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**CALCULATION OF AVERAGE WEIGHTED COSTS OF CAPITAL**  
**WHEN ASSESSING COMPANY BUSINESS ACTIVITIES**

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*Abstract*

Discount cash flows and economic profit are key criteria for business assessment. They can be used to develop efficient business strategies.

Discount cash flows take into account all factors influencing the company value. They give information on future cash flows at the risk rate typical of cash flows. When determining discount cash flows for calculating average weighted costs of capital, a method for calculating average weighted costs based on a contribution of a single cash source to total capital and cost values can be used. Values of average weighted costs of capital can change depending on the structure of investment resources, revenues and profitability. These costs of capital are referred to as *marginal*.

Economic profit can be a measure of costs generated in a singular period. It transforms key cost factors into a uniform cost factor which describes results of company business activities, i.e. economic value added. Average weighted costs of capital can be calculated by three methods. *The first one* is based on use of the finance theory law according to which solvency changes result in changing owned and debt capital structures. *The second one* involves calculation of average weighted costs of capital using real solvency and unchangeable costs of owned and debt capital. *The third one* involves calculation of average weighted costs of capital using a target solvency ratio disregarding calculated solvency ratios.

Different calculation methods for average weighted costs of capital produce different business values depending on goals of business appraisers.

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**Keywords:** Business assessment, discount cash flow, economic profit, average weighted cost of capital.



## **1. Introduction**

The main tasks of company managers and shareholders are to preserve and increase economic resources, profit and production volumes, prosperity of shareholders, improve investment attractiveness and select methods for attracting investment resources. Joint stock companies have to aim at achieving best results, creating stock and company value growth conditions, and maximizing the value of company resources.

## **2. Problem Statement**

The business value index characterizing company resources as compared to the company asset value index is the best measure of business performance. Being more meaningful, it contributes to more reasonable decision-making.

The main criteria stating the significance of the added value are discount cash flows based on key cost factors and economic profit. They are used to develop company strategies.

Indices influencing the business value play an important role in cost management as the company cannot change its own value on its own. The company creates its value receiving information about value indicators by determining cost factors which increase or decrease them.

## **3. Research Questions**

Cost factors are interconnected. When applying them, development scenarios of the situation and their consequences should be analyzed to understand relations of cost factors. For example, under otherwise equal conditions, increasing product prices can increase the business value, but if it causes significant market share losses, product price increase is unwanted and harmful. Therefore, identification of key factors is a complex and important task as they are closely related and have causal relations. For example, there is a close relation between decrease in the company value and investment profitability. However, increase in profitability at the expense of increasing profit and/or a decreasing investment value does not always create a new desirable value if casual relations have not been determined. The cause may be high average weighted costs of capital or specific volume of borrowed assets or a small bank liquidity ratio value, etc.

## **4. Purpose of the Study**

The article aims to analyse key cost factors which are profit, investment capital, invested capital profitability, average weighted costs of capital, solvency and taxes.

## **5. Research Methods**

Discount cash flows are based on all factors influencing the business value and reflecting future cash flows at the risk rate typical of cash flows. Therefore, a key financial goal is to maximize discount cash flows.

Discount cash flows are current costs of a monetary unit in a certain number of time intervals when discounting by a fixed interest rate.

The value of discount cash flows ( $V_{DP}$ ) is calculated by formula (Gryaznova & Fedotova, 2009; Fedotova, 2006; Pratt, 1996):

$$V_{DP} = \sum_{t=1}^m \frac{CF}{(1+i)^t} \text{ or } = \sum_{t=1}^m FCF(1+i)^{-t}, \text{ rubles} \quad (1)$$

where  $CF$  is the cash flow, rubles;

$(1+i)^t$  is the discount ratio;

$i$  is the fixed discount rate for a period, percent;

$t$  is the number of time intervals,  $t = 1, 2, \dots, m$ ;

$FCF$  is the free cash flow of the company which is an actual amount of the cash flow from the main activities (or it is a total cash flow produced by the company), rubles:

$$FCF = (\Pi - h) \left( 1 - \frac{\varepsilon}{R} \right), \text{ rubles.} \quad (2)$$

$\Pi$  is the taxable profit, rubles;

$h$  is the amount of taxes paid, rubles:

$$\Pi - h = \Pi_0;$$

$\Pi_0$  is the net after-tax profit, rubles;

$\varepsilon$  is the free net profit flow growth rates;

$(\Pi_0)$ , rubles;

$R$  is the profitability of new investment resources, %.

