context of ISA – International Standards on Auditing, the auditor shall place a paragraph with **“The basis for the opinion”** in the auditor's report. The basis for expressing the auditor's report is to obtain sufficient appropriate audit evidence in all phases of the audit.

Auditor's statement about obtaining sufficient appropriate evidence is presented in the paragraph entitled as **“Auditor's responsibility”**. The IAASB believes that this information is relevant to the users and it is required to be presented close to the auditor's opinion. The IAASB considers that this paragraph could be included in the auditor's report also in case when the auditor expresses a modified opinion. It is required to include this paragraph with an appropriate title under the paragraph with independent auditor's opinion in the context of ISA 705 – Modifications to the opinion in the independent auditor's report.

The IAASB attaches a great importance to a location of individual parts in auditor's report as they represent positive features, especially when it comes to information of specific matters of accounting entity in assessing its going concern.

ISA 700 Standard on Auditing was made and accepted in order to ensure a consistency and a comparability of auditor's reports. The standard emphasizes that a consistency of auditor's reports contribute to increase a confidence in the global market and it enables to identify the audits performed in the context of ISA, which are globally accepted standards. It may be difficult to balance between a need to ensure a consistency as well as a comparability of auditor's reports on a global level and a need to increase the importance of the auditor's reports, respectively auditor's reporting, because of the regulations as well as standards are influenced by economic, cultural and other factors.

Given the above facts, *ISA 700 – Forming an opinion and reporting on financial statements* allows to change the form or content of auditor's report by the regulations.

4.1. A going concern

The lingering crisis has highlighted not only a need to improve financial reporting, but also a need to assess a **going concern of accounting entities**, because it represents a significant problem of financial reporting and the audit itself.

Having added an **auditor's declaration** about a going concern may contribute to an improvement as well as development of the content of auditor's report. The emphasis is on defining the responsibilities of the auditor and the management of accounting entity regarding a consideration of going concern. The auditor is required to express a conclusion of further actions of the accounting entity in the business environment. The IAASB considers that the auditor's report should include:

- a conclusion relating to assumptions of management about a going concern and
- a declaration on the identification of uncertainties, that can be so material that they may bring doubts about a future going concern of accounting entity.

In assessing a going concern, the auditor performs the audit in accordance with **ISA 570 - Going concern**. In the context of ISA 570 - Going concern, the auditor is responsible for:

- obtaining sufficient appropriate audit evidence about the fact that the management adequately applied the going concern assumption in the preparation and presentation of financial statements, and
- expressing a conclusion whether there is a material uncertainty about the going concern of accounting entity.

The auditor's responsibility exists even if the framework of financial reporting in the preparation of financial statements is applied, when there are no requirements to assess a going concern of accounting entity coming from the managements.

The existing natural limitations of auditor's abilities to detect material misstatements represent an issue in terms of future events or conditions that may endanger a going concern because the auditor is not always able to predict such future events or conditions.

"Accordingly, the absence of reference to substantial doubt in an auditor's report should not be viewed as providing assurance as to an entity's ability to continue as a going concern." (IFAC, 2012)

In case of a detection of a material misstatement, the auditor's responsibility will be to inform the users of auditor's report about a part of the financial statements where the material misstatement was detected.

As the assumptions about a going concern cannot be equated with significant uncertainties, IAASB considers presenting them under separate names included in the part "**Going concern**" in the auditor's report.

If the auditor detects the facts raising an appearance of the inability of going concern of accounting entity, the auditor shall state a description of judgments and procedures performed in order to come to a conclusion that there are no significant uncertainties in the auditor's report. A transparency of performing auditor's profession is ensured by a disclosure of such information.

It is undoubtedly important for the users of report to locate such information in the section of "Going concern" or "Auditor commentary".

Having included the section of "Going concern" into the auditor's report, the users of report will be provided with a view about:

- responsibilities of the management under a valid framework of financial reporting in the context of a going concern,
- the auditor's judgments about the assumptions of management applied,
- a declaration of the absence of significant uncertainties.

4.2. Increasing the information base through the auditor's report

The requirement to increase the information value of an auditor's report comes mainly from the investors as well as analysts in order to make investment decisions. These users suggest that the auditor

should emphasize in the auditor's report those parts of financial statements which are, at the auditor's discretion, the most important and which may help to orientate in financial statements in decision-making.

Other subjects seek a description of the facts that led the auditor to consider a particular part of financial statements to be important with a brief description of the procedures performed in this part, but also a description of the audit process itself with a focus on clarifying the level of significance, using the work of experts or the work of other auditors.

In case of a large group, the auditor of consolidated financial statements may require another auditor to verify the financial statements of certain accounting entities or business activities. If the engaged team auditing the consolidated financial statements comes to a conclusion of insufficient work of the other auditors, they will determine procedures to be performed as well as those who will perform the selected procedures.

In the context of *ISA 600 - Special considerations - audits of group financial statements (including the work of component auditors)*, it is not possible (if a law or a regulation requires otherwise) to refer to the work of another auditor due to a full responsibility of the auditor of consolidated group for the auditor's report on the consolidated financial statements.

ISA do not allow delegation of the auditor's responsibility to another auditor. However, including the other auditors into the audit process may represent an important issue, as the position of other auditors is perceived as a conflict with the principle of "individual responsibility". It is, therefore, proposed to include a disclosure about the work of other auditors regardless of the auditor's decision on responsibility distribution into the auditor's report.

Some users of auditor's report require from the auditor to clarify the subjective parts including the auditor's opinions on a quality of accounting policies, the procedures of accounting entities, an auditor's view on the estimates and judgments of management. According to the beliefs of users, such information may:

- be relevant to understand the facts, whether the management is aggressive or conservative in the preparation of financial statements or
- assess the quality of financial reporting of the accounting entity.²

Given the existing significant qualitative aspects of accounting policies as well as significant difficulties accompanying the business activities, it is necessary to disclose additional information about the accounting entity and the audit process itself.

4.3. "Auditor commentary" as an important part of the auditor's report

The auditor could provide additional information to the users in a separate part of the auditor's report with a reference to the section entitled as "Auditor Commentary", which subjective is ensure the transparency of facts that are essential for the users in order to ensure understanding of audited financial statements and the audit itself.

Through the additional information, the auditor emphasizes:

- reported facts necessary to understand the financial statements, and
- other relevant facts necessary to understand a responsibility of auditor, audit as well as auditor's report.

The new part of the auditor's report entitled "*Auditor commentary*" is thus in line with the existing concept entitled "*Matter paragraph*" or "*Other matter paragraph*".

In the context of requirements coming from the users, it is necessary to include the facts with a significant risk into "*Auditor commentary*" and those that are discussed in accordance with *ISA 260 - Communication with those charged with governance*. Having done so, more transparent process of communication between the auditor and those charged with governance is ensured.

² The subjective auditor's opinions about an accounting entity as well as the quality of financial reporting may obscure the obligations of management and those charged with governance, and eventually lead to discredit the auditor's opinion on audited financial statements.

According to the recommendations of the IAASB regarding the “Auditor commentary”, the auditors should consider the following:

- a part of significant judgments of management in relation to accounting policies, estimates and disclosures in financial statements because there are financial reporting frameworks emphasizing the use of significant judgments of management, since there is a mutual interconnection of those judgments with evaluations coming from the auditor,
- significant, or unusual transactions,
- significant facts detected during the audit regarding the scope as well as the strategy of audit,
- facts consulted with a person performing a quality control review or those charged with governance, because it is necessary to evaluate the system of internal quality and deficiencies detected during the audit by auditor.

The knowledge of accounting entity, its activities and its internal control system are the basis to perform the audit, which contributes to ensuring the transparency of the internal control system.

The IAASB plans to issue a guidance that the auditors will be governed by when making decisions about including information relating to a development of revised standards on auditing focused on auditor's reporting into the auditor's report. The IAASB believes that it is necessary to take into account the facts and circumstances regarding an accounting entity in the questions of determining the scope of the “*Auditor commentary*”, as the nature of disclosed facts will vary depending on the accounting entity. An arrangement of such facts will be in the context of a professional judgment of the auditor.

One of the IAASB's objectives is to warn the users **not to use** the “*Auditor commentary*” as a substitute in expressing a modified auditor's opinion.

The IAASB considers providing the “Auditor commentary” for all accounting entities or for only selected accounting entities due to a transparency from the auditor's point of view which is necessary for the users. The IAASB came to a conclusion of providing the “Auditor commentary” at least in case of **listed accounting entities** with a possibility to provide it to another public interest entities (hereinafter referred to as “PIE”), which are defined by the Code of Ethics of the International Ethics Standards Board for Accountants (hereinafter referred to as “IESBA”) as “listed entities and any entity defined by regulation or legislation as a PIE or for which the audit is required to be conducted in compliance with the independence requirements applicable to audits of listed entities”.

According to the Code of Ethics of IESBA, a compliance with the requirements for **independence** of not only PIE, but also of other subjects that may be included in PIE taking into account a large number of employees and a wide range of the interested parties may increase an effectiveness of the information presented in financial statements. However, it is necessary to consider the factors such as a nature of business activities, the size of accounting entity, or the number of employees.

The comments of the users of auditor's report may help to solve many controversies and specific issues in defining PIE. The comments concern mainly:

- including small accounting entities into PIE,
- the public sector institutions, which could be treated inconsistently due to a classification into PIE and
- large listed companies with many shareholders, which may not be included in PIE.

The auditors may emphasize some facts in particular engagements when performing the audits of subjects other than PIE through the “*Auditor commentary*”. It is up to the auditor's consideration to include the “*Auditor commentary*” into the auditor's report. The IAASB admits that the considerations as well as guidelines regarding the audits of PIC are more relevant for the auditors of those subjects which are not included in PIE.

The “*Auditor commentary*” is supposed to be adapted to a national environment so the initiatives of national makers of standards and other regulations are gradually integrated into it. The national makers of standards and other regulations solve the information gap for example by **using the model of “reasoned assessments”**³ or providing the reports of those charged with governance.

³ „justification of assessments” model – requires discussions in the field of auditor's procedures.

When providing additional information about financial statements and the audit performed by the auditor in the auditor's report, some legal or ethical limitations may exist which may lead to discrediting the auditor's opinion, especially due to the subjectivity of the auditor's opinions. Possible limitations of providing additional information relate to expenses for the auditors and those preparing the financial statements, while they result from additional processes of quality control, from iterative processes of completing the auditor's report that may cause a delay in issuing the auditor's report. (IFAC, 2012)

The presentation of additional information in the "*Auditor commentary*" is accompanied by risks, resulting, for example in a lack of comparability of auditor's report between subjects of the same industry, an increased risk of the difference in expectations of readers of the "Auditor commentary" as a possible guarantee to individual facts and disclosures, adverse facts in case of references to the other information in the document, which contains financial statements, and a standardized form of the "*Auditor commentary*".

The auditor's opinion focused on a responsibility in the context of other information contributes to increase a transparency of the auditor's work. In accordance with *ISA 720 - The auditor's responsibilities relating to other information in documents containing audited financial statements*, the auditor's work is focused only on reading other information, which may lead the users to consider the information to be audited. In order to eliminate such a consideration, it is necessary for the auditors to disclose information in the auditor's report that the auditors did not perform the audit of other information.

Other information may contain material misstatements; therefore, the IAASB requires disclosing statements with those facts. The IAASB is currently preparing a revision of ISA 720 because of a determination of higher responsibility of the auditor in relation to other information.

An audit firm assigns a **partner in charge of each engagement** and it advises the partner's identity and role to the management members of client; it assesses the partner's competences, skills, experience and ultimately determines the partner's responsibility. A disclosure of the partner's name in charge of the engagement in the auditor's report may be considered as another method how to increase a transparency of auditor's report because it reinforces a responsibility of partners in charge of the engagement or performed audit. However, a description of the partner is left to considerations of national makers of standard and other regulations. Potential obstacles are highlighted within such considerations so it is possible to think about a possible reduction of responsibility of an audit firm as well as increasing a responsibility of the partner in charge of the engagement.

4.4. Clarifying the responsibility of the auditor and those in charge of governance in the context of risks-based audit

One of the basic auditor's attributes is the auditor's **responsibility** to third parties. The auditor's responsibility is covered by audit regulations, especially by:

- Act No. 540/2007 Coll. on Auditors, Audit and Oversight of the Audit Performance;
- Code of Ethics for auditors of SKAU;
- ISA – International Standards on Auditing.

The auditor's responsibility is based on a contractual relationship between the independent auditor and a client. The presentation of *additional information* in the auditor's report *regarding the auditor's responsibility* may represent a possible tool to eliminate the differences in expectations of the users of financial reporting as well as help to improve the auditor's report, or auditor's reporting based on considerations of potential users.

One of the advantages of presenting such information lies in:

- *achieving a transparency of the audit process itself,*
- *understanding the tasks of auditor, as well as*
- *the nature of the auditor's activities.*

A description of auditor's responsibility has to comply with the ethical requirements, the compliance of which represents the basis for audit. The IAASB requires an explicit statement on a compliance with the ethical requirements to be noted in the auditor's report.

The audit profession is associated with a **certain degree of risk**. The auditor performing a risk-based audit acquires a reasonable assurance that the financial statements do not contain material mis-

statements caused by a fraud or error. The auditor determines which risks need a special attention based on a professional judgment when assessing the risks. The users of financial information require including this information into the auditor's report because of their irreplaceable place in understanding the auditor's opinion on the audited financial statements.

4.5. The application of the IAASB's visions on a global level

Solid foundations could be created in the field of auditor's reporting as a result of globalization. The efforts to improve the auditor's reports on a global level contribute to the **improvement of auditor's reporting** taking into account the ever-changing conditions.

Relevance as well as balance between the need for uniformity to issue the auditor's report in performing audit in the context of ISA with requirements for the auditor's report, which are important in the context of valid laws and regulations in a relevant jurisdiction can be achieved by a revision of the auditor's report.

ISA – International Standards on Auditing are also undergoing a revision, as the IAASB's objective is to establish strong standards leading to the well-performed audit. In the process of preparing ISA, the considerations concerning guidelines on special considerations for the audits of small and medium-sized entities (hereinafter referred to as "SME") and public sector subjects come to the foreground.

Different approaches to the auditor's report may arise due to the existence of various types of accounting entities. The IAASB believes based on mutual consultations with the IFAC Board for SME that it is important to uniformly approach to the auditor's report as well as to the auditor's reporting. In efforts towards a proportional application of ISA for small and medium-sized entities, the users of financial statements of SME require promoting the idea of disclosing additional information for these accounting entities.

The additional information should bring more information mainly for the users of financial statements of the small and medium-sized entities. However, their needs and approach to an accounting entity preparing the financial statements, which are the subject of verification by the auditor, can vary greatly. It is, therefore, necessary to assess an importance as well as potential limitations of implementation of improvements to the auditor's report; it means the auditor's reporting for those subjects.

Conclusion

At present, there are the processes of revising as well as amending ISA - International Standards on Auditing governing the auditor to verify the financial statements and which lead to issue the independent auditor's report, presenting a result of the auditor.

The users of information presented in the financial statements require more relevant information because they make decisions based on this information. The reason lies in continuously increasing requirements for financial reporting so a revision or **a change of the auditor's report** is necessary.

The revised auditor's report will represent a basis for standard makers in order to ensure a relevance of auditor's reporting with respect to business and financial reporting. Thus, the revised auditor's report will be adapted to national conditions, i.e. legislation, and then applied in the national environment.

Relevance as well as balance between the need for uniformity to issue the auditor's report in an audit performed in the context of ISA with the requirements for the auditor's report, which are important in the context of valid laws and regulations in a relevant jurisdiction, may be achieved by the report revision. **SM**

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Reflections of the Economic and Financial Crisis on Multinational Companies: The Case of Transfer Prices

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Abstract

Changed economic environment and the decline in sales volume, impose various commercial and financial challenges for many multinational companies (MNC). The instruments available to strategic management in those conditions vary from the cost reduction approaches to the restructuring of global value chain. A redefined use of transfer prices also features an important strategic option for MNCs in recession times. The authors' aim is to analyse the challenges faced by MNCs in the area of transfer prices management in the conditions of global economic and financial crisis. After a general review of characteristic and the methods of transfer prices calculation, the authors analyse the impact of changed economic environment on MNCs' operations - the use of transfer prices, intercompany transactions and risk management of the MNCs.

Keywords

Multinational corporations, economic and financial crisis, transfer prices, inter-company transactions, "arm's length principle".

Introduction

The survival of companies on the market in current conditions, especially during the economic and financial crisis, requires the management's commitment towards ensure their companies' growth and development. The search for new markets - both for the sale of goods and services and for providing resources in the form of cheaper raw materials or labour, prompts the managements of large multinational companies to overcome ethnic and cultural differences (Popov, 2011, p. 97). Although these differences can make significant obstacles to business success, it is a fact that most MNCs are operating successfully nowadays.

