

THE RELEVANCE OF USING CASH FLOWS AND ECONOMIC PROFIT-BASED METHODS IN CAPITAL BUDGETING: A FOCUS ON TECHNIQUES – FCFF, FCFE AND EVA

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Purpose: The purpose of this paper is to examine consequences of choice: cash flow or economic value-added method on the net present value of investment project, further on company value.

Design/methodology/approach: The article introduces three main methods to measure the net present value of investment project: free cash flow to firm, free cash flow to equity, and economical value added. Paper examines the challenge of using these three-methods in determining what constitutes cash flow and what is the source of the investment value.

Findings: The cost of capital should be calculated in different ways to ensure the validity of the calculation. Estimation should be explored by other influencing factors, such as expected rate of return, market value of cost, rather than accounting/historical value. Implementing these factors is necessary to evaluate business value. According to the presented approach the use of the FCFF technique creates fewer risks of acting against the interests of the owners than the use of the FCFE or EVA techniques.

Practical implications: As one of the main implications in business, valuation is cost of capital. According to the financing priority theory, when a firm needs financing, the first consideration is internal financing, while equity financing is secondary. Both types of financing sources determine the financing structure and ultimately affect the value of the company.

Originality/value: The paper provided and insight in the different investment project valuation methods that are used in the nowadays practice. This was done in an attempt to answer the question: What method should not be used in the assessment of investment projects? The paper provides evidence that most appropriate method in estimating NPV value of investment project is FCFF.

Keywords: Cash flow, capital cost, financing structure, FCFF, FCFE, EVA.

Category of the paper: case study.

1. Introduction

Globalization of capital markets leads to intensification of capital investment. Despite the practical cases and the extensive literature on capital budgeting, the authors believe that we still have some methodological problems with the commonly used approach for cash flow calculation.

For example, the debt tax shield affects only the equity holders, in that it creates an incentive to hold more debt in order to maximize the tax shield. To show and overcome these issues, the authors try to indicate the most necessary theoretical knowledge and apply it to mainstream cash flow approaches, Free Cash Flow to Firm (FCFF), Free Cash Flow to Equity (FCFE), and Economic Value Added (EVA). It should be noted that the criterion for choosing the particular method depends on the objectives of the company, the internal control environment, the external information process, and the level of risk of misinterpretation by different shareholders.

The relation between capital structure and firm performance has a long history. In the literature on the subject, capital structure can be defined as the composition of equity and debt (Algieri, Aquino, Succurro, 2018). L. Gitman and C. Zutter stated the definition of capital structure as the mix of long-term debt and equity retained by a firm (Gitman, Zutter, 2012).

F. Modigliani and M. Miller have developed a fundamental theory of capital structure. They theorize that the firm's value and its investment decisions are not influenced by a capital structure. Thus, its own assets determine the company value (Modigliani, Miller, 1958). Couple of years later, F. Modigliani and M. Miller adjusted their assumption of a tax-free world. In other words, when the tax deductibility of interest payments enters the model, the value of firm increases with leverage (Modigliani, Miller, 1963).

Consequently, imperfect markets lead to theories that have been proposed as alternatives to F. Modigliani and M. Miller, namely, respectively: trade of theory (TOT), the pecking order theory (POT), the agency theory, the signaling theory.

In corporate finance, the POT theory assumes that the cost of financing increases as the company information is not 'convenience' from a business point of view. The financing of an enterprise can come from three sources (Mielcarz, Mlinarič, 2014):

1. internal (financed by net working capital),
2. external (credit, loan, bond issue),
3. issuing its own shares.

It can be concluded that the source of financing for investment projects and the related costs depend on the capital needs and the rating of the company (Myers, Majluf, 1984).

In turn, the theory of the TOT assumes that companies choose partial debt and equity financing to offset the costs and benefits of this form of financing (Murray, Goyal, 2011).

The signaling theory has been developed by S. Ross, suggests that the choice between debt and equity will result in a signal to the market (Ross, 1977). Firms only issue additional equity if the stock price is higher than true value, which causes a negative signal to investors, which could reduce the shares price (Steinkopf, 2015).