In a transformed form,  $FCF$  is calculated by formula (Gryaznova & Fedotova, 2009; Fedotova, 2006; Pratt, 1996)

$$FCF = \Pi_0 \left( 1 - \frac{\varepsilon}{R} \right), \text{ rubles.} \quad (3)$$

Despite the wide application of the accounting profit instead of  $CF$  in business assessment practices, it is a terminological substitute as there is no equivalent Russian term for  $CF$ .

Discount cash flows can be produced at the facility construction stage while the profit value is not calculated for this period.

Discount cash flows can increase and decrease due to inflow or outflow of funds which are not derived from product manufacturing and marketing processes. The inflow amount is carried undivided while the outflow amount can be carried with or without initial capital. Besides, discount cash flows change due to involvement of new invested funds as a result of investment in current or non-current assets (stocks and costs, capital assets, intangible assets, etc.).

Discount cash flows can be produced during one year or several years which is useful for business activities of mining enterprises as far as deposits are being developed over the course of decades (including reconstruction, modernization, etc.).

Thus, the company value depends on the discount cash flow value,  $CF$ , key cost factors and periods under study. Therefore, a business assessment method accumulating all attributes of company business activities and based on the concept of discount cash flows should be developed.

A discount cash flow model is presented by formula (Grigoryev & Ostrovkin, 2000; Sinyavskiy, 2005; Shipkova, 2012):

$$\beta = D_{DP} + D_P = D_{DP} + D_{PS}, \text{ rubles} \quad (4)$$

where  $\beta$  is the company value index, rubles,

$D_{DP}$  is the value of cash flows produced during the forecast period, rubles;

$D_P$  is the value received after the forecast period, rubles;

$D_{PS}$  is the continuation value, rubles.

Business assessment procedures required division of present value  $D_{DP}$  and the value received after the forecast period  $D_P$ , which forms the continuation value  $D_{PS}$ .

As far as  $D_P$  is formed during the forecast period, it is necessary to determine the length of the forecast period. In a forecast period, expected discount cash flows are produced. They are a continuation value which is determined by formula (Grigoryev & Ostrovkin, 2000; Sinyavskiy, 2005; Shipkova, 2012):

$$D_{PS} = \frac{\Pi_0 \left(1 - \frac{\varepsilon}{R}\right)}{\rho - \varepsilon}, \text{ rubles}, \quad (5)$$

where  $\rho$  is the average weighted cost of capital, %.

It is necessary to pay attention to  $\rho$  (average weighted costs of capital) because business activities deal with different sources of owned and debt financial resources which should be refunded. Costs of investment and resource utilization are costs of capital expressed in percent.

When determining  $\beta$ , it should be taken into account that the discounting rate to  $FCF$  has to be based on alternative costs of capital. Their amount has to be weighed relative to a contribution to the total company capital. As a result, the concept of average weighted costs of capital is formed.

As far as  $\rho$  is not a discount rate in formula (5), it has to reflect any costs, including alternative costs of capital attracted from different sources. To this end, a method taking into account a contribution of one financial source to the total capital and cost values is used to calculate average weighted share values (Copeland, Koller, & Murrin, 2005).

Sample calculation of average weighted costs of capital is presented in Table 1.

**Table 01.** Calculation of average weighted costs of capital

Assumed sources of capital	Contribution to the total capital	Alternative costs	Tax rate	After tax costs	Average weighted contribution values
1	2	3	4	5	2×5=6
Debt obligations	16	8	18	26	4,16
Stocks	84	12	–	12	10.1
Average weighted costs of capital					14.26

Alternative costs of resources are cash expenses on resources and imputed costs resulted from the forbearance to carry out the best alternative activities which require the same amount of time and resources, i.e. *imputed costs* are missing opportunities in money terms (Yastrebinsky & Gualteros, 2009).

Alternative costs differ from accounting costs. They are higher than the latter ones, because they consist of accounting costs and any imputed costs which correspond to the cost of an alternative activity which could bring income.

An *alternative* is not a set of different variants. It is a set of opportunities excluding each other or allowing one of several opportunities based on disjunctive propositions "A is either B, or B, or C, or D", for example, angles are either obtuse, sharp, or right.

Therefore, alternative costs are costs of alternative opportunities. Alternative costs are associated with a generalized method of economic profit calculation. The economic profit is a difference between consolidated cash inflows and total alternative costs of products and services.