A multinational company is characterized by internal trade realized in transactions that take place between the parent company and related subsidiaries. Rapid changes in the global market and a more intense competition have motivated companies to search for the best ways to access the world market. By employing capital in foreign direct investments and opening branches in other countries, MNCs have gained access to cheaper resources (raw materials, energy, labour etc.), thus providing both economic efficiency and profitable sale of products and services. Another reason for the application of internal trade is the fact that the output branches in one country are often input branches in another country. MNCs apply a similar technique for technology transfer: greater security and benefit of applying technology when MNCs open their branches in a country that is most suitable for its application, rather than selling technology to an independent company. In this way, they avoid the increasing competition in the world markets at the same time. The effects of these processes are twofold. On the one hand, the

volume of international trade increases with the accompanying positive effects such as reducing unemployment and improving economic development of the country. On the other hand, the parent company and MNCs' subsidiaries create an internal market in order to achieve their objectives such as maximizing profit and minimizing costs and liabilities.

For the purpose of inter-company transfer of capital and profits, multinational companies use various mechanisms such as transfer pricing, internal loans, acceleration or deceleration of mutual payments, mergers and other forms of business ventures as well as commonly managed stock. All this enables easier application of intercompany transfers. On the other hand, tax authorities are, in this situation, faced with more complicated procedures of proving the unreality of reported taxable profits. All these mechanisms and techniques are of a great importance for MNCs since they are exposed to large number of economic and political risks.

The importance of MNCs, and consequently the importance of transfer prices at which they realize inter-company transactions, is growing in the global economy. It is estimated that almost two-thirds of the world's business transactions are conducted on the internal market, with a tendency to grow in the future (European Commission - EuropeAid, 2011, p. 1). This fact is of particular importance for developing countries and their endeavour to enable the arrival of MNCs on their territory by creating favourable conditions for foreign direct investments. The current economic and financial crisis has caused a significant shift in MNCs' approach to business. The presence of MNCs in the world market, as a result of the globalization process, was crucial for the penetration wave of the crisis in all national economies (Denčić-Mihajlov, 2009, p. 2).

The aim of this article is to analyse all the challenges faced by MNCs in the field of transfer pricing management in the global economic - financial crisis. Having analyzed the characteristics of MNCs' intra-company market, we present a general overview of the characteristics and methods of transfer prices calculation, with a special emphasis on the application of the "arm's length principle." The second section deals with the challenges faced by MNCs during the economic and financial crisis. This article analyzes the impact of the changed economic environment on transfer pricing, intercompany transactions and risk management at the MNCs level.

1. Intracompany market of multinational companies and the application of transfer prices

One of the main characteristics of the MNCs' operations is the presence at two types of the markets: first, the external market where the trade of the products and services is done with other independent participants at the prices depending on the market conditions, and second, the internal market, where transactions are conducted between related parties and the prices are established at the level of the parent company, regardless of the market conditions (Jovanović & Stojadinović, 2008, p. 155). The intra-company market is an area where the use of transfer prices enables MNCs to provide and achieve a high level of profitability, which is the main goal of all the business entities.

Intra-company market is characterized, in the first place, by the specificity of the participants – MNCs' subsidiaries located at different locations in the world. The trade which takes place between the subsidiaries or between subsidiaries and parent company does not actually result in a change of ownership. Another important feature of intracompany markets are prices at which the transactions are conducted between the participants. Transfer prices, which are applied to trade between different parts of a MNC, do not correspond to the actual value of the product, and are formed by the parent company in accordance with the requirements of the company as a whole. The main objective is to maximize the financial result of the whole company by moving the profit from the country where the tax burden is higher to the countries with more favourable fiscal environment. Operationalisation of this goal is achieved through the transfer pricing mechanism by which the MNCs transfer the profit earned in the country with high tax rates to countries where the rates are at a lower level. This mechanism is also used for the purpose of directing profits towards a parent company: the branch which is located in the country with the constraints on the transfer of profits made on its territory to another country, undervalues its products when selling to a parent company and overvalues them in the case of the purchases (of materials, semi finished products and various services) of the parent company. In this way, in fact, it transfers profits to a parent company (Popov, 2011, p. 109). The country in which the transfer price mechanism

is applied directs profits to other countries and remains without significant fiscal revenues which would be generated.

Transfer pricing exists in the intra-company markets and is used by related parties. The reasons for the application of transfer prices are mostly of a fiscal nature, and are reflected in the reduction achieved taxable income. However, related parties may also apply transfer pricing in their mutual transactions for other reasons (Ilić-Popov & Kostić, 2011, p. 154):

- when one party should increase liquidity,
- when the aim is to provide a competitive position in the market and acquire new markets, or
- when the aim is to present better financial result of one party in order to provide favourable financial support from the banks.

Although these reasons are not purely of a fiscal nature, the application of the mechanism of transfer prices in these cases results in the reduction in the revenue of a particular state. This is the main reason why the national tax authorities are trying to determine the subjects that carry out their economic transactions by transfer pricing and the extent to which these prices differ from market prices. It should be noted that the tax laws, which seek to provide public revenue to the state, should not inhibit making rational business decisions.

The increasing presence of MNCs on the global market stems from the efforts of developing countries (and not only these, especially in the conditions of the financial crisis) to attract foreign direct investments. When a potential investor evaluates that the presence of the needed resources in a foreign country is at a satisfactory level, and that the required level of security for the equity is provided, then the tax competitiveness of the country comes to the fore. As well as (un)regularity of the profit transfer of the parent company the tax burden of the investors is of a primary importance for a foreign investor. Creating a favourable investment climate for a developing country can be a double-edged sword. Specifically, the level of tax rates for certain types of income must be carefully defined, since the creation of favourable tax conditions creates additional costs for the national economy at the same time. Reduction of revenues deriving from corporate income tax requires reciprocity in terms of tax burden on other types of income in order to meet the necessary level of public expenditure of the country.

The manifestation of tax competitiveness, in the form of income tax exemption in a given period of time, is very attractive for MNCs because it provides dual benefits. In addition to the purpose of a legal cost elimination (as a tax on realized income), MNCs use transfer pricing mechanism for transferring earned profits from branches that operate under less favourable fiscal regime towards the branches that have the right to use this kind of tax incentives.

For the purpose of tax liability reduction and income transfer to other branches or the parent company, in addition to the mechanism of transfer pricing, at a disposal to MNCs is also the thin capitalization method (a capital structure heavily weighted toward debt, generally undertaken in order to gain the tax advantage of deducting interest expenses). Thin capitalization is a situation where the debt participates in capital structure more than equity, which has as a result illegitimate tax evasion (Popović, 2008, p. 329). One of the main reasons of the application of the thin capitalization principal is in the tax field (Ministry of Finance, Tax Administration, 2007, p. 353).

2. Transfer prices methods and the “arm’s length principle”

The need for more accurate determination of transfer prices, caused by their reflections on the different areas of global business operations, resulted in the establishment of different methods for their identification. Each country applies particular methods for determining transfer prices in accordance with the regulation of its tax legislation. The methods recommended by the OECD (Organization for Economic Cooperation and Development) are:

- *comparable uncontrolled price method,*
- *retail price method,*
- *cost-plus method,*
- *profit split method, and*
- *net profit method.*

The *comparable uncontrolled price method* is based on a comparison of the transactions that are conducted between related parties with the same or similar transactions performed between independent entities. In cases when controlled transfer prices could be compared to uncontrolled, it is necessary to analyze the conditions under which prices are formed (Ilić-Popov & Kostić, 2011, p. 162). The price of products or services which are the subject of the transaction is affected by the payment terms, the quality of products and services, the approved standard or special guarantees, the provision of additional services, various discounts in price, and by the method of distribution. The taxpayer confirms which factors have been decisive for the formation of prices at a given level by filing the corresponding documents. The prices of controlled and uncontrolled transactions are considered to be comparable if they do not deviate significantly from the market, i.e., when the difference among them can be quantified and eliminated. The problem that arises with the application of this method is that the modern business conditions are characterized mainly by the transactions between related parties, and this reduces the chances of finding comparable uncontrolled transactions. This is particularly applied when it comes to intangible assets such as technology, patents, or different marketing strategies that MNCs export by establishing their subsidiaries rather than by selling to third parties.

When it comes to developing countries, the problem of comparability of issue price of transactions can occur because these economies are less developed, and therefore the price data are not adequate for comparison. Therefore, the database used in transfer prices analysis (Amadeus, Global Vantage, Kompass etc.) are mostly formed on the basis of the data from developed countries and cannot be applied for comparison with developing countries (European Commission - EuropeAid, 2011, p. 9).

The *retail price method* is based on the price that the subsidiary will achieve if it sells the same goods to an independent company, deducted by the normal profit rate. The essence of this method is in determining the level of margin, and in verifying whether, from the point of transactions executed between related parties, this level, differs from the level of margin that would be realized in the transaction conducted by an independent company. The application of this method in MNCs is difficult because thousands of transactions between its subsidiaries are performed every day, and the analysis and comparison of each individual transaction is not only inappropriate but also impossible. In order to improve the efficiency of control, some criteria for grouping transactions are applied, after which control and comparison are confirmed.

The *cost plus method*, or cost plus a reasonable profit, is a method set on the prices based on costs of production to which an appropriate amount of profit is added. The costs of producing goods and services are a measurable parameter, and a common salary is the salary that would be realized in the same on similar conditions in an independent company, at the same or at least approximately the same time (Ministry of Finance, Tax Administration, 2007, p. 347). The applicability of the methods is dependent on the existence of comparable cost, and this can be determined after identifying which costs are included in the calculation, and which method of making calculations is applied. It is also necessary to determine which inventory valuation method is applied, and which costs are considered in profit margin calculation. For this reason, at the beginning of implementation of this method, one should identify which accounting policies are in effect, and define the elements that determine the level of profit.

The three methods explained above are so-called traditional methods of determining transfer prices, and they are an integral part of the legislation of almost all countries that regulate the transfer prices. Transactional net income method and the method of sharing profits should be mentioned among other methods (Radolović, 2010, p. 818).

The *profit split method* is based on a comparison of profit distribution between related companies to the profit distribution that can be expected by independent companies that participate in one or more transactions. The contribution of a transaction by each participant is estimated by using a functional analysis. The method is applicable in situations where it is difficult to identify each individual transaction.

The *net profit method* compares net profits made by subsidiaries in their mutual transactions with net profits that independent enterprises would achieve in the same or very similar conditions. The method is very similar to the cost-plus method, and is also applied in situations where it is difficult to identify each individual transaction.

The “arm’s length principle” should be applied in order to bring down the transfer price to the market price. This principle is applied in order to prevent tax evasion and direction the flows of economic activities towards the informal economy (Popov, 2011, p. 112). Legislative administrations, with special regulations, govern the control of operations between related parties in order to determine more realistic the taxable profits of its tax payers. This is primarily because the conditions agreed between two related subsidiaries can largely deviate from the business conditions that exist between two independent companies. Application of the “arm’s length principle” means that a transfer price should be the same as if the two companies involved were two independent entities, rather than parts of the same MNC. In order to accurately estimate the transfer price, the stress is put on a real picture of transactions, to the extent permitted by the circumstances. Attention is directed to the type of activity (which should be the same or very similar for subjects that are compared), and the risks associated with this type of business (such as terms of buying or selling contract, economic conditions, goods or services that are the subject of transaction). All these risks should be common, or at least similar for the entities that are compared. If any special mitigating or aggravating circumstances that accompany the operations of related entities are presented, their impact on the generated revenue has to be considered and evaluated (Doernberg, 2008, pp. 128-129).

Proving that certain transactions have been carried out by the transfer pricing can be very difficult, and even a big problem for tax administration, especially in developing countries. The nature of the products or services that are the subject of the transaction is of high importance in the process of proving the application of transfer pricing. Transfer pricing in the area of services is very unstable ground for tax administration, because the determination of market prices in the service sector is complicated, which makes it easier to apply the transfer pricing mechanism. The prices of professional services, managerial fees, compensation for the use of equipment between the parts of MNCs and many other services are not suitable for comparison either at the regional or the global level. Due to their size, the presence in many countries and knowledge of business conditions and opportunities for increased efficiency offered by each country in which they are located, MNCs can use transfer pricing to a large extent without violating law.

By shifting profits from countries with high tax rates in the branch with favourable fiscal environment by using the mechanism of transfer prices, MNCs reduce their tax liability and retain most of the profits in their possession. In the same way, the mechanism of transfer prices is used for the repatriation of profits to a parent company. Branches located in the country with restrictions related to repatriation, undervalue products or services while selling them to a parent company, and overvalue of the purchase from it (materials, raw materials, semi finished products, various services), and thus transfer profits to a parent company.

When entering into cooperative agreements with other companies in the country where they invest their capital, MNCs often use restrictive clauses which condition the host country that necessary raw materials must be purchased only from the parent company (Kulić & Stojanović, 2003, p. 73). MNCs explain the legitimacy of these restrictions by the specificities of technological processes. Chemical, pharmaceutical, electronic and other related industries are more than suitable for these purposes. This way, the host country is focused on just one supplier, which opens for MNCs a wide space for applying transfer pricing.

3. The impact of the economic and financial crisis on MNCs

Multinational companies are present on the global product and service markets, but also on financial and information markets. National economies, especially those of developing countries, are interested in attracting MNCs to their territory primarily due to the inflow of foreign direct investments and new technologies which generate growth, development and the increased competitiveness of the country. Long-term orientation of MNCs’ investment projects requires monetary and currency exchange rate stability in the host country as well as adequate legal framework that will allow the protection of the investments and repatriation of the profit.

The current economic and financial crisis has certainly a high impact on the business strategy of MNCs operating on the territory of both developed and developing countries. Foreign direct investment, as a major generator of economic growth in developing countries, but also as a very important factor to promote economic growth and development of developed countries, experienced a significant decline at

the beginning of the crisis period in comparison to pre-crisis period. Due to failure of most greenfield investments in 2008, there was a 15% reduction in the global foreign investment flows (Denčić-Mihajlov, 2009, p. 3). One consequence of the financial crisis is the rising costs of business operations due to increase of the price of bank loans. This influences the ability of MNCs to invest, which is also limited by the reduced profits, difficulties in maintaining liquidity and inflationary pressure. The reduction in demand, as a side effect in conditions of crisis, has influenced the decline in production. The decrease in demand leads to reduced sales and consequently reduces the gained profits. In order to reduce operating costs (which are primarily a result of increased financing costs) companies are forced to dismiss workers and therefore the unemployment increases.

According to the UNCTAD data, during 2011, a number of countries adjusted their investment policies to the current crisis conditions in order to enable the inflow of investments. Apart from the usual, new measures were introduced to regulate the inflow of investments, with a significant part of these measures related to corporate taxation (UNCTAD, 2012a, p. 4). Ghana has reduced the tax rate in the area of hotel and catering industry from 22% to 20%, Russian Federation exempts from taxation corporate profits in education and health services, while Zambia has reduced the tax rate on corporate profits for the agricultural sector to 10% and for banking sector to 35%. The same source points out that in 2011, despite the turbulence and oscillations due to the global economic crisis, there is an increase of foreign investment, and that the actual FDI level is even slightly higher than the level of foreign investment in the period before the crisis (Figure 1). At the same time, South, East and Southeast Asia recorded a growth of foreign investment from 11%, Latin America and the Caribbean recorded an increase of foreign investment of 35%, transient economy recorded a growth of foreign investment of 31% and Africa, as a region with the largest number of least developed countries, still has decreased inflow of foreign investment.

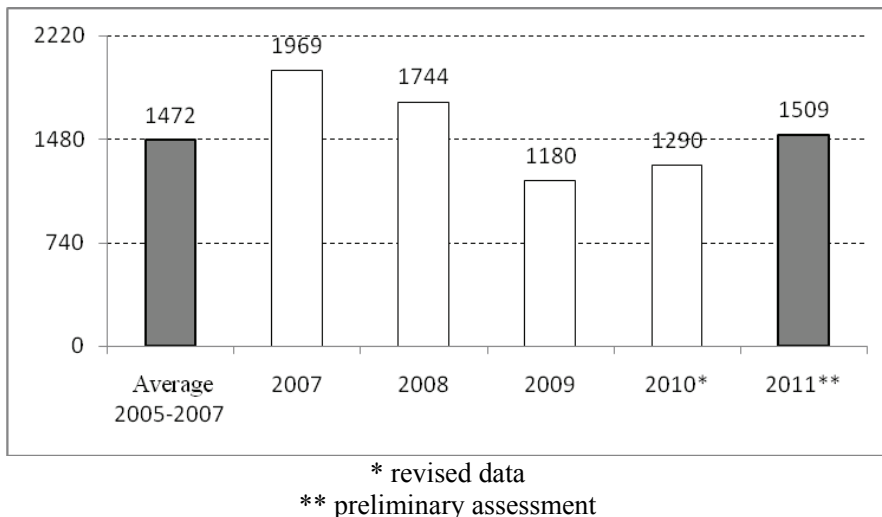


Figure 1 Global flows of foreign direct investment: average 2005-2007 and 2007- 2011
Source: UNCTAD, 2012b, p. 1.

If we analyze the structure of foreign investments (Figure 2), we notice that in most developed countries the share of invested capital dropped to less than 40%, while almost half of foreign investments that were realized in the period related to the 2011 accounted for reinvested profits. There was also an increase in other capital flows, especially internal company loans, which is a sort of reaction of MNCs' parent companies to financial difficulties faced by their subsidiaries.

