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INFLUENCE OF INVESTMENT PROJECTS ON DIVIDEND POLICY OF A COMPANY IN CONDITIONS OF FUZZY INFORMATION

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Abstract

This article describes the problem of using fuzzy logic in the forecasts of variants of the results of implemented investment projects. It also shows the possibility of using calculations with the application of fuzzy triangular numbers L–R in the variants of results: an optimistic result, a pessimistic result and the most probable result (the central result). Moreover, the article draws attention to the possibility of using fuzzy numbers to estimate fuzzy risk of a forecasted financial result of a company. In addition, the article presents how a dividend may be shaped in consideration of multiplicity of variants if dividend policy takes into account dependence on company results as well as implemented investment projects.

Keywords: dividend policy, investment projects, fuzzy logic.

JEL classification: G35, G17, G31.

Introduction

Companies which implement investment projects operate in conditions of an increased risk, which is a result of various groups of risk connected with the activity of the company itself and, additionally, with the risk connected with the implementation of a given project. Negative phenomena caused by a failure to implement the project[1] influence the result of the whole company, and also spoil a company's image in the eyes of investors.

That is why a possibility of estimating changes of the forecasted results of the implemented projects and their influence on the results of the whole company as well the changes in the paid out dividend[2] is especially important.

Fuzzy logic in widely used in economics so it is also used in forecasted results of a company, which, among others, are influenced by implemented development projects. Similarly, we can present the possible payout of dividends by means of fuzzy logic.

The aim of the article is to present the use of fuzzy logic in the dividend payout forecast taking into account many variants, if in the dividend policy the relation with a company's results is considered after dividend project had been implemented.

1. Investment projects in the conditions of fuzzy information

Company investment as well as other activities are burdened with a risk of not achieving desired results. So it is important to take into consideration, as early as at the planning stage, different scenarios of achieved results in the future. These scenarios should include the most possible variant, an optimistic variant, and the worst of them: a pessimistic variant.

Fixed assets investments are the main form of a company's internal development. They are made to widen the scale and scope of a company's activity, increase its profitability, improve its competitiveness, e.g. by achieving the economies of scale, or by widening the company's offer[3].

The influence of investments on the overall functioning of a company is always important, no matter at which stage of development a company is. An organic growth of a company or its acquisitions are connected with investments which are a part of strategy of every entity.

Investing is not an isolated activity, but an integral part of a company's general operation. It is connected, to a smaller or bigger extent, with all other kinds of activities of a company. Investment activity shapes and is shaped by many other decisions and actions which make up a company's operations[4].

When realising investment projects one should analyse some financial parameters to which we can undoubtedly include:

1. WACC, showing a capital structure and its possible changes, which is estimated as:

$$WACC = w_E \cdot k_E + w_D \cdot k_D \cdot (1 - T_C) \tag{1}$$

where:

$WACC$ – Weighted Average Cost of Capital,
w_E – share of equity capital in a company's capital,
k_E – cost of equity capital,
w_D – share of external capital in a company's capital,
k_D – cost of external capital,
T_C – income tax rate.

2. NPV of a project, i.e. its net present value, which is calculated as:

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{I_t}{(1+i)^t} \tag{2}$$

where:

CF_t – net financial flows in subsequent years,
I_t – capital investments in subsequent years,
i – discount rate.

An entity should implement only these projects for which NPV > 0. Very often a discount rate is the company's WACC or a sum of a risk-free interest rate, inflation or accepted risk for a given project.

3. ROC (return on invested capital)[5] of a project, for which the inequality should be satisfied:

$$ROC > WACC \tag{3}$$

because only then a company creates value.

The analyses – which precede the implementation of any investment project – should also take into consideration the risk of a project understood here as the failure to achieve the planned target values. For this purpose we can use fuzzy numbers showing a given phenomena as not an acute number.

A fuzzy number is a fuzzy set defined on real numbers. Formally, a fuzzy number A is denoted by:

$$A = \{(U_A(x), x)\} \ \forall x \in R \tag{4}$$

where $U_A(x)$ is a membership function of a fuzzy set, which represents the degree of belonging of each $x \in R$ number to the set A, taking into account that:

$$U_A(x) \in \langle 0, 1 \rangle \tag{5}$$

A fuzzy number can also be presented as a triangle fuzzy number L–R, whose membership function is denoted as:

$$U_A(x) = \begin{cases} L(x) \text{ for } x \in (M_A - \alpha_{A,} M_a) \\ R(x) \text{ for } x \in (M_A, M_A + \beta_A) \\ 1 \text{ for } x = M_A \\ 0 \text{ for remaining } x \end{cases} \tag{6}$$

where:

$L(x)$ is a non-decreasing function,

$R(x)$ is a non-increasing function.