The agency theory, developed by M. Jensen and W. Meckling (Jensen, Meckling, 1976), and O. Hart and J. Moore (Hart, Moore, 1994). Such a theory argues that the optimal capital structure to maximize firm value is the one which minimizes conflicts of interest among shareholders, managers, and debt holders.

An essential prerequisite for ensuring the firm's market positions and good direction of development is the ability to make investment decisions. One of the components of efficient financial management of a company is that management strives to achieve the optimum level of financing. As a result, the investment decisions could lead to (Sierpińska, Jachna, 2012):

- Accepting or rejecting a specific investment projects.
- The ability to classify the investment project data according to the expected rate of return.
- The precise development of the budget for approved investment projects.

In the subject literature, we can meet the four stages of investment project appraisal (Sierpińska, Jachna, 2012):

1. identification of the project,
2. research and development,
3. project selection,
4. control over the projects carried out.

The above-mentioned stages of the realization of investment can be analyzed by using the same procedures and methods for estimating cash flows. R. Burns and J. Walker indicate that the project selection area is the most neglected and undiscovered area of budgeting (Burns, Walker, 2009).

Determining the NPV of investment projects which directly influence the company's value is one of the most common and intensively process, but at the same time it is relatively complicated thus can be viewed from many perspectives. C.A Magni raises the valuation problem of company and investment projects from the perspective of scenarios that can be implemented by the investors and owners (Magni, 2020). The issue of valuation is viewed from an accounting point of view which based on financial statements. This valuation method is determined by the accounting principles that present the current image of the company's performance (Accounting Act). Nevertheless, from the point of view of potential investors, the present value of future cash flows - possible to be realized by a given company in the form of implementation of given investment projects - is particularly important, because it may have a higher information value from their perspective (Penman, Yehuda, 2019). One of the most effective methods is the discounted cash flow method, which includes models based on FCFE and FCFE. The values obtained in this way can be used to determine the competitiveness of the

assessed company or investment project. On the other hand, the advantage of the EVA model over the cash flow model is that the EVA is a useful measure for understanding the sources of value in each individual year of an investment.

The literature on the subject lists many techniques for cash flow and discount rate calculation, where applied correctly should lead to an identical Net Present Value (NPV) (Michelon, Lunkes, Bornia, 2020). According to the authors, most of the investor society believes that net profit is the best factor that represents the financial situation of the company. Therefore, for example, the widespread use of the P/E ratio in practice (Ghaeli, 2017). However, net profit does not reflect two underlying factors, such as the risk that has been associated with the company since its inception (which also affects the structure and cost of capital) and does not consider the value of money over time. Efficient alternative to net profit are methods which relay on cash flow estimation. Based on the authors' practical experience valuing dozens of investments projects and entities, we focused our research on the most comprehensible and informative NPV calculation: FCFE, FCFE, and EVA. These approaches should lead to the same result in NPV calculation. It should be noted that interchangeability of assumptions often causes wrong conclusions that can be used to estimate the impact of the analyzed project on the value of the whole company. C. Drury and M. Tyles pointed out frequent misapplications due to project risk with manufacturing technologies (Drury, Tyles, 1997). R. Burns and J. Walker have also revealed an investment problem. They identified misapplications due to treatment of inflation in project valuation (Burns, Walker, 2009). P. Fernandez and A. Bilan listed 110 errors in six categories concerning company valuation (Fernandez, Bilan, 2013). We are faced with contradictory decisions where correctly applied techniques give the same NPV, but still can lead to decreasing value investment decisions. Many corporates compare expected investment returns to a hurdle rate (minimum acceptable rate of return). Nevertheless, plenty of studies indicate that hurdle rates differ from the standard cost of capital due to adding a buffer to the capital cost. Practice intimate that setting higher hurdle rate helps entities to focus on the best projects (Decaire, 2021).

In Section 1, the authors present a review of the relevant literature on capital budgeting techniques used by practitioners. Section 2 presents the three most common valuation approaches and ground for future discussion has been prepared. In Section 3 the authors show short numerical examples to demonstrate the divergence between the mentioned above methods. It helps to harmonize the final result of the study. The section also elaborates on the risk found in the FCFE application and the risk using Weighted Average Cost of Capital (WACC) of a particular investment project instead of the WACC of the company WACC. Final section summary of our major findings.