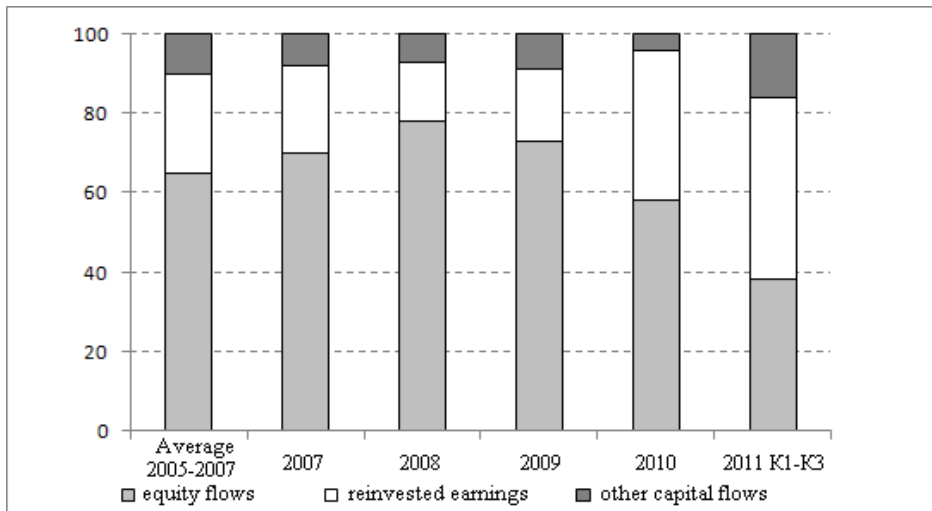


Figure 2 The inflow of foreign direct investment by component for 27 selected developed countries*, the average for the period 2005-2007, and 2007-2011 (data for 2011 include the first three quarters), in percent.

* The elected countries are: Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Israel, Japan, Latvia, Lithuania, Malta, Netherlands, New Zealand, Norway, Portugal, Slovakia, Slovenia, Sweden, Switzerland, the United Kingdom and the United States.

Source: UNCTAD 2012b, p. 3.

These indicators of FDI trends show how MNCs react to problems caused by the global financial and economic crisis. High credit risk, which can negatively affect the financial result and capital of banks and financial institutions, has resulted in the increased prices of loans, which in turn directly affects the rising costs of business operations. Therefore, MNCs are forced to reinvest profit to a higher extent. The reported capital gain for MNCs also means the cost manifested in the form of corporate tax. Thus, large multinational companies prefer to borrow funds on the capital market because the interest paid on loan capital is included in operating costs and does not cause the cost in taxes.

These reasons lead the managements of MNCs to use various mechanisms of inter-company transfers. The bank from the resident country of the parent company may extend a credit given to the MNC's branch in another country. The loan amount should correspond to the amount of funds deposited by the parent company. From the bank's point of view, this credit agreement does not bear credit risk, as it is practically covered by the amount deposited by the parent company. In this way, MNCs can solve the problem of financing their subsidiaries abroad and, at the same time, report the cost in the form of interest instead of taxable income. This financing method is appropriate for MNCs also because of the different treatment of inter-company loans and bank loans by the tax authorities. Moreover, in special (crisis) circumstances, if foreign payments are limited, the authorities often do not decide also to limit the payments of the banks, since this reduces the country's credit rating (Lovrinović, 2012, p. 15).

The special structure of MNCs, as a network of subsidiaries and parent company, can have advantages in times of crisis. Although the crisis undoubtedly has an impact on MNC's operations, its subsidiaries which operate profitably can cover the losses of those companies that financially suffered from the effects of the crisis. This capability reduces the risk effects on the operations of the company as a whole, but in the other hand, it requires greater availability of funds that will be directed to cover the losses of distressed subsidiaries.

4. Application of transfer pricing in the economic and financial crisis

While developing strategy in foreign markets in times of global economic and financial crisis, MNCs place emphasis on the analysis of investments security and repatriation of profits generated in host countries. By the implementation of transfer prices mechanisms, MNC determines the amount of realized income for the selling branch, and defines the level of costs for the subsidiary in the role of the buyer. The main objective of MNCs, operating both in regular business conditions and the changed conditions caused by the global economic and financial crisis, is to maintain the required level of profitability. Inter-company transfer prices allow the allocation of resources and profits generated within the

MNCs, they result in achieving the objectives both of each branch individually, and of the MNC as a whole. Transfer pricing can be based on marginal costs or market prices, all depending on whether the company wants to maximize profits in a short time or achieve increased shareholder value in the long run (Denčić-Mihajlov & Trajčevski, 2011, p. 399). The primacy of one goal excludes the realization of the second one.

It is a fact that OECD does not address explicitly the issue of transfer price application in periods of economic crisis. However, one of the important principles of the *OECD Guidelines for the application of transfer pricing* is the one which states that profits generated by a MNC's branch should reflect its function, the risk it faces and the economic conditions in which it operates. Economic and financial crisis and instability in the economic environment have significant implications on the international allocation of functions and risks at the MNCs level. The measures available to strategic management in those conditions vary from approaches based on the reduction of costs, redefinition of price strategies, changes the location of branches, to the restructuring of the global value chain. Changes in business strategy often require a redefined application of transfer prices. In this regard, it may turn out that adherence to the "arm's length principle" in previous strategy is not continued in the new MNC's business strategy (Radolović, 2010, p. 818). On the other hand, the tax authorities, faced with a lack of funds in the tax system, are expected to be focused on the analysis of changes in transfer pricing policy of MNCs, particularly on the changes that MNCs have introduced during the crisis period.

In the field of transfer pricing management in times of economic crisis, MNCs are focussed on: a) a review of existing inter-company contracts, b) risk management, c) transfer of intangible assets, and d) the audit of existing and contracting of new Advanced Pricing Agreements (APA). Changes in credit margins and continuous uncertainty on the capital market is reflected in the level of interest rates, and hence the necessity of redefining inter-company contracts in order to comply with the "arm's length principle." In addition to adjusting the movement of interest rates, multinational companies are faced with the need to change their credit policies. Redefinition of the minimal criteria that customers must meet in order to be granted a credit is aimed at minimizing default risks. Credit policy should be redefined so as to provide the necessary flexibility of MNCs in terms of response to unanticipated changes in financial market in the near future. In that sense, credit policy at the level of MNCs and its subsidiaries changes towards shortening the credit (discount) period and / or introduction (increase) discount percents.

From the point of transfer pricing application, it should be documented which economic and commercial factors affect the reduction in profits, both at the level of MNCs as a whole and at the level of their organizational units, in order to minimize losses and allocate the risk between the branches appropriately. The effective loss management implies a careful planning from the perspective of the responsibility of loss occurrence, the expected loss amount and the available options for the treatment of losses in the future. Apart from the preparation of documents related to transfer pricing, MNCs may also be required to change and reallocate the risk between the branches (Wilmanns & Christian, 2009). This situation is possible if the reduction in profitability of a branch is a consequence of risk which it cannot be currently compensated for. In this sense, it is necessary for transfer pricing policy to adequately reflect the risk allocated between the entities within the group. In other words, it is essential for entities that bear the risk to be compensated for accepting that risk.

Faced with decline in profitability, MNCs may consider the transfer of intangible assets (whose value also decreases) to organizational units in more favourable fiscal environments, or as a part of the value chain restructuring. Reduction in profitability causes lower valuation of intangible assets, and therefore lower transfer prices, but also lowers the base for determining the tax on capital gains. Therefore, transfer of intangible assets is an important technique in the process of planning the MNC's tax burden.

Advanced Pricing Agreements is a contract, usually for a longer period, between the taxpayer and at least one tax authority, which specifies the method of calculating the price in inter-company transactions. These contracts are designed in order to help taxpayers respond in a proactive and cooperative way to real or potential problems in transfer pricing management. APA implies a greater certainty in applying the method of transfer price calculation, reduce the frequency of international double taxation as well as costs related to tax documentations audit. While negotiating new and reviewing existing APA agreements during the period of economic crisis, MNCs modifies the method of transfer prices calcula-

tion, but also considers other strategies aimed at increasing the flexibility of APA application (such as shortening the duration of the agreement, the definition of critical events to cancel or modify APA elements and changing the method of calculating transfer prices) (PricewaterhouseCoopers LLP, 2009).

Conclusion

Amid the contemporary global economy and turbulent changes that accompany economic processes, the role of multinational companies becomes increasingly important. The increasing number of transactions performed at the inter-company market using the mechanism of transfer prices is the confirmation of the dominance of these businesses entities. The level of transfer prices is not only affected by market conditions, but also by MNCs' needs to maximize their profits. A precondition of the accomplishment of this basic objective is in the fiscal area: profit earned in countries with high tax burden is transferred by the mechanism of transfer prices to the affiliated branches in countries with more favourable fiscal environment.

In addition to the natural tendency of multinationals to expand their market share, the reason of their dominance lies in the need of developing countries to attract foreign investment and new technologies in order to achieve economic growth. One of the positive effects of this process is that the long-term character of investments requires the host countries to provide and maintain monetary and currency exchange rate stability. The other factors of competitiveness include adequate legal framework and tax competitiveness of the country, with all the implications that such competition entails.

The global economic and financial crisis sheds a new light on all these business conditions, complex by their nature. A decline in foreign investments, due to increased operating costs and more expensive bank loans, was observed in 2008, at the beginning of the crisis period. In response to financial difficulties caused by the crisis, multinational companies have changed the structure of investments and shown the growth of inter-company credits. The practice also shows that due to the high credit risk and the increase of the cost of loan, companies are focussed on profit reinvestment in order to reduce operating costs.

Changes in the economic environment caused by the economic and financial crisis impose the need for changes in business strategy and, in this regard, redefined application of transfer pricing. Due to the instability on the market, companies have to adjust their operations following the changes of interest rates. The changes in credit policies are directed towards providing the necessary flexibility in response to potential unforeseen changes in the financial market.

A decline of the profitability of multinational companies can focus their strategy on the transfer of intangible assets towards the branches located in a favourable fiscal environment. In this case, transfer prices are directly aimed at defining the amount of taxable income.

Due to their territorial presence, multinational companies are one of the main factors influencing the intensive penetration of the crisis wave to all national economies. However, for the same reason, they are also a factor to overcome the difficulties caused by the changed business conditions. **SM**

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The Importance of Hedge Funds: The point of View of Insurance Companies and Other Institutional Investors

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Abstract

Hedge funds invest capital of a limited number of wealthy individuals and institutional investors' in high-risk and high-return investments. English origin of the word hedge means to protect, enclose, fence and initially word hedge corresponded to the characteristics of these funds. In modern business conditions, word hedge has different interpretation because they usually take highly speculative position, which in combination with large amount of capital can be very risky. By investing in hedge funds, capital owners can achieve positive absolute returns as well as enhanced portfolio diversification. The aim of this paper is to explain the concept, basic characteristics and essence of the hedge funds and to point out the connection between insurance companies and other institutional investors and hedge funds from the different aspects, through the convergence of capital markets and insurance markets.

Keywords

Hedge funds, insurance companies, institutional investors.

Introduction

Insurance companies and hedge funds are mutually connected. Insurance companies in developed countries can invest their reserves in hedge funds and provide insurance coverage for insurable risks that hedge funds are exposed to and recently, participation of hedge funds in insurance risk management is even more popular (Njegomir, 2008a). Investors are crucial for the mechanisms of insurance risk transfer to the capital market, and without them it would not be able to achieve convergence of insurance and capital markets. Investors include pension and hedge funds, banks, insurance and reinsurance companies and traditional investment funds in the insurance risk (Njegomir, 2006).

The most popular investment funds are mutual funds, and closed-end funds are known beside them. In mutual funds, there is always a possibility of purchasing or redemption of investment fund units. Closed-ended investment funds are the oldest type of investment funds. Investors can buy their investment units on the primary or secondary market, but sell them only on the secondary market. They can issue ordinary shares as well as preference shares and bonds. Assets managed by hedge funds have grown faster over the last 10 years than assets managed by mutual funds (Stulz, 2007).

Hedge funds invest capital of a limited number of wealthy individuals and institutional investors in high-risk and high-return investments. Professional managers of hedge funds often have their own capital in the financial assets of these funds. English origin of the word *hedge* means to protect, enclose, fence. Initially the word *hedge* corresponded to the characteristics of these funds. The essence of the concept was based on a market-neutral investment, which means investment with a high alpha – α (high return compared to the taken risk level) and almost zero beta – β (correlation of rate of return on in-

vestment portfolio and average rate of return on the financial market) using a mix of long and short investment positions. Many hedge funds structured their portfolio in order to reduce risk and uncertainty, trying to pay back invested capital and earn above-average returns in different market conditions.

1. The modern concept of hedge funds

In modern business conditions, the word *hedge* has different interpretation, because they usually aggressively overtake risks related to changes of exchange rates, stock prices, market indexes, interest rates and other financial market's instruments all over the world (Clifford, Krail, & Liew, 2001). One of the key characteristics of hedge funds is exemption from regulation in terms of investment so thus hedge funds are able to invest in various securities and apply different investment strategies. But from the year 2010 there are even more requirements of the European Union institutions (the attitude of USA is opposite) to regulate the business of hedge funds globally. For example, they are able to take "short positions" or sell shares which they do not have, hoping that they will be able to buy them later at a lower price. Hedge funds use a high leverage position and move huge amounts of capital in and out of the market quickly, and they can have significant impact on daily trading of various assets (Levy, 2002). Due to high-risk investments, hedge funds are able to reach returns higher than expected compared to returns of traditional investment funds (Liang, 1999).

Although the word *hedge* originally means protection against risks, investors in hedge funds can achieve higher returns compared to undertaken risks as well as the realization of return regardless of fluctuations in the financial markets. This can be achieved by taking a very complex long and short market positions, using leverage in financing and financial derivatives. As a result, hedge funds can be significant drivers of market changes and have impact on other participants in financial market (Ćirić, 2008).

Membership in the hedge fund is typically achieved through the main partnership structure, where the investment fund advisors and/or key sponsors are general partners. In the case of hedge funds established in the U.S., sponsors are usually investment advisers of the fund and are in charge of marketing and investment management activities. External investments are realized in the form of limited partnerships in which partners (with limited interest), when leaving the fund, have to announce date of leaving the fund to the general fund partners in advance. Except the funds established in the U.S., there are offshore hedge funds, usually founded in offshore zones (Cayman Islands, British Virgin Islands, Bahamas, Panama, Netherlands Antilles, Bermudas, etc.). They are usually organized by financial institutions that delegate fund management to independent investment advisers who have significant participation in the fund portfolio and their compensation is mostly based on the performance of the fund. Hedge funds located offshore may also hire independent fund administrators whose role is to help investment advisers in the evaluation of securities and the calculation of net asset value of the fund, to keep the fund documents, to process transactions, to manage fund accounting and other services. It is common practice that salary of investment advisers in the U.S. and *offshore* funds mostly depends on the realized profit of the fund (usually around 20%) and an minor part (about 1% to 2%) depends on the fund net assets value. This motivation and incentives system provides harmonization of the interests of fund managers and investors in hedge funds.

2. Advantages and disadvantages of investing in hedge funds

The main reason of the huge popularity of hedge funds and their increasing participation on financial markets in the world is their ability to provide positive absolute returns regardless of market trends and possible negative correlation between invested capital, markets of investments and domestic markets from which capital derives. But in the terms of global financial crisis 2008, some hedge funds have shown exception from this rule of providing positive absolute returns. In fact, their primary goal is to reduce the variability of return and risk while simultaneously striving to preserve capital and provide a positive return in all market conditions. Since the beginning of the global financial crisis (2008), capital invested by institutional investors has increased, and it is expected that this trend is going to be continued in the future period. Numerous hedge funds managers intend to launch new funds in the next period in terms of recovered investors' confidence and new investments opportunities.

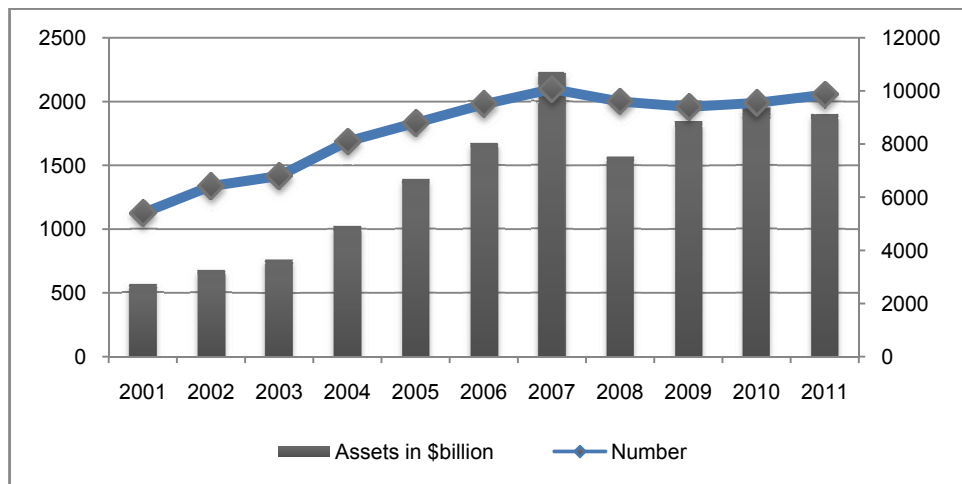


Figure 1 The number of hedge funds and their net assets value worldwide (in US\$ billion)
 Source: Hedge Fund Research Database, n.d.