Fuzzy triangle number L–R is denoted as:

$$A = (M_A, \alpha_A, \beta_A) \tag{7}$$

A fuzzy number intersection ε of a fuzzy number is an acute set defined in the following way:

$$A^s = \{x \in R : U_A(x) \geq \varepsilon\}, \varepsilon \in \langle 0, 1 \rangle \tag{8}$$

The set is denoted as: $< \alpha^{-s}, \alpha^{+s} >$, where:

$$\alpha^{-s} = \min \{x : U_A(x) \geq \varepsilon\} \tag{9}$$

$$\alpha^{+s} = \max \{x : U_A(x) \geq \varepsilon\} \tag{10}$$

ε fuzzy number intersection is shown in Fugure 1.

The accepted interpretation of parameters of a fuzzy number enables us also to describe a fuzzy risk of a forecasted financial result of a company as[6]:

$$S_A = (\alpha_A + \beta_A) / 2 \tag{11}$$

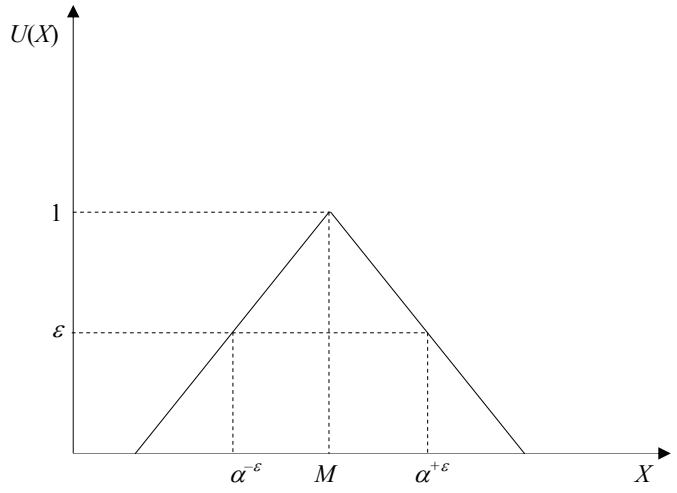

Fig. 1. A fuzzy number and its intersection ε

Source: own study.

Using the ε intersection operation one can perform the decomposition of the membership function according to the formula (decomposition principle):

$$U_A(x) = \sup [\varepsilon \wedge I_A\varepsilon(x)], x \in R, \varepsilon \in \langle 0, 1\rangle \tag{12}$$

where:

$I_A\varepsilon(x)$ is a characteristic function of a set A^S,

while ^ is an algebraic minimum operation.

The decomposition principle expresses a membership function of a fuzzy number by characteristic functions of acute sets. Using fuzzy number one can define arithmetic operations with the use of a widening principle. Unfortunately, although this method is very precise, it is quite laborious. That is why simplified forms of arithmetic operations based on representations of L–R fuzzy numbers are often used[7].

If a forecasted result of an investment made by a company is defined in fuzzy numbers categories (especially in a form of a triangle fuzzy number), the variants of results of an investment are described as:

M_A – most possible variant (central), (13)

$M_A - \alpha_A$ – pessimistic variant, (14)

$M_A + \beta_A$ – optimistic variant. (15)

Figure 2 presents the examples of forecasted results of investments of a company described in acute number categories.

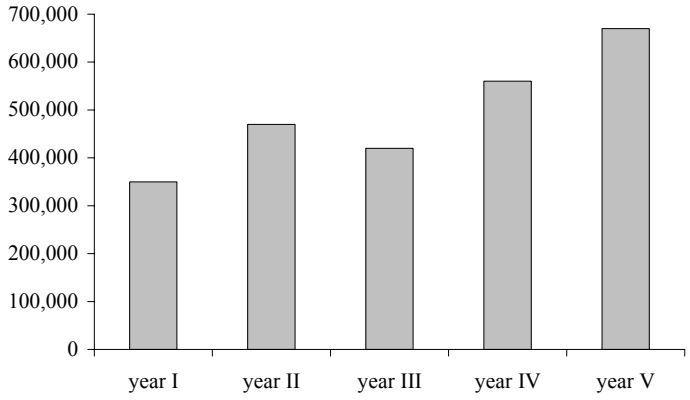

Fig. 2. Forecasted results of investments of a company (in thousands of zloty)

Source: own study.