Alternative costs of recourses are recognized amounts of cash expenses on resources and imputed costs when abandoning the best possible alternative projects under otherwise equal conditions. Alternative costs consist of explicit and implicit (imputed) costs. The first ones (the amount of prime costs of required resources) as a part of alternative costs do not differ from traditional explicit costs. Implicit (imputed) costs are assumed costs which are not accounted for. An example is abandoning a project of energy production using renewable energy sources (solar energy, wind energy, tidal energy, etc.) assuming that they rank below traditional energy sources. Other examples are abandoning leasing deals or fire energy production methods, or working on a textbook in favor of working on a thesis, despite the fact that the first activity is more profitable. Hence, imputed costs are missing opportunities.

Turning to  $\rho$ , it should be noted that the calculation method based on average weighted costs of capital is not the only one. When costs of capital and expenses on fund raising are variable,  $\rho$  can be calculated by formula (Abdulaeva & Kolayko, 2000):

$$\rho = \sum_{j=1}^m P_j F_j, \% \quad (6)$$

where  $F_j$  are the sources of funds,  $j=1, 2, 3, \dots, m$ ;

$P_j$  is the established profitability of the capital source  $j$ .

Calculated values of  $\rho$  can change depending on the structure of investment funds, profit and profitability, or the calculated index can differ from the marginal value in the capital cost  $\rho_m$ . In this case, it is necessary to compare two schemes presented in Table 2 (Copeland, Koller & Murrin, 2005).

**Table 02.** Investment sources, their percentage in the total volume and minimum investment profitability which satisfies investors

Investment sources	Percentage		Minimum profitability	
	Types, percentage (%)			
	Base	Marginal	Base	Marginal
Owned funds. including:	0.72 (72.00%)	0.70 (70.00%)		
Ordinary stocks	57.0	53.0	11.2	12.00
Priority stocks	3.0	3.5	11.5	13.00
Undistributed profit	10.0	11.7	13.30	15.00
Stable liabilities	2.0	1.8	13.5	13.00
Third-party sources of funds	0.28 (28.00%)	0.30 (30.00%)		
Bank loans	22.00	20.5	22.00	25.00
Direct foreign investment resources	2.70	3.25	25.00	26.00
Leasing deals	2.80	4.75	6.00	7.00
Mutual funds	0.20	1.23	3.00	3.50
Bond loan	0.17	0.12	2.00	13.00
Private creditors	0.13	0.15	11.00	11.50

Based on Table 2, let us calculate the value of  $\rho$  :

$$57.0 \cdot 0.112 + 3.0 \cdot 0.035 + 10.0 \cdot 0.117 + 2.0 \cdot 0.018 + 22.0 \cdot 0.22 + 2.70 \cdot 0.25 + 2.80 \cdot 0.06 + 0.20 \cdot 0.03 + 0.17 \cdot 0.12 + 0.13 \cdot 0.11 = 13.4187.$$

The result (13.42) is a percentage of expenses on capital in the total amount of investment resources. Minimum investment profitability requirements should be met.

As far as there are alternative solutions, it is necessary to calculate the value of the marginal cost of capital  $\rho_m$ :

$$0.53 \cdot 0.12 + 0.035 \cdot 0.13 + 0.117 \cdot 0.15 + 0.018 \cdot 0.13 + 0.205 \cdot 0.25 + 0.0325 \cdot 0.26 + 0.0475 \cdot 0.07 + 0.0123 \cdot 0.035 + 0.0012 \cdot 0.13 + 0.0015 \cdot 0.115 = 0.0636 + 0.00455 + 0.01755 + 0.00234 + 0.05125 + 0.00845 + 0.00333 + 0.00043 + 0.00016 + 0.00017 = 0.15183\%.$$

The marginal value exceeds the base one by 1.7643% (i.e. by 15.1830-13.4187≈1.76%). It is due to the appreciation of capital costs depending on the structure, profitability, contribution of different sources to the total volume of investment resources. The company can attract investment sources if they provide a profitability level which is not less than 13.42%, 14.26% or 15.18%. Otherwise, the company will be unprofitable.

To assess business activities of the company, along with the discount cash flow model, an economic profit model can be used (Hitchner, 2008).

The economic profit model ( $E_n$ ) presents the following expression (Pratt S., 1996):

$$\mathcal{E}_p = (R - \rho) \cdot \lambda, \text{ rubles,} \quad (7)$$

where  $\lambda$  is the invested capital, rubles.