According to the figure it can be seen that the number of hedge funds worldwide reached almost 10000, with exception of year 2007 when number of hedge funds all over the world was nearly 11000. They manage approximately US\$ 2 billion of total assets. It is estimated that by 2015 the total assets managed by hedge funds may reach a value of over US\$ 6 billion.

Hedge funds can improve the liquidity and efficiency of financial markets. One should also bear in mind that not all hedge funds have investment strategy of profit maximizing, but there are also hedge funds aimed at the preservation of invested capital. Those types of hedge funds use leverage and derivatives rarely, or they do not use them at all. However, hedge funds are primarily known as institutions able to take risks avoidable by other players on financial markets, and that gives them a great economic importance. Hedge funds allow banks and other creditors to reduce risk by active participation on the secondary financial markets. Reallocation of financial risk supported by hedge funds enables creation of additional benefits in the form of reducing costs of capital in other economic sectors. Besides improving liquidity and efficiency of financial markets, hedge funds provide more financial choices and risk management methods which finally results in a decrease of average costs of capital.

On the other hand, market speculations of hedge funds are often perceived as causes of destabilization of financial markets (for example, crisis in Asia in 1997 and partly financial and debt crisis of Greece). From the investors' point of view, the key disadvantage of hedge funds is the lack of transparency in decision-making of fund managers about investment of capital, making it difficult to estimate the resistance of the fund to the extreme and unpredictable markets. The outcome of the lack of transparency and insufficient regulation is a great sensitivity to fraud. However, hedge funds will continue to contribute significantly to the development of financial markets worldwide. Although their property is only 5% of total net assets under management in the U.S.A, about 30% of the total volume of stock trading in this country is related to activities of hedge funds.

Funds of hedge funds are particularly attractive for small investors. In general, funds of hedge funds offer smaller or less experienced investors access to a broad range of funds and a level of industry expertise that would normally be beyond their capabilities. Although funds of hedge funds are more observed after the financial crisis, they will continue to be important allocators of capital to the hedge fund industry and innovators in their field.

3. The most popular investment strategies of hedge funds

There are different investment strategies of hedge funds, which enables selection of the best investment alternative according to the investment needs. All investment strategies of hedge funds can be divided into strategies of extremely high, medium and low risk as well as strategies of variable risk. The investment strategies of extremely high risk include: 1) *emerging markets strategies*, which means investments in securities of emerging markets (China, India, Russia and Brazil), characterized by high variability and high inflation and extremely high returns, 2) *short selling investment strategy*, which

involves borrowing and selling securities with the aim of buying them later at a lower price, and 3) *global macro strategy* that seeks to achieve high returns based on changes in the global economy, such as changes of interest rates, exchange rates, etc., which have feedback on the changes in the stock and bond markets.



Figure 2 Performances of hedge funds depending on the applied investment strategy
Source: Stulz, 2007.

One of high-risk investment strategies is aggressive growth strategy, which involves investing in shares of companies with small market capitalization and low dividends, but a great potential for growth in earnings per share (stocks of issuers in the field of information technology or biotechnology). Typical examples of medium risk strategy are funds of hedge funds and *event driven* strategies. Funds of hedge funds are essentially hedge funds that invest in other hedge funds and thereby seek to achieve additional diversification of risk. They represent investment of balanced return and risk, which is a key motivating factor to attract investments of insurance companies and other institutional investors.

Event driven or strategies for special situations represent strategies of investing in stocks or bonds for which price changes are expected in a short period. Those price changes are usually caused by some unusual event such as mergers, acquisitions, reorganizations and the like. These funds are primarily focused on profit probability of certain events (Culp, 2006). Examples of low-risk strategies include: 1) *distressed securities* or strategy of investments in debt or equity securities of companies that have financial difficulties, that are facing bankruptcy or just have overcome that state, or are in the process of reorganization and 2) *market neutral strategy* such as the *securities hedging strategy* that involves investing similar amounts of capital in the long and short positions of securities, usually from the same sector. Long positions are applied to the securities which are expected to increase in value, and short position in securities which are expected to decline in value.

Finally the variable risk strategies essentially involve the simultaneous use of different strategies in order to achieve better diversification of the investment portfolio and short and long term returns, as well as profit from situations such as sudden changes in prices, initial public offers and the like. During the nineties, the most common investment strategy of hedge funds was global macro. After that, it was strategy of taking long and short positions in buying and selling shares, and event driven investment strategy has been the most popular since the middle of the first decade of the new millennium.

4. Interests of institutional investors in investing in hedge funds

As institutional investors and wealthy individual capital owners are usually investors in hedge funds and minimal thresholds of capital needed for investing are set on a high level, hedge funds have become especially interesting for the investment of institutional investors. Global investment environment has significantly changed in terms of global financial crisis and institutional investors were forced to diversify their portfolios more. Hedge funds' portfolios have become more attractive to institutional investors as instrument for higher diversification and compliance to alpha (α). These non-standard investment

strategies and other advantages of investing in hedge funds provide relatively high and risk adjusted returns to institutional investors (Ackermann, McEnally, Ravenscraft, 1999). Between 2008 and 2010, in the period of the most expressed effects of global financial crisis, hedge fund managers modified their fee structures, liquidity, transparency and marketing techniques in order to enhance investor confidence and increase flexibility of hedge funds. Investors were mostly satisfied with the performance of their hedge fund investments, and about 20 % of investors stated that returns of hedge funds exceeded their expectations (Preqin Global Investor Report Hedge Funds, 2011).

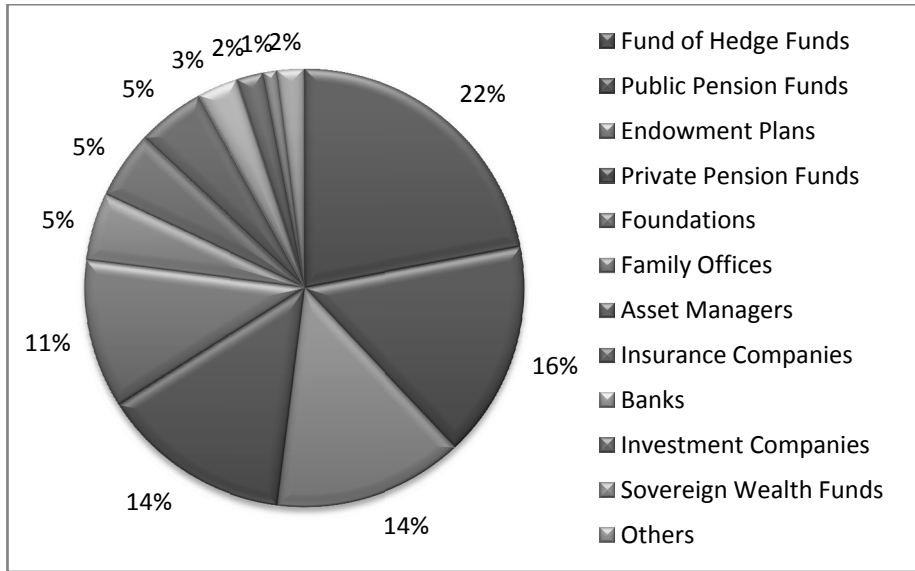


Figure 3 Participation of institutional investors in portfolios of hedge funds
 Source: Preqin, 2011.

Funds of hedge funds are dominant participants in hedge funds’ portfolio. Pension funds invest the on financial market in order to manage their liquidity, provide business stability, preserve the value and provide return of invested capital (Vunjak, 2003). As well as endowments plans, public and private pension funds have significant participation in the assets value of hedge funds worldwide. Even during the global financial crisis, public pension funds have increased assets under hedge funds management from 4 to 7 % and their investments have reached US\$ 4 trillion. Although investments of public pension funds in emerging manager funds have decreased, some large public pension funds continue to actively invest in emerging manager hedge funds. Simultaneously, private pension funds’ investments to the hedge funds have been increased and they become one of the most important institutional investors to the hedge funds industry. Since the financial crisis, private pension funds have become more demanding in both liquidity requirements and the returns they expect from their hedge fund investments. Private sector pension funds and funds of hedge funds account for over half of the European hedge fund investors.

According to the research of *Preqin* (Preqin Global Investor Report Hedge Funds, 2011) investors from the U.S.A. are the largest source of institutional hedge fund capital (54%). About one third of institutional investors in hedge funds are European, and UK is the second largest country globally in terms of the number of hedge fund investors (12%). Switzerland, Germany, Netherlands, Sweden and France are also amongst the top ten countries investing in hedge funds. European investors are more cautious in terms of investing in emerging manager funds and these types of investments are more represented in U.S.A. In Asia, a positive trend of launching new hedge funds is marked, and increasing capital amounts of capital are invested in hedge funds, parallel with growth in the number of hedge funds, which indicates development of the hedge funds industry. According to the newest data, 12% of hedge fund investors are based in Asia and the rest of the world (without U.S.A. 54%, Canada 2%, Europe 33 %), and they are mostly funds of hedge funds and pension funds.

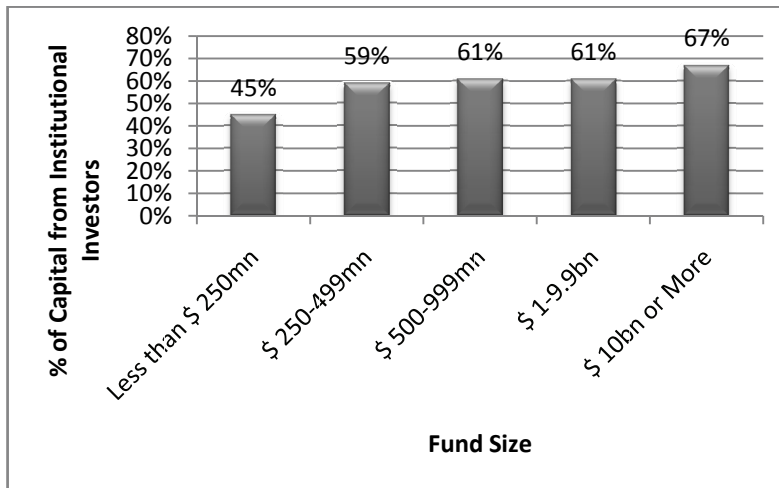


Figure 4 Percentage of hedge fund managers' total capital coming from institutional investors
 Source: Prequin, 2011.

Institutional investors have significant impact in the shaping of the global hedge fund industry in terms of the distribution of capital between the largest and smallest funds. Comparing total assets under hedge fund management to the proportion of their assets coming from institutional investors, it can be noticed that smaller hedge funds collect less capital from institutional investors. In the portfolio of the largest hedge funds, with more than US\$ 10 billion in assets under management, institutional investors have key role. Many institutional investors are seeking for higher level of protection by allocating capital exclusively to the largest hedge funds.

5. Investment in hedge funds from the point of insurance and reinsurance companies

Insurance companies mobilize capital in the form of reserves and realize the function of capital accumulation (Kočović & Šulejić, 2002). Based on the fact that insurance premiums are paid in advance and cash outflows derived from losses occur successively during the year, small amounts of capital of insured individuals become large funds of capital available for investment through the insurance institution (Marović, Kuzmanović & Njegomir, 2009). Insurance companies carry out the function of financial intermediation by collecting insurance premiums, their accumulation and placing available funds (Njegomir, 2010).

Insurance and reinsurance companies should be familiar with different investment strategies of hedge funds, because returns and risks depend on the implemented investment strategy, as well as risk and performance of the insurers' investment portfolios. Some strategies that are not connected with stock markets volatilities can provide relatively high returns at very low risk, while other strategies may be significantly riskier than traditional investment funds. Insurers sometimes select funds of hedge funds which are generally more balanced in relation to individual hedge funds, because their investment portfolios combine different strategies and types of assets in order to create more stable returns compared to individual hedge funds.

Although participation of insurance companies as institutional investors, in the hedge funds' portfolio have decreased during the global financial crisis, their investments in hedge funds are still significant due to relative size of insurance and reinsurance companies. Numerous practical examples indicate feasibility of insurance companies' investments in hedge funds. For example, the empirical analysis of life insurance companies' investment in Germany indicated the advantages of investing in hedge funds and the fact that financially weaker insurers are more interested in investments in hedge funds (Berry-Stolzle, Klaver & Qiu, 2007). Bermuda based reinsurance company Max Re has been applying a policy of investing in hedge funds since its foundation, and in 2004 about 30% of the company's assets were invested in hedge funds - 50 different hedge funds, but with the participation of less than 5% in each (Global Reinsurance, 2005, p. 47).

Justification of investments of insurance companies' reserves in hedge funds is supported by the fact that hedge funds have not had significant falls in their relatively short business history and they have not threatened performance of insurance companies' portfolios. The only two known cases were in 1994 when interest rates rose sharply, and in 1998 when Long-Term Capital Management (LTCM) hedge fund lost 44% of its value with \$ 125 billion of assets under the fund management (before the collapse, the rate of return per annum was about 40%) (Dowd, 1999). Generally speaking, in the period between 1994 and 2008, hedge fund returns, measured by Credit Suisse / Tremont Hedge Fund index, were not higher than the S&P 500 index in each year. However, the average returns of hedge funds for the entire observed period were higher than the returns achieved on the basis of S&P 500 index. It is particularly important to note that, at the beginning of the new millennium, hedge funds avoided the negative impact of internet business (*dot com*) bubble bursting (Brunnermeier & Nagel 2004). In 2008, S&P 500 index recorded a decline of 40%, but the index that tracks performance of hedge funds recorded a decline of only 20%. During the past global financial crisis, there were even hedge funds that made significant amounts of profit, contrary to general market trends, thanks to adequate forecasting of market trends and "betting" on the certainty of the financial crisis. Leading hedge fund managers (25 of them), including the most famous such as James Simons, John Paulson and George Soros, made profit of over \$11 billion in 2008.

However, hedge funds have also a negative side – that insurance companies have to be aware of and limit exposure to higher risk of investments in hedge funds. The global financial crisis demonstrated the importance of cautiousness in investment approaches of insurance and reinsurance companies. Although the impact of the crisis on investments was not significant in terms of insolvency in the insurance and reinsurance sector, the investment losses or reduced results achieved by insurers and reinsurers who have experimented with the high risk investments atypical for the insurance and reinsurance sector, such as investments in asset-backed securities, shares that are not quoted on stock markets and hedge funds (Njegomir, 2010). Some hedge funds benefited during the crisis, but there is always a risk of non-traditional forms of insurance companies' investments. Hedge fund management usually gets some compensation before losing the total amount of capital of its investors and fund disappears from the market. Also, the fund management should provide certain additional information to investors, as most of them do not. However, if hedge fund is successfully managed, investors can achieve returns that are similar to investments in shares, and by stability similar to investments in bonds. Also, risk exposure can be reduced through investing in hedge funds with different investment strategies.

Hedge funds are often subject to judgment, and claims made by clients are possible due to inadequate information on financial results, possible mistakes in managing investment portfolios, or inadequate information to investors about their risk exposures. Managers of financial institutions that suffered losses from investments, including hedge funds that invested in complex financial instruments, can be accused on the base of inadequate understanding of the complexity of the transactions by making investment decisions. This segment demonstrates another aspect of the relationship between insurance companies and hedge funds. This relationship refers to the fact that some specific risks in the business of hedge funds can be insured by insurance companies.

5.1. Insurable Risks of Hedge Funds

Insurable risks of hedge funds are primarily liability risks that hedge funds are exposed to because of the constant changes in the regulatory environment, the variability of market conditions and public interest in relation to corporate governance. Hedge funds may be accused by investors, competitors, partners, regulatory authorities, as well as by companies within funds investing capital. Reasons why hedge funds may be accused include: misguided presentation of information on investment risks and performance, lack of supervision, employee fraud, employment-related practices (sexual harassment and fired without justified reason), negligence in terms of the wrong committed sales, mismanagement, unintentional or intentional disregard of instructions received from investors and the like. Insurance companies offer a wide range of services that can have potential benefits for hedge funds. Regarding characteristics of hedge funds, the key types of insurance products necessary to protect their business include directors and officers liability insurance, errors and omissions liability insurance in order to protect hedge fund managers, life insurance of key personnel if fund's performances depend on one person or a few key

people, and fidelity insurance in order to protect hedge fund of losses that can be caused by criminal acts such as fraud, misappropriation and stealing money or securities by employees.

The importance of insurance for risks that hedge funds are exposed to can be illustrated by the example of LTCM hedge fund, which has been under investigation by U.S. regulatory authorities due to fraud of potential investors, because fund searched for additional capital and new investors when the collapse of the fund was obvious (Lowenstein, 2000). The existence of directors and officer liability insurance and errors and omissions liability insurance would provide protection in such cases.