Next, the same results can be presented with a use of a fuzzy number (7) in accordance with the specified variants of realisation of results of an investment (13)÷(15).

The variants of forecasted results of the planned investment created, for example, for the sake of taking a bank loan, are an outcome of a forecast presented by experts from a given company, such as a financial director and/or a management board member. The possibility of presenting the forecasted results of investments of a company is shown in Table 1.

Table 1. Variants of forecasted results of investments of a company [in thousands of zloty]

Variants of forecasted results of investment	year I	year II	year III	year IV	year V
Optimistic variant	434.720	503.928	453.202	678.900	769. 903
Most probable variant	349.881	453.765	421.432	579.292	673. 910
Pessimistic variant	276.483	367.348	339.487	456.382	532. 764

Source: own study.

A graphic presentation of the data from Table 1 is given in Figure 3.

Table 1 clearly shows that forecasted results of investments represented in a form of acute numbers are the most probable variant written in a form of fuzzy numbers. The difference between the optimistic variant and the most probable one is a positive aberration from the

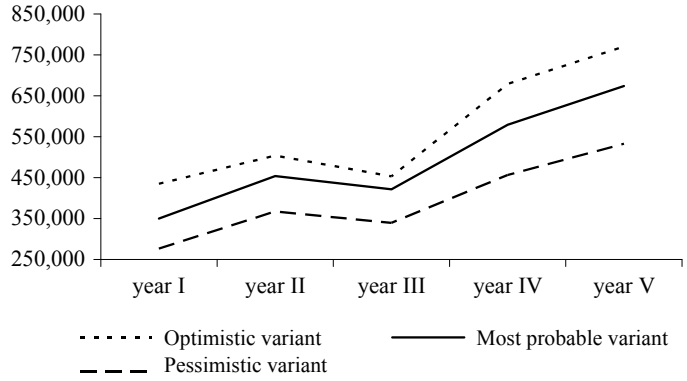

Fig. 3. Variants of forecasted results of investments (in thousands of zloty)

Source: own study.

central variant, whereas the difference between the pessimistic variant and the most likely one is a negative aberration from a central variant. The risk of the investment project realisation and its variants can be presented with a use of a formula (11).

2. Investment projects and dividend policy in the conditions of fuzzy information

Variants of investment result forecasts taking into account the risk presented in this way influence, among others, the accepted dividend policy.

A dividend policy specifies what part of profit is divided among shareholders and what part is retained for growth and development of a company. So there are the decisions made about the division of profits which can be divided into two cash flow streams. The former goes to shareholders in a form of a dividend. The latter is retained in a company and can be used for financing its growth and development. Similarly to the debt policy, the dividend policy can be formulated in a resolution made during an ordinary general meeting of shareholders[8].

There are many studies of different strategies of a dividend payout (permanent dividend rate, permanent payout rate, surplus dividend policy, target payout rate, 100% payout rate policy and zero payout rate dividend)[9].

A properly created dividend policy should encompass in its structure, among others, the influence of investment projects on a possibility of realisation of payout policy[10]. Each allocation of capital that a company accumulates for projects for which the condition (3) is met reduces the possibility of a dividend payout.

We should emphasize that although at the initial stage of the capital market development it is common not to pay out a dividend to shareholders, on a developed market investors expect current income from investment in companies' shares. If a management board has a reasonable investment policy, we can expect that no dividend means investing money in a project which will contribute to the growth of a company value in the future (a growth of value for the owner). And, as the company is developing, investment needs are getting smaller, which eventually result in an attempt to work out a long-term stable dividend policy[11].

In addition, one can find results of research made on portfolios built from dividend companies and the properties they show[12]. Portfolios built only from dividend companies are characterised not only by a higher return in the period of bull market, but also smaller falls in the period of a slump – they are defensive companies.