When using the economic profit value, the total company value differs from the cost of cash flows. The continuation value as a part of the total value is not the company value after forecast period  $D_{PS}$ . It is a company invested capital cost increment  $E_n$  after the forecast period.

The economic profit  $E_n$  measures the costs generated in a singular time interval and transforms key cost factors into a unified cost factor which reflects company results, i.e. the economic value added (EVA) (Shipkova, 2012).

In an increasingly competitive climate, companies are in need of technology innovations and innovation activity indices, among which one can mention the economic value added.

This innovation index is an indicator of management decisions and an information source characterizing the added cost, its positive and negative values. Furthermore, due to the EVA, it is possible to get meaningful quality and quantity data on the net after-tax profit, taxes, owned and debt capital costs and solvency ratios. In other words, the EVA being a data storage device, provide data on different indicators.

Indicators applied to assess management decision do not serve the main economic goal of the company – cost increasing. Therefore, they can give an objective result causing inevitable errors and aggravating financial conditions of the company.

The EVA allows assessing the company cost dynamics.

Let us calculate the capital cost value based on the average weighted costs of owned and debt capital ( $\rho$ ) and solvency ratio (Rosch, 2008):

$$\rho = S_S \cdot K_p + S_Z \cdot (1 - K_p), \% \quad (8)$$

where  $S_S$  is the cost of owned capital, %;

$K_p$  is the solvency ratio, fraction;  $K_p = S_S/P$ , where  $S_S$  is the cost of owned capital, rubles,

$P$  is the cost of liabilities, rubles.

$S_Z$  is the cost of debt capital, %.

The main indices characterizing the company solvency are a profit margin ratio, an intermediate margin ratio, and an absolute liquidity ratio. The total number of liabilities is determined based on balance sheet sections III, IV, V (Sinyavskiy, 2005).

$\rho$  can be calculated by *three methods* (Mochulaev, 2017).

*The first one* is based on the use of the finance theory law according to which changes in solvency result in changes in the owned and debt capital structure.

Example. Assuming that the cost of owned capital is 18%, and the cost of debt capital is 6%, the target (normal) solvency ratio is 50%. If the solvency ratio decreases up to 31% (the cost of owned capital is 24,1% and the cost of debt capital is 7,1%), the average weighted cost of capital should be calculated.

Provided that the solvency ratio is 50%, the average weighted cost of capital  $\rho$  is as follows:

$$\rho = \frac{18 \cdot 50}{100} + \frac{6 \cdot 50}{100} = 12.00, \%$$

Provided that the solvency ratio is 31%, the average weighted cost of capital  $\rho$  is as follows:

$$\rho = \frac{24.1 \cdot 31}{100} + \frac{7.1 \cdot 69}{100} = 11.53, \%$$

Result: changing solvency and relations of the owned and debt capital cause insignificant changes in the average weighted costs of capital  $\rho$ .

*The second method* involves calculation of the average weighted cost of capital using a real solvency ratio and unchangeable costs of owned and debt capital (21% and 6.5% correspondingly). Other relations are unchanged.

$$\rho = \frac{21 \cdot 50}{100} + \frac{6.5 \cdot 50}{100} = 13.75, \%$$

$$\rho = \frac{21 \cdot 31}{100} + \frac{6.5 \cdot 69}{100} = 11.00, \%$$

The results show the dependency of the average weighted cost of capital on the solvency ratio (up to 11%), which disagrees with the finance theory, according to which it cannot have such value.

*The third one* involves calculation of average weighted costs of capital using a target solvency ratio (42%) disregarding calculated values of solvency ratio values (50% and 31%).

Assuming that the cost of owned capital is 21% and the cost of debt capital is 6.5%, let us calculate the value of  $\rho$ :

$$\rho = \frac{21 \cdot 42}{100} + \frac{6.5 \cdot 58}{100} = 12.59, \%$$

Thus, when assessing business costs using the economic profit method for different relations of owned and debt capital and different solvency ratios, different values of the average weighted cost of capital  $\rho$  can be obtained.

## 6. Findings

Company assessment and management aiming to develop business strategies and ensure short-term and long-term progress require justification of assessment criteria, identification of key cost factors influencing the value of cash flows, cash flow management, identification of cost assessment stages, development of measures for improving company investment attractiveness.

## 7. Conclusion

There are different business assessment methods (a discount cash flow method, an economic profit method). Hence, there are different calculation methods for average weighted costs of capital which produce different business values depending on the goals of business appraisers.

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