All three methods always give the same value if the input data are consistent within the estimation of the profitability of investment project. The result is logical, since all of them analyse the same hypotheses, they differ only in amount of cash flows considered at the early stage of investment. Thus, the main aim of this paper is to find advantages and limitations of

these three methods. The substantive review of these methods leads the conclusion of the choice of adequate method to assess the value of project, further the value of whole company. Therefore, the study findings are expected to benefit both academicians and practitioners. Academicians could assist their future research or revising curriculum adopted by business school by using article results. Practitioners could also draw many benefits. This study shows analysis, which could improve investment decision by using the right capital budgeting technique.

2. Literature review

There is no doubt that one of the most important parts of company value creation is the analysis and evaluation of investment projects and the decision which among them should be undertaken. Complex decisions and accompanying uncertainty in connection with future cash flow, as well as relation in technological and economic impacts on the calculation increase their complexity (Egbide, Uwalomwa, Agbude, 2013). Empirical research provides inconclusive evidence on project investment valuations among practitioners. A sample of research showed that payback period (PB) as the most popular technique, other ones indicate cash flow as the most frequently used budgeting technique (Andrés, Fuente, San Martin, 2015).

According to L. Alles (Alles et al., 2020), the selection of the appropriate technique can be influenced by both financial and non-financial factors. Research conducted in Tanzania indicated the following business-related factors: industry of the business, sales growth, and number of employees, which play a vital role in selecting capital budgeting methods (Katabi, Dimoso, 2016).

S.-O. Daunfeldt and F. Hartiwg showed that the choice between cash flow technique estimation of entities listed on Stockholm Stock Exchange depended on leverage, growth opportunities, dividend payout ratio, industry, and CEO personal traits (Daunfeldt, Hartiwg, 2014).

G. Kester and G. Robbins performed analysis on the Irish Stock Exchange on capital budgeting techniques used by Irish listed companies. The discounted cash flow method (DCF) and NPV was the most popular measure for capital budgeting decisions. Respondents also indicate for a single discount rate based on WACC as the most widely accepted method used for calculating discount rate (Kaster, Robins, 2011).

The study of 200 non-financial firms listed on the Pakistan Stock Exchange with a response rate of 35% found NPV and internal rate of return (IRR) for capital budgeting (61.4% of the respondents always use NPV). WACC is estimated using target value weights and capital assets pricing model (CAPM) is used to estimate cost of equity (Mubashar, Tariq, 2019).

The study of 75 listed companies of Morocco revealed that 64% of the firms used IRR, 63% accounting discount rate (ARR), but NPV is the least popular method (Baker et al., 2017).

The study conducted by P. Alleyne suggested that analyzed firms in Barbados are not likely to use capital budgeting practices in project selection (Alleyne et al., 2018).

Phone survey of 400 CEOs of small, medium, and large companies in the countries of central and Easter Europe showed that the choice of capital budgeting techniques depends on the size of the firm, the culture, the code of ethics. Larger firms used mostly the DCF method - 56%, which is more than small and medium companies - 46% (Andor et al., 2015). Other surveys which refer to CFO's, suggest that cash flow expectations play a significant role for both, investment plans and their realization. Thus, downside and upside scenarios are developed in the base case investments scenario (Bordalo et.al., 2020).

K. Bennouna stated that Canadian companies preferred to use NPV. 17% of the companies did not use DCF. Of these, the majority firms used NPV and IRR. Only 8% preferred real options implementation in the process of project selection (Bennouna et al., 2010). Recently studies also showed that subjectivity of the corporate managers leads to miscalibration of the IRR's outcomes which impact on the given entity capital structure policy (Shleifer, 2019; Barrero, 2022).

On the other hand, complementarity theory perspective says, that NPV analysis should be expanded including additional factors. Research performed by S. Ioulianou et.al. indicates that the real option, which could help to choose strategy investments directions is a key factor which should be considered. Various of studies states, that real option valuation combined with finance performance analysis – for example expressed through free cash flow, allow to increase the value of investments (Jensen, Kristensen, 2022; Belderbos et. al., 2019).

Comprehensive research of CFO responses of manufacturing and trading companies listed on the Colombo Stock Exchange revealed that NPV was the most used capital budgeting method and the most preferred method to calculating cost of capital was WACC (Nurullah, Kengatharan, 2015).