However, an influence of the level of dividend and its share in a company's earned profit on the wealth of shareholders is not unambiguous: on the one hand – higher dividends mean an increase of wealth, on the other hand – they limit a growth potential of a company's profit in the future and, consequently, the investors' capital profits. The main question is if there are any optimal – from the point of view of a company value and the wealth of its owners – proportions of the dividend of profits for reinvestment and cash paid out to investors[13].

If the results of the realised investment (together with variants presented as an example in Table 1) affect the payout of a dividend according to the worked out concept of a company's dividend policy, then the dividend policy can also be presented with the application of fuzzy numbers.

An example of a dividend payout forecast is shown in Table 2.

Table 2. Variants of dividend payout forecast [PLN]

Variants of dividend payout forecast	year I	year II	year III	year IV	year V
Optimistic variant	2.66	3.01	2.75	3.15	3.45
Most possible variant	2.55	2.90	2.70	3.05	3.22
Pessimistic variant	2.23	2.75	2.62	2.99	3.15

Source: own study.

Variants of a dividend payout forecast according to the notation of variants (12)÷(14) are shown in Picture 4.

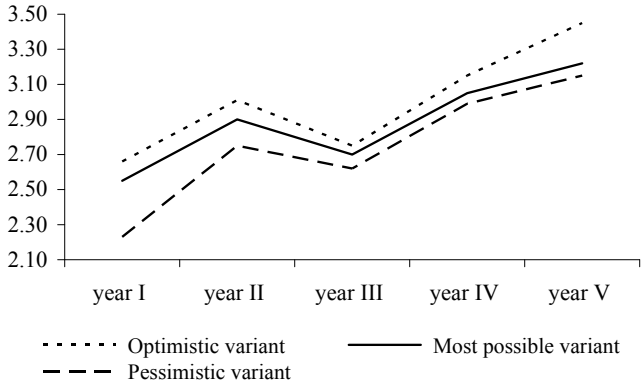

Fig. 4. Variants of a forecasted dividend payout (in zloty)

Source: own study.

In Picture 4 we can see that year III is a time of a temporary slump of an entity (Table 1 shows a decrease of the forecasted results of a company's investment in this period), which also results in lower variants of possible paid out dividend in this period. We should add that a dividend is paid out for the preceding year, so we have to take a time shift into consideration.

Conclusions

The presented example of the use of fuzzy logic in the analysis of the results of implemented investment projects shows its advantages. It gives a company management board a possibility to analyse the realised projects as variants of their realisations, a full picture of possible aberrations from the central value (the most probable variant), as well as the risk connected with these aberrations.

Moreover, such application of fuzzy logics enables us to reflect – after implementing investment projects – the changes of results in the dividend policy itself.

The results shown in this way to shareholders and the proposals of dividend payout variants make it possible to realise different scenarios and investors can learn what are the possible aberrations of results of companies they are interested in.

Notes

[1] Or considerable aberrations from the assumed results.

[2] It has been assumed in the article that a dividend policy refers to a company's results in a form of the achieved net profit.

[3] Różański (2006), pp.14–15.

[4] Marcinek (2004), p. 15.

[5] ROC – often referred to in literature as ROIC. ROC = (EBIT × (1 – T))/constant capital.

[6] Przybycin (2009), pp. 49–63.

[7] Piegat (2003), p. 85.

[8] Pomykalska, Pomykalski (2007), p. 162.

[9] See among others: Brigham (2005), p. 204; Marsh, Merton (1987), pp.1–40; Brealey, Myers (2003), p 438; Brav and others (2005), pp. 483–527; Baker, Powell, Veit (2002), pp. 267–283; Duraj (2002), p. 93; Benninga, Sarig (2000), p. 285.

[10] Dividend policy includes dividend policy and buy-back. They are profit division mechanisms (profit transfer) with sharholders which are often used interchangeably.

[11] Kaźmierska-Jóźwiak (2008).

[12] The author of the article conducted research into the analysis of investment only in dividend companies listed on Warsaw Stock Exchange in the period of 1991–2009 which shows that they are characterized in a along term by a higher return rate than companies which do not pay out dividend or have been added to portfolios according to the same criteria. The results of the analysis of portfolio profitability made from dividend companies listed on Warsaw Stock Exchange in the period of 1991–2009 were widely discussed. See more in: Jabłoński (2011); Jabłoński (2010a); Jabłoński (2010b).

[13] Cwynar, Cwynar (2007), p. 178.

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