The insurance company's decision to provide insurance coverage to a hedge fund depends on the debt to equity ratio. The higher the leverage (debt to equity ratio), the more likely it is that a rational and prudent insurer will refuse insurance coverage. It is possible that the insurer will provide insurance only with increased insurance premiums, but it is also possible to refuse hedge fund's request for insurance coverage. Insurance companies consider degree of leverage as well as the type of fund's investment strategy by making a decision on acceptance or rejection of hedge fund for insurance coverage. Insurance companies are less interested in providing insurance coverage to funds that use more risky investment strategies, because their future is uncertain. In addition, insurance companies will give preference to funds that have experienced investment advisors and high level of data transparency to investors. Insurance premium usually pays the general partner but hedge fund can also participate in the total costs. Coinsurance is usually contracted as a percentage of insured's participation in the loss or maybe determined in an absolute amount. The volume of a coinsurance is often used as a marketing tool of insurance companies. Insurance premium is generally lower than the price that would have to be paid in the case of a loss event realization without insurance. The existence of insurance coverage provides indirect economic protection and features as a specific marketing tool that hedge fund's managers can use to attract potential investors.

5.2. Hedge funds on the insurance and reinsurance market

At the early beginnings of the application of alternative risk transfer solutions, a small number of insurers, reinsurers and investors participated in the process of risk transfer to capital markets. However, as time passed the interest for insurance risk transfer to capital markets increased at the side of transactions' sponsors (insurance and reinsurance companies) as well as at the side of investors (insurance and reinsurance companies, hedge funds, specialized funds that invest in securities related to insurance risk, banks, pension funds and other institutional investors) (Njegomir, 2008b). The introduction of the role of hedge funds in the reinsurance market caused revolutionary changes in the insurance and reinsurance sector. Hedge funds took the role of traditional reinsurers and retrocessionaires as holders of higher levels of insurable risks. During 2004., hedge funds invested about \$ 2 billion in the insurance market, but greater hedge funds' capital was invested in insurance risk after the hurricane season of 2005. Insurance markets are attractive for hedge funds primarily because their investment associated with insurance risk offers additional diversification, that is, the possibility that additional investments are not associated with changes in financial markets.

Investments in insurance risk are particularly interesting for funds with multiple investment strategies, regarding the effects of diversification achieved by investments in insurance risk that is not correlated with other risks. Some hedge funds (Acheron Capital, Eskatos Capital Management, Secquaero Advisors, Solidum Partners, Coriolis and Securise Investment Partners) are focused on investments in the insurance risk. These hedge funds invest exclusively in securities related to insurance risk and diversification is based on different types of risk (life and different types of non-life risks). Diversification can be achieved by including risk peaks such as hurricane risk in the U.S., European windstorms risk and earthquake risk in Japan as well as similar other risks such as risks in marine insurance, aviation insurance, crops insurance and the like.


Investments of hedge funds in insurance risk or in securities related to it, such as catastrophe bonds, typically amount up to 1% of the total investment of funds. If we compare the returns on corporate bonds of the same credit rating as well as catastrophe bonds (rating BB) in the period 2005 - 2008, catastrophe bonds demonstrated significantly higher average returns even during the global financial crisis. But later, hedge funds that have survived financial crisis started to withdraw from investments in the insurance risk and searched for more profitable investments.

Conclusions

Insurance and reinsurance companies, investments funds and pension funds are financial institutions that institutionally invest collected capital and at the same time join the individual risks of small investors. They provide a better balance between risk and return than is generally available through direct investments of individual investors.

Hedge funds are a special type of closed-end investment funds. The common feature of investment and hedge funds is a mechanism for collecting capital from individual investors and placement of the raised capital on the collective basis. Both types of funds sell shares or participation in the fund's portfolio, which is professionally managed. Hedge funds and mutual funds perform the same economic function, but hedge funds are largely unregulated while mutual funds are tightly regulated. Hedge funds have become more popular in the 2000s than they have ever been because they provide higher returns than usually could have been achieved by investing in bonds and shares. During the global financial crisis institutional investors have been more interested for hedge funds because this type of investment enables additional opportunity for portfolio diversification. This trend of increasing number of hedge fund investors, assets under management and number of hedge funds worldwide is expected to be continued in the next period. Hedge funds can improve liquidity and efficiency of financial markets and provide more financial choices and risk management methods which finally results in a decrease of average costs of capital.

Insurance and reinsurance companies have significant participation in hedge funds' portfolios, but hedge funds have also a negative side, so that insurance companies have to be aware of this, and should limit exposure to higher risk of investments in hedge funds. There are also different types of risks that the business of hedge funds is exposed to, and insurance companies can provide insurance coverage for those risks. Insurance markets are attractive for hedge funds primarily because their investment associated with insurance risk offers additional diversification and those investments are not associated with changes in the financial markets.

Hedge funds are beginning to have significant impact on the functioning of the reinsurance market. Their emergence in this market has caused revolutionary changes because hedge funds have replaced the role of traditional reinsurers and retrocessionaires as holders of higher levels of insurance risks. 

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Placebo Models

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Abstract

Based on international research conducted in 2002, only one-third of the 288 researched companies used any kind of methodology when implemented changes. According to a non-representative survey carried out in Hungary in 2011 in the topic of change management, only 10 % of all the companies taking part in the survey applied change management models found in the professional literature. Nevertheless, almost half of them were still satisfied with the outcome.

From the point of view of the success of the changes, choosing the methodology is not a guarantee by itself. We can especially not predict what the situation of the company will be at the end of the procedure in comparison with the initial status since, in the meantime, the change itself is taking place, too.

Keywords

Models, validity, change.

1. Problem

While the models are partially of good for everything, they are nevertheless nothing really like therapy: aspirin from the waist up, downwards laxative – real placebo! The placebo reduces stress by its psychological effect to the metabolism. Faith cannot take more, but the lack of something takes it away, one might say simplistically.

According to Wikipedia, a placebo is a medical operation or preparation, which aims to improve the patient's condition, without real surgery or drugs, by simple faith in the treatment. Thus, it is “an apparent drug”, which, however, can often mentally achieve real improvement. Because of faith, it works on a large scale, whatever we may believe. When a new drug is tested, placebo examinations are always performed, as well. Placebos look like the real medication; they are packed the same way, only that they do not contain the agent. In such examinations, it is not just the patient but also the doctors that do not know that the object that looks like medication is really a placebo, since otherwise the placebo would have no effect. At the same time, this way, patients often improve by using placebo just as well as by using real medication. Ariely (2010) tried it with SoBe energy drink. Some people got it at full price, some at half price. The results showed that those who did not get anything showed the same results as those who got it at full price. However, those who received it at half price, showed significantly worse results. **“Placebo reduces stress by its psychological effect on metabolism.”** To put it simply, faith cannot bring more; however, the lack of it can take something away.

The ideas cannot be produced but they can be reproduced by means of logic. Therefore Simon (1973), at least for most of his life, believed that it was possible to build a General Problem Solver (GPS). As a professional anarchist, Feyerabend (1987) rejects the use of any methods, as he observes that there is absolutely nothing that is present in all creativity but is absent in all other enterprises. Thus he declares that “Anything goes!” (Feyerabend, 1993). “Thus the creation of idea is typically associated with creativity and the creation of value with innovation; but we will refrain from using the term inno-

vation due to its widespread overuse and misuse.” (Dörfler, Baracskaï, & Velencei, 2010) In his various books, De Bono (1994) describes creativity as unexpected, non-linear, non-algorithmic, antimethodical mode of thinking. This is what he calls lateral thinking, to contrast it to convergent thinking, or parallel thinking to contrast it with vertical thinking. Yet, he offers a series of tools (used when needed) and habits (always present) for lateral thinking.

For example, according to a non-representative survey of change management carried out in Hungary in 2011, only 10 % of all the companies taking part in the survey applied change management models found in the professional literature.

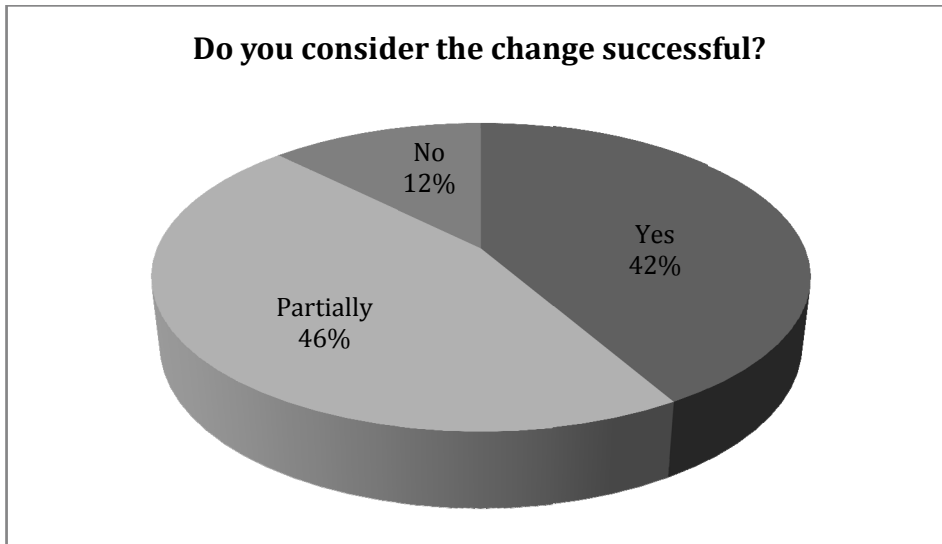


Figure 1 Satisfaction with the outcome of the change process
Source: Molnár, 2012

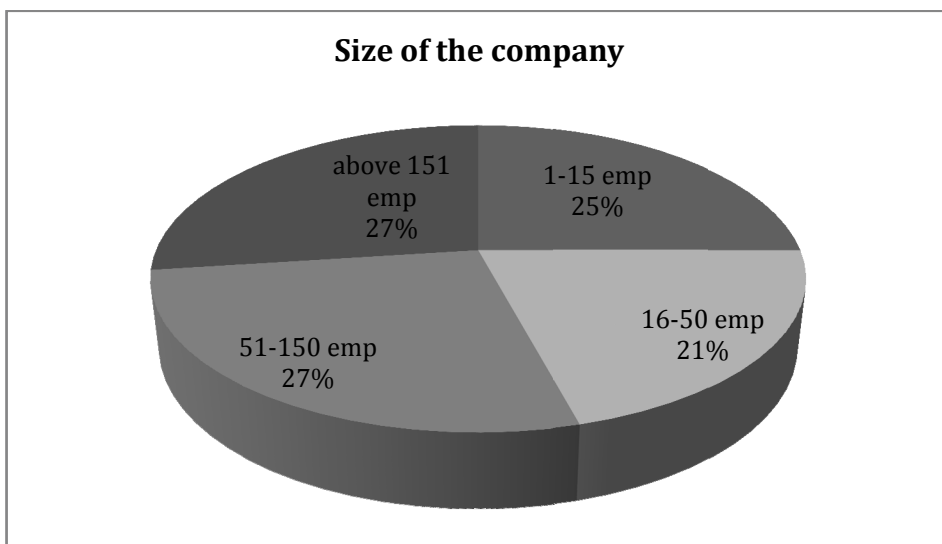


Figure 2 Size of the companies in the change management survey
Source: Molnár, 2012

Among all the fifty companies surveyed, there were only five where any methodology was being applied in order to achieve their change objectives.

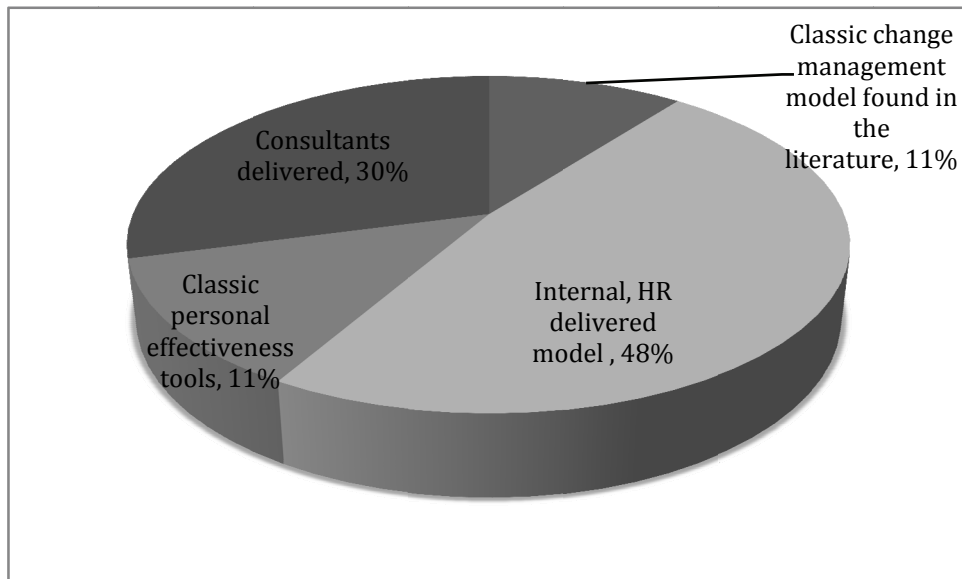


Figure 3 Used methodology during the change process
Source: Molnár, 2012

According to another international survey carried out on 288 companies by the experts of the www.change-management.com portal in 2002, only a third of the enterprises were applying any methodologies when implementing their changes.

Besides, even among the companies that did apply models (that 10%), a vast majority of their managers (80%) were using the usual three-letter tools (mainly BPR and BCG) to modify their processes and became slightly more effective, and only a 20% chose to rethink the basics, that is, reconsider their ongoing strategy and start from the zero. These figures came from in-depth interviews made with the leaders of the enterprises.

From the point of view of the success of the changes, choosing the methodology is not a guarantee by itself. We can especially not predict what the situation of the company will be at the end of the procedure in comparison with the initial status since, in the meantime, the change itself is taking place, too.

We are only dealing with the BCG model, but the essence of three-letter models is the same, whichever may be concerned. There is a point where the model steps out of its validity range, but its use still does not cease to exist. Faith in an expensive placebo replaces the validity range by an “**application range**”. The model keeps functioning even where it is invalid, since it provides security for the analysts. Nobody has any doubts about it, as nobody is interested in looking behind the curtains. The limits of the application range are drawn by the limits of faith.

2. Hypothesis

Norbert Wiener’s cybernetics (1961) opened the way for the business model. The beginning of business schools dates back to this same year. A number of things happened that required tidying in the area of business knowledge. Ansoff (1965) was the first one to come up with a new idea in the sixties. He was very soon followed by the Bostonians. Out of the two models, the second one proved to be more lasting; thus, we are examining this latter one. The most recent models (BPR, BSC, BCG, etc.) do not substantially differ; therefore, the one withstanding more storms will be at an advantage.

There are only a few who understand that models – as opposed to fiction – rather than revealing correlations, are skilfully putting next to each other pieces extracted from the world. We can only model (reproduce artificially) those business procedures that we know well. The model is similar to the operation of the original procedure. The caricaturist captures the main features of reality, so that the original can be recognized. Of course, a caricature does not function as the original. Thus, a caricature is not a model. The pillars of the decision-making thinking in business are meaningful symbols, as well as the different readings of those. When modelling thinking by arithmetic relations, its operation will not be similar to the original. Because, after all, what is the original of the past? The analyst only uses data

required by the model accepted by a majority. If he or she did not do so, then they would fail at the first step because those carrying the shield of objectivity could bother them. Truly flexible models allow for hypothesis depending on the colour of the hat.

“What we call the third wave of the positioning school started streaming as an underground creek in the mid-1970s but, after 1980, it flooded everything in the professional literature of strategic management. The essence of this wave is a systematic and empirical search for interrelations between the different conditions and the internal strategies: faith in sermons and imperatives had faded, at least as far as the content of the strategy is concerned. It was rather believed that systematic examination can help find the ideal strategy in a given system of conditions.” (Mintzberg, Lampel, & Ahlstrand, 1998)

Three-letter performance analyzing models, as memes, have been conserved up to this date. This means it is not enough to perform but often something also needs to be created and then realized. Dawkins (1976) highlights another gene-like aspect of cultural elements: the fact that new types of gadgets capable of autoreproduction have emerged and started their struggle for survival in human culture, due to imitation, i.e. the ability to imitate one another more or less accurately. These novel replicators were dubbed so by Dawkins (1976). The name was backformed from the Greek-sounding word *mimema* and, to his special delight, he noticed how similar it sounded (in this form) to the word gene, how it reminded of the word *memoria* and how it related to the French word *même* (same), too. “A meme can be a melody, a thought, a password, clothes fashion, the method of manufacturing dishes or building arches. Just as genes spread in a set of genes by moving from body to body through sperms or ovules, the same way do memes spread in a set of memes by moving from brain to brain through a procedure that can be called imitation in a broader sense. If a scientist hears or reads a good thought then they pass it on to their colleagues and students. They mention it in their articles and lectures. If a thought is successful then we can say it multiplies by spreading from brain to brain. If you plant a productive meme into my brain than you literally parasitize on my brain because you make it a tool for spreading the meme, just like a virus parasitizes on the genetic mechanism of the host cell.” (Dawkins, 1976) Nothing could be more natural than for “the army of analysts” to maintain the BCG-analyzing model.

Every model has its validity range, within which it functions well and outside which it loses its validity. This even applies to Newtonian mechanics. When an attempt was made to apply it to very small particles, it led to a total crash. As long as it was only applied to phenomena within its validity range (from dust particles to orbs) the model worked fantastically and it established a technical progress never seen before. The situation became totally different when quantum physics appeared. Then it became obvious that the previous (Newtonian) model was not providing explanations to phenomena. Before colliding with them, we could not possibly know about the limits of Newtonian model’s validity.

Business models prided in having validity range as wide as that of Newtonian mechanics. There were always doubts and phenomena that were harshly contradictory to the model. Still, the so-called equilibrium pricing models of the last half a century brought a world economic progress so strong and stable as never seen before. We always need to go too far in order to realize how far we can go. Since we had not encountered any serious walls for a long period of time, it was too late when we realized we should not have gone that far. But it is also thanks to this that developed countries have enough reserves to be able to sacrifice huge amounts on experiments from which they hope to recover from the crisis. What is more, we can also benefit from these. Sophisticated scientific models are replaced by common sense. This does not bring back the previous stormy development (since its engine has been turned off), but decline can be stopped. Then, after theories and models are developed the validity range of which corresponds to the world’s new situation, then the period of visible progress can return.

Nowadays, everybody accepts the fact that the analyst presents the past through the BCG model. Over time, a reading of this model accepted by the analyst has been established. This also implies the fact that readers and/or listeners of the analysis see it as one of the most natural things in the world to be able to receive the model of the currently expected colour through the BCG model.

Something interesting happened: the three-letter models’ validity range can be extended as needed. They can also be used beyond the limits of the original validity range. In reality, as time passed, the model effective in a narrow validity range has become a model applicable in a wide validity range.

3. Discussion

We still remember the times when only a few people believed in the BCG model presented in Neubauer's book (1982) that could be purchased for thirty-five Hungarian forints. Later on, when paying business school tuition fees for it, a little more people started believing in it. And when having to pay several dozens of millions of forints for it to the "big five", almost hardly anyone questioned it any more.

Whether we want it or not, "three-letter-placebos" have a beneficial effect for many, since they do not require them to stress out about validation. Only a few will understand that, throughout validation, the internal contradiction of the concept needs to be explored and the validity range of the concept here and now needs to be somehow scented. No one can really think that anyone can predict the movement of the validity range. The future validity range of the concept cannot be modelled, thus, it is indefensible. "By the time we know the right direction it is too late to go that way", warns Handy (1995). The destiny of three-letter models is not necessarily about their clarification but just as well about the graduate alternation of the various validity ranges. It makes no sense to search for a compulsive balance between the analyst's emotions and the usefulness of three-letter models, since it would be too easy to stick to the conclusion that "the more expensive it is the better it is".

Of course we are not making enough use of placebos either. Most of all, at large companies, it is up to the consultants involved whether they will use "three-letter" models, and if so, how. According to a survey, small and medium enterprises are even less conscious.

The reader might find out more important things than just the psychology of raising awareness in three-letter models. The basis of a multidisciplinary vision is that people may find out new things placing psychology and management one next to the other. Our essay shows that the important thing is not the inconsistency of the two disciplines but the construction of a new context. After writing the essay, concepts are changed in the heads of each of us as opposed to what they looked like before. The validity range of three-letter models has been questioned by more fastidious teachers of management and the essential part has been constructed after the understanding of memes and the placebo effect. The more fastidious psychologists and teachers of corporative behaviour have also started thinking, but they could only make conclusions by understanding the destiny of BCG. This is already a transdisciplinary world-view. To put it in another way, the by-product shows what will follow the multidisciplinary dusk. What we offer here is no formula, no theory, not even the set of propositions as much as the framework by which to think about. We are also thinking in a framework and it cannot be done in any other way than by forgetting having laid the two disciplines next to each other. **SM**

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Advantages of Acid Compliance in Application Development in Firebird Databases

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Abstract

This article presents a special way of developing information systems, where the complete application logic is stored in the database. We present a possible model of information system development and show how to use advanced database functions, in order to embed the logic of application into the base. Several methods and technologies for developing an information system are described, and part of that special attention has been processed in this work. The information system, a major part of application for which was developed inside the Firebird's database, is taken as an example. This database is very extensive, as evidenced by the fact that we have 61 tables, 21 domains, 30 views, 125 stored procedures with triggers, 92 generators and 14 exceptions in it.

Keywords

Firebird database, stored procedure, trigger, ACID characteristics.

Introduction

Databases have increasingly developed over time, so that today we have a database that can do logic applications itself. In this situation, the client-side of application is expected to pass only the necessary arguments which would in turn call a particular stored procedure, in which all necessary calculations would be performed and stored in a way to make the database work as quickly as possible, and so that we could come up with any kind of report in the end. In the data management and database analysis, data domains are related to the unique value the data element can hold. The rule determining the domain boundaries can be as simple as of data type with a numbered list of values.

Firebird is an open source SQL relational database management system running on Linux, Windows, and a variety of Unix. Firebird inherited the sophisticated storage architecture of Interbase. For ensuring the ACID properties of transactions, the database engine keeps different versions of each record changed by the active users in the database. When the transactions are committed, the last version of every changed record is marked as definitive. If transactions are rolled back, the database engine keeps the mark on the original record versions, leaving them untouched (IB Expert Team, 2011a). As a result, Firebird disk writes are very reduced in comparison with databases using the traditional transaction log architecture (IB Expert Team, 2011b). Transactions writing data do not block other ones reading it and vice versa, because each one sees its own version of the database (Firebird, 2011). The advantages of this design, however, have a trade-off: some maintenance ("sweeping") is required from time to time to clean-up old record versions and freeing disk space (Saračević, Mašović, Medjedović, Kamberović, & Lončarević, 2011).

1. Maintaining integrity of applications and term of the transaction

The critical part of every application is to ensure that the operations that it performs are partially separated. If the application needs to perform an operation, and this operation is performed only partially, then the obtained state of application would be incorrect. In this context, we use the term “state” which means the values that the data contains and which are associated with the application or the data contained in the database.

The transaction is an autonomous business unit that fails as a whole or succeeds as a whole. This is particularly useful for scenarios such as the transfer of cash that has just been described, in which the completion of a job consists of successfully completed several related but separate actions - so that the failure of one or more actions causes inconsistency or a similar problem (Stankić, 2012). Transaction may be composed of several actions, and if each part of the transaction is successful, then the transaction is successful itself. In contrast, if any part of the transaction fails (or if more than one part of the transaction fail), then the entire transaction is to be marked as failed. When the transaction is marked as failed, the system automatically returns everything to the initial state that existed before the transaction, by canceling all changes and resetting the transaction.

For example, consider the cash transfer transaction, which consists of two separate but related actions – one that updates a database table showing deduction of the sum from the balance account and the other updating database with sum deposited to another balance account. If the phases of deduction and reception of money fail, then all the changes that have been made in the transaction will be cancelled. The transaction will be successfully completed only if all components are successfully carried out. How to decide whether a transaction is successful or unsuccessful? As noted, a transaction can be divided into different parts, each responsible for different actions. Then each action is provided an opportunity to vote on whether it is completed successfully and in a proper way:

- if the action succeeds, then the transaction may register a vote for completion, and
- if the action fails, then the transaction may register a vote for failure.

But there is one more thing to point out: the voting system in a transaction requires a single-vote consensus. The transaction will succeed only if all its components succeed, so the majority of decisions is not sufficient to make a transaction successful. If any part of the transaction registers a vote for failure, then the whole transaction must fail.

2. ACID compliance and Firebird

Up to now we have discussed the notion through which transaction guarantees that the application will stay in a consistent state. However, the transaction may be defined more precisely. In fact, the transaction is an action or group of actions that show four completely definite characteristics (collectively known by the acronym ACID):

- atomicity,
- consistency,
- isolation, and
- durability.

In order to form the right transaction by a set of related actions, they all must show the four characteristics (Stankić, 2012).

2.1. Atomicity

The transaction is atomic, which is related to the uniqueness of the transaction’s constituent parts. Transaction atomicity ensures that the components of the transaction will be completed all together or none of them. If the transaction updates the system, then the update should be completed in its entirety (if the transaction is voted for success) or it is to be brought to the original state (if one part of the transaction registered a vote for failure). If the transaction is interrupted, the atomicity will ensure that everything that happened before the interruption is suspended and brought to the original state. Now let us clarify why cash transfer transaction is atomic. The transaction consists of two parts. After withdrawing money from account A, deposit to account B follows. As we have previously seen, if the power goes out

after the money from account A is withdrawn, then the phase of reception will be marked as failure. Then the system will cancel the transaction and return the deducted amount to the account, and thus restore the system to its original state.

2.2. Consistency

Transaction supports the consistency of the system status, allowing the system to be in a good condition at the end of each completed or failed transaction. If the transaction is successfully completed, then its consistency guarantees that all changes in the system were made properly and that the system is in working order. If the transaction fails, then the changes that have already been made will be automatically cancelled (and will be returned to their original state). Since the system was in a consistent state when the transaction started, it will be in a consistent state again. We will consider a system of transferring money through accounts again. The measure of consistency in the system is that the total balance of all accounts does not change, i.e., the bank does not have permission to make money, and we do not want to make some money disappear. If an error occurs in the transfer of cash, all parts of the transaction are cancelled and the overall state remains as it once was. If the transaction is completed, then the sum withdrawn from one account and added to another account is equal, the overall situation remains the same and the system maintains consistency as a whole.

2.3. Isolation

Transaction is separate, which means that the transaction is executed separately from other transactions and processes that are happening around them. Yet, at the time the transaction is being executed, it runs in the belief that only it uses a system, so that it thinks it is the only action that the system performs at the time. This is important because the state of the system may not be consistent during the transaction (property of consistency enables the system to be consistent at the beginning and end of the transaction, but not necessarily during the time of the transaction). If transaction finds inconsistent data arising from the fact that there is currently another transaction, then we have a problem. This separation is avoided by prohibiting the execution of two simultaneous transactions.

2.4. Durability

Transaction is permanent in a way that following the successful completion, all changes made in the system are permanent. There is a protection that prevents loss of information, even in case of system errors. Through “report” of the steps performed by the transaction, the system state can be restored even if a hardware error occurs. The concept of durability allows the designer to know that the completed transaction is a permanent part of the system, no matter what will happen later with the system. This raises the following question; how does cash transfer transaction demonstrate the durability? The answer is that the bank database records results of the transaction.

2.5. Transaction logging

Durability is one of the hardest principles to comply with. Other database management systems that claim ACID support have traditionally dealt with it by storing uncommitted transactions in a transaction log. However, logging never totally guarantees durability, since the log file itself may be logically or physically corrupted by the event that interrupts the transaction.

Some DBMSs that rely on logging to achieve durability try to reduce that risk by using a “write-ahead log” to log requests to disk before attempting to post changes. If the write-ahead log survives undamaged, it may be possible to retrieve uncommitted work when the system recovers and use it to reconcile database state and restore it as it was before the event. Such systems are characterised by the need for a lengthy “recovery procedure” after network or power failures.

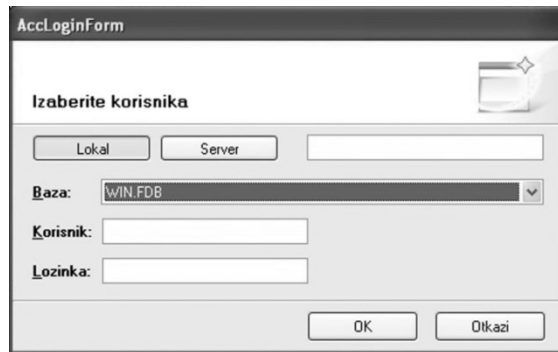


Figure 1 Form and select a user database
Source: Authors

Certain high-profile DBMS products are notorious for log-related breakages resulting from interrupted transactions. The instability of these database engines is such that, even on sites with moderate requirements, it becomes a necessity to employ staff to “babysit” the server around the clock to keep it out of trouble and fix breakages before problems propagate too deeply to save data integrity.

2.6. Firebird's multi-generational architecture

Firebird's architecture avoids the need for recovery logging by literally retaining the preceding version of every deleted or changed record, not just for the duration of the transaction but until all transactions that were “interested” in that record, for any reason at all, have ended. The term for this is “multi-generational architecture”, or MGA. MGA was unique to InterBase for about 10 years until it was imitated by Oracle. Once the Firebird sourcecode was available, PostgreSQL copied it. More recently, Microsoft has introduced MGA in the latest evolution of SQL Server.

3. Stored procedures

Stored procedure is a subroutine available to applications that access relational database system (Bedoya, Cruz, Lema, & Singkorapoom, 2006). Stored procedures (sometimes called proc, sproc, Sto-Pro or SP) are actually stored in the data dictionary. Typical use of stored procedures includes data validation (integrated in the database) or mechanisms of access control. They are used to consolidate and centralize logic that was originally implemented in applications. Large and complex processing that might require the execution of several SQL statements is placed in the stored procedures and all applications call procedures only.

Stored procedures are similar to UDFs (user defined functions). The main difference is that UDFs can be used like any other word in the SQL statement, while the stored procedures are called using the CALL statement. Stored procedures can return a result, for example: the result of SELECT statements. This result can be processed using the cursor of other stored procedures by joining result locators, or using applications. Stored procedures can also include variables for processing data and cursors that allow crossover through multiple rows in a table. Standard SQL provides IF, WHILE, LOOP, REPEAT, CASE statements, and more. Stored procedures can receive variables, return results or modify variables and return them, depending on how the variable is declared (Saračević et al., 2011).

3.1. Implementation

Correct and exact implementation of stored procedures varies from base to base. Most databases support them in their own way. Depending on the database system, stored procedures can be implemented in many programming languages, e.g., SQL, Java, C, Pascal or C++. Stored procedures that are not written in SQL can or cannot perform SQL statements on their own. Wide acceptance of these procedures led to the representation of procedural elements in SQL. This made SQL an imperative programming language.

Most database systems offer specific extensions. For example, Microsoft SQL Server allows stored procedures to be written using Transact-SQL, Oracle calls it a dialect of PL / SQL, DB2 uses SQL / PL,

PostgreSQL provides a PL / pgSQL and also allows user to define his languages for features such as pl / perl or pl / php.

In a Interbase/Firebird stored procedure (Figure 2) you always have to use the SUSPEND command to return a result. With INTO you can copy the field values of the SELECT statement to the return-parameters. If a query has no result, the INTO parameter is NULL.

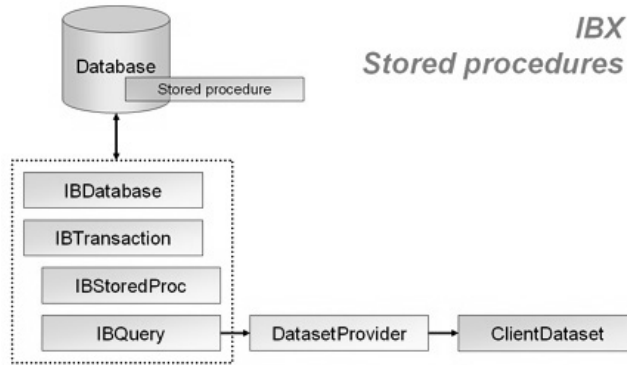


Figure 2 Interbase Express (IBX) and Firebird/Interbase
Source: Authors

Using dbExpress (DBX) components with Interbase is not so much different then InterBase Express (IBX), so you should be familiar with it. Always start first with a TSQLConnection. A feature-rich connectivity solution to provide direct high-performance access to InterBase and Firebird databases. Stored procedures can be executed with a TSQLStoredProc component (Figure 3).

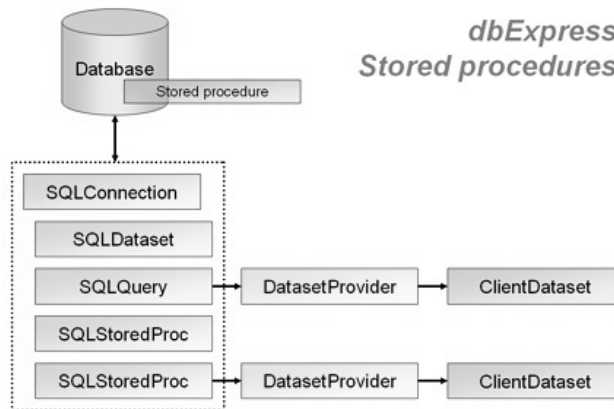


Figure 3 dbExpress (DBX) en Firebird/Interbase
Source: Authors

MySQL also supports stored procedures. Declaring stored procedures:

```
CREATE PROCEDURE name [
(param1 datatype1,param2 datatype2,...) ]
[RETURNS
(param3 datatype3,param4 datatype4,...) ]
AS BEGIN
<body>
END;
```

3.2. Benefits of stored procedures in the described system

In some systems, stored procedures controlled transaction management, while in others, stored procedures are run within a transaction so that their transactions are effectively transparent. Stored procedures can also be initiated by a trigger from a database or by a conditional trigger. For example, stored procedures can be “triggered” by inserting in the designated table, or by update of a specified field in the table, and the code within the procedure would run (Figure 4).

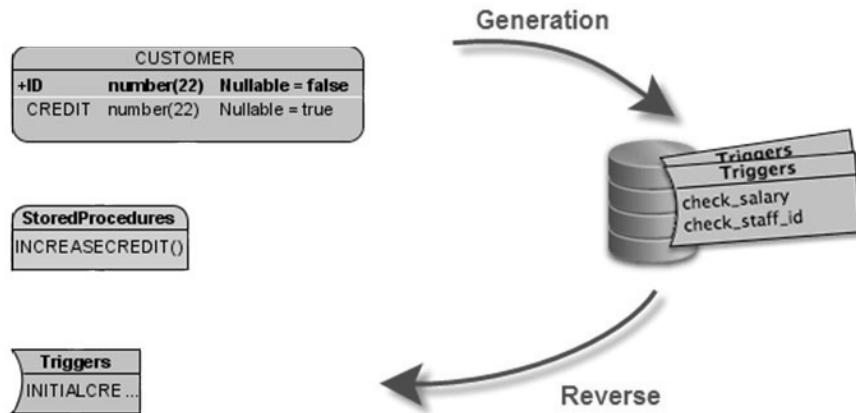


Figure 4 Generation and reverse process
Source: Authors

Writing stored procedures as conditional triggers also allows the database administrator to monitor the errors in detail using stored procedures to catch errors and record any audio information in the database or an external resource such as a file (Bedoya, Cruz, Lema, & Singkorapoom, 2006). This can avoid further compilation that is usually required in situations where applications send direct SQL statements to the database because the stored procedures are stored directly in the database (Klemt & Miles, 2005). However, most database systems implement a cache for the statement in order to avoid recompilation of dynamic SQL statements, avoiding some additions. Besides, precompiled SQL statements, while avoiding some additions, contribute to the complexity of creating an optimal plan for execution, because not all arguments are assigned to the SQL statement during the compilation time. Depending on the implementation and configuration of database, the mixed performance results will be seen in the stored procedure as opposed to the generic statements or UDFs (user defined functions).

The main advantage of stored procedures is that they can be run directly in the database (database engine). In the system of production, this usually means that the procedures run entirely on a specialized server for the database, which has direct access to data that are accessed. The profit is that the cost of network communication can be completely avoided. This becomes especially important for complex series of SQL statements. Stored procedures allow you to embed business logic, same as embedding API to the database, which can simplify data management and reduce the need for coding the logic anywhere in the clients' program. This can result in lower damage incidence of data through the use of wrong client programs. Thus, the database system can ensure the integrity and consistency by using stored procedures (Saračević, Mašović, Kamberović, & Lončarević, 2010).

Differences between stored procedures and functions are:

- only functions can return a value (more precisely, only functions can use Return),
- procedures can use the command Return, but they cannot assign any value to it,
- functions can be used in SELECT statements,
- provided they do not manipulate data inside and that they also should not have OUT, in OUT parameters.

Stored procedures are subroutines that run on the server side and are called from the client side (Borrie, 2004). Stored procedures are precompiled, so they do not have to be sent over the network every

time. They are simply executed. Procedures can have parameters (such as SELECT) and return the data in the form of a table. The advantages of this method are:

- pieces of code implemented only once mean that the client applications are less complicated to implement and maintain,
- easier maintenance which means that client applications do not have to recompile and redistribute,
- increased performance due to reduced network traffic,
- stored procedure can execute a particular action and not return any data,
- to perform the procedure, the user must have the execute rights (GRANT / REVOKE).

Example of stored Procedure: CREATE_SMS_ACTION

Procedure that will add necessary data in the table SMS_ACTIONS in order to selected customers sent notice of the action via SMS.

```

CREATE PROCEDURE CREATE_SMS_ACTION(
  ID_ACTIONS INTEGER)
AS
declare variable message_sms varchar(480);
declare variable price double precision;
declare variable quantity double precision;
declare variable article integer;
declare variable name_Article varchar(40) character set win1250;
declare variable mobtel varchar(20);
declare variable items varchar(450);
begin
delete from sms_ACTIONS where ACTIONS_prod_id=:id_ACTIONS and isporuceno=0;
for select numbers from sms_numbers
where active = 1
into :mobtel do
begin
if (mobtel is not null) then
begin
  message_sms=:mobtel || ' Action: ';
  items = "";
for select aps.article_id, (select name from articles where id = aps.article_id),
  aps.price_with_pdv, aps.quantity from ACTIONS_prod_items aps
where aps.ACTIONS_prod_id = :ID_ACTIONS
into :Article, :name_Article, :price, : quantity
do begin
  items = items || :name_Article || ' price: ' ||
    cast(:price as numeric(7, 2)) || ' quantity: ' ||
    cast(:quantity as numeric(7, 2)) || ', ';
end
  message_sms= message_sms|| items;
insert into sms_ACTIONS(NUMBERS, MESSAGE, DELIVERED, ACTIONS_PROD_ID)
  values (:mobtel, :message_sms, 0, :id_ACTIONS);
end
end
post_event 'ACTIONS_PROD';
end

```

3.3. Triggers in Firebird

Triggers are “own-controlling” routines (special stored procedures), which are associated with a table or view. A trigger is executed automatically when inserted to, updated or deleted from tables / views (Worboys, 2005). It cannot be called directly but only through the commands INSERT, UPDATE, or DELETE. Triggers are written in the DDL language and they can use exceptions. The advantages are as follows:

- automatic imposition of conditions and restrictions on content,
- modification mechanism can be implemented for logging to table,
- generators can be automatically recognized and assign their values to the fields,
- automatic announcement of applications through call of events.

Triggers are run in accordance with their transactions; they are considered as a part of the current operation (IB Phoenix Editors, 2007). The action of a trigger that is initiated in a transaction which is ROLLBACKED, will also ROLLBACK. A trigger will be activated before insertion into the table ACTIONS_PROD. Their task was to check whether the data is completely related to the action. If object and the user are not specified, there will be a mistake; finally, the generator will generate new URI for the data.

Example of Trigger: CLIENTS_AIUD0

Trigger will be activated after ACTIONS insert, update or delete over CLIENTS table. According to the calculation, result is posted to the user.

```

CREATE TRIGGER CLIENTS_AIUD0 FOR CLIENTS
ACTIVE AFTER INSERT OR UPDATE OR DELETE POSITION 0
AS
declare variable uri_temp bigint;
begin
  uri_temp = old.uri;
  if (inserting or (updating) ) then
    begin
      uri_temp = new.uri;
      execute procedure sms_numbers_iu(:uri_temp, new.mobtel, 1);
    end
  else
    delete from sms_numbers where uri = :uri_temp;
    post_event 'CLIENTS';
  end

```

Conclusion

This paper shows one possible way of developing an information system with all its advantages and disadvantages, and of course, advantages and disadvantages are present in all modes of development of information systems. Applications developed in this way have many advantages in respect to an application whose logic was developed on the client side. One of the most important advantages of information system development of this type is certainly transferability. In other words, if the company using this information system shows the need to move to the Web, that task will not be that demanding and it can be performed very quickly. We just need to create web pages that can use atomic data which would be forwarded as arguments to functions and procedures stored in a database. In addition to transferability, the project fully satisfies the ACID properties, because the transaction is the basis of such database.

SM

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Strategic Management Under the Conditions of Uncertainty and Indefiniteness

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Abstract

In order to expound on the application of the fuzzy set theory in strategic management decision making properly, it is necessary to start from the essence of decision making. Just as in many other areas, strategic management makes use of mathematical modelling in cases such as setting strategic goals, formulation of strategies, selection and realization of the chosen strategy, and strategic control. Criteria and restrictions of alternatives are also encompassed in the space of uncertainty and indeterminacy. In addition to being incomplete and fuzzy, they have multiple meanings. The ordering method is based on the assessment, i.e. mark-giving method used by teachers in education. Values of criteria are treated as fuzzy sets, given as marks. It can be easily programmed by fuzzy logic software.

Keywords

Mark-giving-method, strategic management, business decisions.

Introduction

The sense, value, manner and process of decision-making problems in strategic management are determined by the cultural, social, temporal, value, as well as logical context. Fuzzy logic was developed more than five decades ago. The characteristics of fuzzy logic include operating by fuzzy notions, imprecise authentication tables, and fuzzy inference rules. All these characteristics of fuzzy logic are highly important, especially if we try to exchange or supplement the long-dominating approach of strategic decision making with the descriptive one.

The fuzzy set theory and various mathematical reviews, the measures of uncertainty and information have an unlimited possibility of application in all the fields of sciences using a lot of information and data, like for instance, in decision-making. The contexts of strategic management are under the conditions of uncertainty and indefiniteness (Dubois & Prade, 1980).

The criteria, limitations and performances of measures of alternatives bear in themselves some aspects of indefiniteness – in determinativeness, multiple aspects of meaning, incompleteness and fuzziness.

Business decisions in modern-day business are made under conditions of growing uncertainty, which cannot be measured, and business risks, which are measurable. High uncertainty and risk levels result from disruptive innovations and great unexpected shocks (Kotler & Caslione, 2009). Decisions about the strategy of business have always been made under the conditions of uncertainty and risk, but modern-day pace of change and intensity of shock are more extreme than ever. For this reason, decision makers should be qualified for appropriate assessment of acceptable risk level, so as to secure the best effects and control the damage from made marketing decision.

1. Fuzzy decisions

As the name says, the subject of the decision making discipline is the study of how decisions are really made, and how they can be made better and more successful.

The predominant focus of this discipline was in the area of strategic management, where the decision-making process is of key importance for functions such as investment, new product development, resource allocation, and many others.

In most cases, business decisions are made under conditions of uncertainty and high risk. According to some authors (Kotler & Keller, 2006), this is most contributed to by:

- a relatively high number of relevant variables,
- impossibility of controlling relevant variables,
- their instability and nonlinearity,
- stochasticity of relevant variables,
- difficult quantification and measurement of effects of relevant variables,
- shortage of marketing information.

The decision maker's expertise and appropriate assessment of tolerable risk levels (i.e. the subjective factor) is therefore of extreme importance for the final effects of decision made.

Fuzzy systems approximate those equations. Fuzzy systems enable us to make optimum approximations of the non-linear universe. If it is possible to build a mathematical model, we shall use it. Fuzzy systems enable us to model the universe in linguistic terms, rather than forcing us to write a mathematical model of the universe. The technical term for it is *model-free function approximation*.

The Fuzzy Approximation Theorem claims that a graph can always be covered with a finite number of fuzzy patches. The more uncertain the rule, the larger the fuzzy patch. According to the Fuzzy Approximation Theorem, a fuzzy system can approximate a continuous system to a sufficient degree of accuracy. This includes almost all systems studied by science. Fuzzy systems can model dynamic systems changing over time.

Viewed geometrically, every portion of human knowledge, each rule "if A then B" defines a patch on a graph. A fuzzy system is a large set of fuzzy "if ... then" rules, representing "a large set of patches". The more knowledge, the more rules. The more rules, the more sets. If the rules are more indefinite, i.e. uncertain, the patches are larger. If the rules are more definite, the patches are smaller. If the rules are so precise that they are not fuzzy, then patches are reduced to points.

The Fuzzy Approximation Theorem says more than that. Theoretically, all equations can be translated into rule patches. Fuzzy systems approximate systems in physics, communication, physiology, etc. Fuzzy systems can be applied wherever the brain is used.

It is hard to deny that modern-day knowledge is fuzzy. Meanings of statements are undoubtedly fuzzy. Knowledge has always been regarded in terms of rules. If knowledge is fuzzy, then rules are fuzzy as well. Fuzzy rules connect fuzzy sets. Fuzzy knowledge comprises fuzzy rules, and "if A then B" rule. Fuzzy patches cover the system graph. It is the Fuzzy Approximation Theorem and fuzzy patches that explain the functioning of fuzzy systems.

1.1. Fuzzy Linear Programming

Operational research offers optimization models aimed at finding an activity programme that will yield the best possible results. The models use precisely determined and known data. Constraints are also precisely determined, and the goal function is clearly defined, so that it can be formulated easily and simply.

Reality, however, is different: very often we lack precise information on the value of individual input parameters, or the values of coefficients in constraint and goal functions, and imprecise formulation of limitations themselves is possible as well (Maier, 2008).

Fuzzy sets can be introduced into existing decision making models in several ways. As an economic institution, a company bases its existence on the environment, both from the aspect of providing input and from the aspect of achieving and valorising input. Miscellaneous knowledge and experience, and also decision making in the areas of investment, market operations, financial function, production function or research and development, can be considered more fully and exactly applying fuzzy sets. Under

the existing circumstances containing fuzzy characteristics, there is a wish to achieve radical improvements of the production management and decision making (Sedlak, Kocic Vugdelija, Kudumovic, Besic, & Djordjevic, 2010).

The need arises for choosing an appropriate corporate goal out of the available possible alternative goals. When accomplishing and executing the alternatives, the company achieves different levels of increase in sales (because, although the subject issue is decision making on production, one must bear in mind that the ultimate goal of production is sale of the produced commodities).

In addition to many constraints under the given conditions, one must particularly bear in mind limitations, i.e. constraints such as:

- that the selected alternative (goal) is to be accomplished in the shortest possible period,
- that investment in accomplishing the selected alternative should not be excessive.

The goal of decision making is a large number of sold products. The decision must best meet the goal and constraints of the given problem.

The nature of the problem displays the characteristics of uncertainty and vagueness. The need for fuzzification, i.e. fuzzy decision making systems from the fact that the decision maker is faced with a large number of scenarios and sub-scenarios out of which the optimum must be chosen, and the imprecision of input data results from subjective approach in interpreting *per se* vague information.

1.2. The Mark Giving Method

The basic prerequisite to apply fuzzification for obtaining more effective instruments for using different kinds of uncertainty, as well as for using the natural language in modelling decision-making, in the field of business decision-making of hierarchical level, faces a whole range of problems which cannot be solved by the methods of classical quantitative analysis.

Above all, we would point to the following problems:

- ambivalence of aims,
- variability of factors,
- subjectivity of sight,
- linguistic description of variables (Besic, Sedlak, Grubor, & Ciric, 2011).

In practice, we often meet models where multiple criteria take part in decision-making simultaneously. This article is an attempt to prepare a decision by the use of the fuzzy method of ordering alternatives (i.e. aims), and to set priorities among some alternatives and criteria, in the decision-making situations where there are multiple decision-makers, multiple criteria, and in the multiple time periods. The applied method of evaluating in this article is based on the usual assessment, i.e. marking method used in education.

The mark-giving method, very similar to R. Jain's ordering method, is based on the weighted aggregation of marks. As mark processing can be described by many rules, the method forms a fuzzy set of extra marks by the aggregation on the basis of rules, and it can also be programmed as a fuzzy system. The values of criteria, which describe alternatives, are given as marks. An extra mark is assigned to every alternative, aggregating fuzzy sets of marks which describe alternatives. Alternatives are ordered on the basis of extra marks. The mark-giving method based on examples can be generally applied for ordering. (Philips, 1995)

The method is applicable if the values of criteria can be treated as marks (or if they can be transformed into them).

Let us assume $x = \{a_1, a_2, \dots, a_n\}$ is the final set of alternatives, and then take $K = \{k_1, k_2, \dots, k_m\}$ as the final set of fuzzy criteria. Let g_1, g_2, \dots, g_m be the weights belonging to criteria, where the maximal value of the weight is 1.

Let every K_j fuzzy criteria be over x a linguistic variable ($1 \leq j \leq m$), also letting $K_j = \{S_1, S_2, \dots, S_{p1}\}$ where S_1, S_2, \dots, S_{p1} are the values of the linguistic variable. The functions of belonging (μ) S_1, S_2, \dots, S_{p1} to fuzzy sets are determined on the basis of marks:

$$\mu_{S1}(x) \quad \text{supp } S1 = [0,4;1,6] \tag{1}$$

$$\mu_{S2}(x) \quad \text{supp } S2 = [1,4;2,6] \tag{2}$$

...

$$\mu_{Sp_j}(x) \quad \text{supp } Sp_j [p_j-0,6;p_j+0,6] \tag{3}$$

Let every function of belonging be over the sets of the same form of a triangular fuzzy set. The degree of marking (p) can be any whole number, but the exactness and possibilities of expression differ from case (Figure 1 represents the fuzzy sets of the criteria K_j in the case $p=5$). The alternative $a_1 (IS \ i \ S_n)$ with S_1, S_2, \dots, S_{p1} fuzzy sets of criteria can be evaluated.

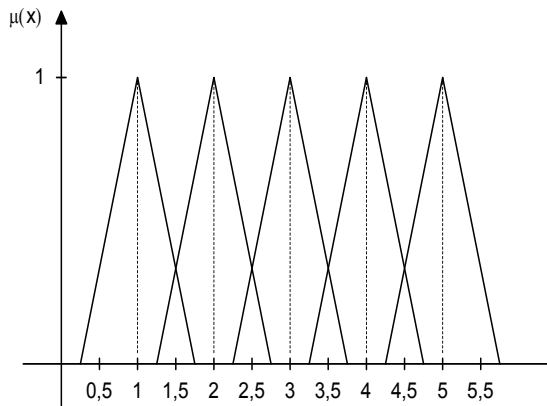


Figure 1
Source: Kosko, 1992.

The mark-giving method assigns every alternative a_1 one fuzzy set R_i , i.e. extra marks, which will appear in one E fuzzy set of results. The set E will enable the set R_i to be compared, as well the set R not to be defined. The set E is a fuzzy set identical with the set of criteria:

$$E = \{S_1, S_2, \dots, S_p\} \tag{4}$$

where $K = \max P_j (j=1,2,\dots,m)$, and every R set will be formed on the basis of partly activated subsets of the E set.

Copying and aggregations of fuzzy sets are necessary for forming R_i sets. In the program package of fuzzy logic, which is applicable, these operations can be performed only with the help of such program blocks which the program package treats as Kosko's FAM (fuzzy associative memories) (Kosko, 1992).

One simple FAM system copies n dimensional fuzzy sets into m dimensional with K parallel FAM rules and their simultaneous use $(A_1, B_1), (A_2, B_2), \dots (A_k, B_k)$. Every A-input information activates rule of FAM system in a way every. (A_i, B_i) is FAM rule and has the form:

$$\text{IF } C = A_i \text{ THEN } D = B_i \tag{5}$$

(where C, D are linguistic variables, and A_i, B_i are their possible values). Input information A is copied into the part of B_1 set, which is partly activated into B_i . The B set is produced from the whole FAM system, which is the weighted sum of partly activated B_1, B_2, \dots, B_k fuzzy sets:

$$B = w_1 \cdot B_1 + w_2 \cdot B_2 + \dots + w_k \cdot B_k \tag{6}$$

where W_i values in the interval (0,1) designates the weights of FAM rules. One procedure of defuzzification is directly connected to the FAM system, which assigns one sole number to the B fuzzy set (Table 2). The focus point in the B set is given by the COG (Centre of Gravity) Method.

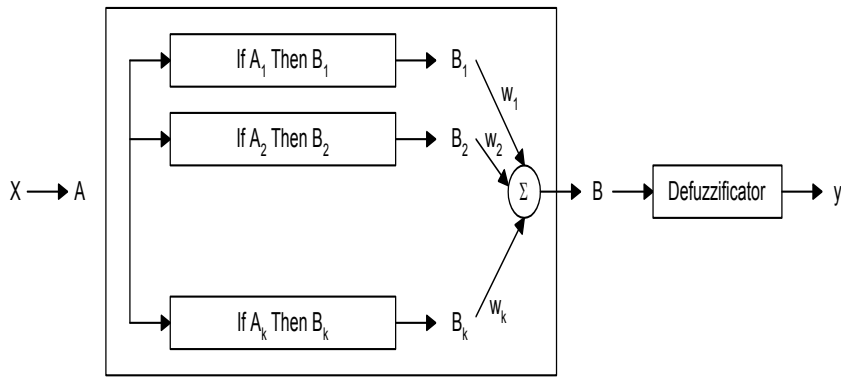


Figure 2
Source: Kosko, 1992.

Input data of the program block are the marks of the criteria: o_1, o_2, \dots, o_m . Any o_j mark of the given values of the criteria S_1, S_2, \dots, S_p partly activates one or two neighbouring ones, and FAM rules copy these partly activated sets into the E set. The R_i set is a weighted sum, even more times, of partly activated S_1, S_2, \dots, S_{pi} sets.

In the course of functioning, the FAM system, one series of marks o_1, o_2, \dots, o_m , belonging to one a_i alternative, partly activates S_1, S_2, \dots, S_{pi} sets, which are located in the part of the conditions of the FAM system. In the same way, the rule activates the same set in the part of consequences. With every copying into the set E, the given triangular number is multiplied with the CF value.

CF (Certainty factor) gives the degree of rule security by which the FAM system automatically multiplies the result of the rules. This CF value is determined by the square of criteria weights. After copying, the sets partly activated by the operator of the algebraic sum are aggregated and added, and finally, the centre of gravity of the aggregated set is formed by defuzzification.

Kosko uses the term “fuzzy associative memory” to describe how a fuzzy system works. The system activates all the rules in parallel and to a degree. Computers use direct memory. Associative memory searches the entire memory. (Kosko, 1992)

2. Comparing methods

The formal similarities between Jain's method and the mark-giving method are used for comparing (formerly applied signs are used in comparing).

Steps of Jain's method:

1. One R_i fuzzy set is formed for every a_i alternative in the form:

$$R_i = \sum_{j=1}^m g_j \cdot r_{ij} \tag{7}$$

where g_i is the fuzzy set of weights, r_{ij} is the fuzzy value K_i of criteria in case of a_i alternative (signed operations mean the multiplication and addition of fuzzy sets).

2. A union of multiples of R_i sets is formed:

$$S = \bigcup_{i=1}^n \sup R_i \tag{8}$$

and one 'maximized' M fuzzy set is defined in the set S:

$$\mu_M(r) = [r/r_{\max}]^\beta \tag{9}$$

with the function of belonging, where $r_{\max} = \sup S$ and β is a natural number (the set M gives the upper limit for the values $\mu_{R_i}(r)$).

3. A fuzzy set R_{i0} is formed from M and R_i sets with the functions belonging to:

$$\mu_{R_{i0}}(r) = \min\{\mu_{R_i}(r), \mu_M(r)\}, (r \in S) \tag{10}$$

4. One Y_i value is assigned to every alternative:

$$y_i = \max \mu_{R_{i0}}(r), (r \in S) \tag{11}$$

Conclusion

Many have criticized Jain's method as it does not give any help in forming the set M (choice β), and Y_i , which is assigned the alternative a_i , represents only one maximum value (the other ones are not taken into consideration in ordering).

Comparing to Jain's method, the steps of this method are the following:

1. Like in Jain's method, one R_i fuzzy set is formed for every a_i alternative in the form:

$$R_i = \sum_{j=1}^m g_j \cdot r_{ij} \tag{12}$$

where the values of the weight g_j can range within the interval (0,1) of real numbers, the values r_{ij} are special, and the fuzzy sets of marks are the same for every criterion (the degree of marks can be different depending on the criteria).

2-3. The method does not limit the values of functions of belonging to the sets R_i , it is not necessary to define M , nor form R_{i0} sets. Instead, the sets R_i are compared in the mutual E set.

4. The value y_i , which joins the alternative a_i , representing the centre of gravity, is formed taking into consideration all the values of criteria. The value y_i , shows the ordinal number of alternatives.

We can conclude that the mark-giving method, compared to Jain's method, represents a different principle of problem solving.

Taking into consideration every value of the "possibility of realization", Yager's method assigns the value Y_i to the alternative a_i (Philips, 1995).

$$y_i = \max \min (\mu_k(a_i)t_j) \tag{13}$$

It also orders every $K_j (\leq j \leq m)$, as well as alternatives on the basis of the value Y_i .

Yager's method does not always differentiate between alternatives with approximately the same weight, so it assigns the same numerical values to the groups of alternatives. With the mark-giving method we notice quite the opposite: it assigns a different numerical value to almost every alternative. According to this, the mark-giving method points more to the difference between alternatives than Yager's method. **SM**

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✉ Correspondence

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A paper must be written in text processor Microsoft Word. Paper size: A4. Margins: 3.0 cm on top and bottom, and 2.5 cm on left and right sides. As a guide, articles should be no more than 5.000 words in length. In case the paper exceeds the normal length, the Editors' consent for its publication is needed. Articles submitted for publication in Journal should include the research aim and tasks, with detailed methodology, presenting literature overview on the research object, substantiation of the achieved results and findings, conclusions and a list of references. Manuscripts should be arranged in the following order of presentation.

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- Ljubojević, T.K. (1998).
- Ljubojević, T.K. (2000a).
- Ljubojević, T.K. (2000b).
- Ljubojević, T.K., & Dimitrijević, N.N. (1994).

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Authors must be listed by their last names, followed by initials. Publication year must be written in parentheses, followed by a full stop. Title of the article must be in sentences case: only the first word and proper nouns in the title are capitalized. The periodical title must be in title case, followed by the volume number, which is also italicized:

Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number*(issue number), pages.

➔ Journal article, one author, paginated by issue

Journals paginated by issue begin with page 1 in every issue, so that the issue number is indicated in parentheses after the volume. The parentheses and issue numbers are not italicized, e.g.

Tanasijević, V. (2007). A PHP project test-driven end to end. *Management Information Systems*, 5 (1), 26-35.

➔ Journal article, one author, paginated by volume

Journals paginated by volume begin with page 1 in issue 1, and continue page numbering in issue 2 where issue 1 ended, e.g.

Perić, O. (2006). Bridging the gap: Complex adaptive knowledge management. *Strategic Management*, 14, 654-668.

➔ **Journal article, two authors, paginated by issue**

Strakić, F., & Mirković, D. (2006). The role of the user in the software development life cycle. *Management Information Systems*, 4 (2), 60-72.

➔ **Journal article, two authors, paginated by volume**

Ljubojević, K., & Dimitrijević, M. (2007). Choosing your CRM strategy. *Strategic Management*, 15, 333-349.

➔ **Journal article, three to six authors, paginated by issue**

Jovanov, N., Boškov, T., & Strakić, F. (2007). Data warehouse architecture. *Management Information Systems*, 5 (2), 41-49.

➔ **Journal article, three to six authors, paginated by volume**

Boškov, T., Ljubojević, K., & Tanasijević, V. (2005). A new approach to CRM. *Strategic Management*, 13, 300-310.

➔ **Journal article, more than six authors, paginated by issue**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., et al. (2005). Putting the user at the center of software testing activity. *Management Information Systems*, 3 (1), 99-106.

➔ **Journal article, more than six authors, paginated by volume**

Strakić, F., Mirković, D., Boškov, T., Ljubojević, K., Tanasijević, V., Dimitrijević, M., et al. (2003). Metadata in data warehouse. *Strategic Management*, 11, 122-132.

➔ **Magazine article**

Strakić, F. (2005, October 15). Remembering users with cookies. *IT Review*, 130, 20-21.

➔ **Newsletter article with author**

Dimitrijević, M. (2009, September). MySQL server, writing library files. *Computing News*, 57, 10-12.

➔ **Newsletter article without author**

VBScript with active server pages. (2009, September). *Computing News*, 57, 21-22.

B. BOOKS, BROCHURES, BOOK CHAPTERS, ENCYCLOPEDIA ENTRIES, AND BOOK REVIEWS

Basic format for books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.

Note: "Location" always refers to the town/city, but you should also include the state/country if the town/city could be mistaken for one in another country.

➔ **Book, one author**

Ljubojević, K. (2005). *Prototyping the interface design*. Subotica: Faculty of Economics.

➔ **Book, one author, new edition**

Dimitrijević, M. (2007). *Customer relationship management* (6th ed.). Subotica: Faculty of Economics.

➔ **Book, two authors**

Ljubojević, K., Dimitrijević, M. (2007). *The enterprise knowledge portal and its architecture*. Subotica: Faculty of Economics.

➔ **Book, three to six authors**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., & Perić, O. (2006). *Importance of software testing*. Subotica: Faculty of Economics.

➔ **Book, more than six authors**

Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., Boškov, T., Strakić, F., et al. (2007). *Supply chain management*. Subotica: Faculty of Economics.

➔ **Book, no author or editor**

Web user interface (10th ed.). (2003). Subotica: Faculty of Economics.

➔ **Group, corporate, or government author**

Statistical office of the Republic of Serbia. (1978). *Statistical abstract of the Republic of Serbia*. Belgrade: Ministry of community and social services.

➔ **Edited book**

Dimitrijević, M., & Tanasijević, V. (Eds.). (2004). *Data warehouse architecture*. Subotica: Faculty of Economics.

➔ **Chapter in an edited book**

Boškov, T., & Strakić, F. (2008). Bridging the gap: Complex adaptive knowledge management. In T. Boškov & V. Tanasijević (Eds.), *The enterprise knowledge portal and its architecture* (pp. 55-89). Subotica: Faculty of Economics.

➔ **Encyclopedia entry**

Mirković, D. (2006). History and the world of mathematicians. In *The new mathematics encyclopedia* (Vol. 56, pp. 23-45). Subotica: Faculty of Economics.

C. UNPUBLISHED WORKS

➔ **Paper presented at a meeting or a conference**

Ljubojević, K., Tanasijević, V., Dimitrijević, M. (2003). *Designing a web form without tables*. Paper presented at the annual meeting of the Serbian computer alliance, Beograd.

➔ **Paper or manuscript**

Boškov, T., Strakić, F., Ljubojević, K., Dimitrijević, M., & Perić, O. (2007. May). *First steps in visual basic for applications*. Unpublished paper, Faculty of Economics Subotica, Subotica.

➔ **Doctoral dissertation**

Strakić, F. (2000). *Managing network services: Managing DNS servers*. Unpublished doctoral dissertation, Faculty of Economics Subotica, Subotica.

➔ **Master's thesis**

Dimitrijević, M. (2003). *Structural modeling: Class and object diagrams*. Unpublished master's thesis, Faculty of Economics Subotica, Subotica.

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Tanasijević, V. (2003, March). Putting the user at the center of software testing activity. *Strategic Management, 8* (4). Retrieved October 7, 2004, from www.ef.uns.ac.rs/sm2003

➔ **Document from an organization**

Faculty of Economics. (2008, March 5). *A new approach to CRM*. Retrieved July 25, 2008, from <http://www.ef.uns.ac.rs/papers/acrm.html>

➔ **Article from an online periodical with DOI assigned**

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems, 2* (2), 45-54. doi: 10.1108/06070565717821898.

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Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems, 2* (2), 45-54. Retrieved from <http://www.ef.uns.ac.rs/mis/TestDriven.html>.

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If a work is directly quoted from, then the author, year of publication and the page reference (preceded by “p.”) must be included. The quotation is introduced with an introductory phrase including the author's last name followed by publication date in parentheses.

According to Mirković (2001), “The use of data warehouses may be limited, especially if they contain confidential data” (p. 201).

Mirković (2001), found that “the use of data warehouses may be limited” (p. 201). What unexpected impact does this have on the range of availability?

If the author is not named in the introductory phrase, the author's last name, publication year, and the page number in parentheses must be placed at the end of the quotation, e.g.

He stated, “The use of data warehouses may be limited,” but he did not fully explain the possible impact (Mirković, 2001, p. 201).

➔ Summary or paraphrase

According to Mirković (1991), limitations on the use of databases can be external and software-based, or temporary and even discretion-based. (p.201)

Limitations on the use of databases can be external and software-based, or temporary and even discretion-based (Mirković, 1991, p. 201).

➔ One author

Boškov (2005) compared the access range...

In an early study of access range (Boškov, 2005), it was found...

➔ When there are **two authors**, both names are always cited:

Another study (Mirković & Boškov, 2006) concluded that...

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(Jovanov, Boškov, Perić, Boškov, & Strakić, 2004).

In subsequent citations, only the first author's name is used, followed by “et al.” in the introductory phrase or in parentheses:

According to Jovanov et al. (2004), further occurrences of the phenomenon tend to receive a much wider media coverage.

Further occurrences of the phenomenon tend to receive a much wider media coverage (Jovanov et al., 2004).

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Yossarian et al. (2004) argued that...

... not relevant (Yossarian et al., 2001).

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A similar survey was conducted on a number of organizations employing database managers ("Limiting database access", 2005).

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If two or more sources used in the submission were published by the same author in the same year, the entries in the reference list must be ordered using lower-case letters (a, b, c...) with the year. Lower-case letters will also be used with the year in the in-text citation as well:

Survey results published in Theissen (2004a) show that...

➔ To **credit an author for discovering a work**, when you have not read the original:

Bergson's research (as cited in Mirković & Boškov, 2006)...

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(Britten, 2001; Sturlasson, 2002; Wasserwandt, 1997)

➔ When there is **no publication date**:

(Hessenberg, n.d.)

➔ **Page numbers must always be given for quotations:**

(Mirković & Boškov, 2006, p.12)

Mirković & Boškov (2006, p. 12) propose the approach by which “the initial viewpoint...

➔ **Referring to a specific part of a work:**

(Theissen, 2004a, chap. 3)

(Keaton, 1997, pp. 85-94)

➔ **Personal communications, including interviews, letters, memos, e-mails, and telephone conversations**, are cited as below. (These are *not* included in the reference list.)

(K. Ljubojević, personal communication, May 5, 2008).

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A few footnotes may be necessary when elaborating on an issue raised in the text, adding something that is in indirect connection, or providing supplementary technical information. Footnotes and endnotes are numbered with superscript Arabic numerals at the end of the sentence, like this.¹ Endnotes begin on a separate page, after the end of the text. However, Strategic Management journal **does not recommend the use of footnotes or endnotes.**

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