P. De Suetza and R. Lunkes investigated capital budgeting techniques used by practitioners in large Brazilian public interesting entities. They concluded that widely used methods are: PB (71%), closely followed by NPV (65%) and IRR (61%). Research also revealed that the most frequent practice used in calculating the rate of return is WACC (63%) (De Suetza, Lunkes, 2016).

The evidence from 77 companies listed on Bombay Stock Exchange reveals that managers follow capital budgeting practices proposed by academic theory – NPV and IRR techniques are to most popular (Batra, Verma, 2017).

T. Wnuk-Pel stated that Polish companies employ the same methods of capital budgeting as companies in more developing countries. The most extensively used techniques by entities are IRR and NPV (Wnuk-Pel, 2015).

W. Rogowski, in his research, focused on investment practice in Polish companies. Findings reveal that Polish companies employ discounted methods (32%) or discounted and simple appraisal methods (39%) (Rogowski, 2013).

Mukhlynina and Nyborg found that almost 84% professional's analysts always or almost always use NPV valuation techniques (Mukhlynina, Nyborg, 2020). They conclude that gap between theory and practice is wide. In authors opinion such conclusion creates needs for additional analysis which might help close the theory and practice.

The popularity of NPV among the presented studies, rise several questions which should be explored. For instance, whether each time managers with appropriate power of authority conduct detailed and consistent cash flow discount rate estimations? And whether changing in environmental nature of corporation have been properly reflected in their cash flow?

Bearing in mind performed literature review, following conclusion could be drawn: NPV method is a critical one, for assessing the profitability of the project investments. Considering techniques implications and the knowledge gap between theory and practice, create a strong argument to accomplish theoretical research which allow to indicate potential opportunities and threats from using the NPV techniques.

3. Choosing the optimal NPV calculation technique: FCFF, FCFE, EVA?

The methods of calculating cash flows have a fundamental character for the appropriate assessment of investment projects, as they cause a change in the cash flows generated by the entity treated as a whole. Contrary to appearances, the use of an appropriate technique of its estimation is not an easy task.

The FCFF technique is one of the most applied techniques in economic practice (Fernandez, 2007). It reflects free cash flows owed to all parties involved in the financing of the investment project. In this method, interest on debt capital is not considered because the cost of such financing is included in a discount rate expressed as an average weighted cost of capital. Therefore, including interests in the cash flow calculation using the FCFF method would lead to decreasing costs of debt and would unduly decrease the net present value of the project and thus the value of the whole company (Rogowski, Michalczewski, 2005).

The value of free cash flows for all funding parties can be calculated using the following formula (Mielcarz, Paszczyk, 2013):

$$FCFF = NOPAT + A-CI,$$

$$NOPAT = EBIT * (1-TC),$$

where:

NOPAT (net operating profit after tax) – operating profit after tax,

EBIT (earnings before interest and tax) – gross profit + interest (financial cost),

A (depreciation) – depreciation costs,

CI (capital invested) – additional capital expenditure excluding expenditure incurred during the zero period and investments in net working capital,

TC – tax rate.

In the last period, the free cash flow should be increased by the residual value.

The subject literature interprets EBIT as operating profit (Mielcarz, Paszczyk, 2013). According to the authors, this is just a social approach. EBIT should be calculated as gross income plus interest. At first glance, one can claim EBIT does not differ from operating profit. However, EBIT does not include only this operating category of profit. The U.S. Securities and Exchange Commission interprets EBIT as follows (<https://www.sec.gov/rules/final/33-8176.htm>, before the beginning of 17.08.2021):

$$EBIT = net\ profit + tax + interest.$$

An incorrect interpretation of EBIT could lead to an incorrect calculation formula, which could negatively affect the valuation of investment projects.

According to the authors, the following formula can be used to calculate FCFF for a specific investment:

$$EBIT\ (adjusted) = Project\ revenue - Variable\ costs - rising\ fixed\ costs\ without\ depreciation - (tax\ depreciation).$$

The argument for considering tax depreciation instead of the balance sheet is that the level of the tax shield is affected by tax-deductible expenses (the balance sheet depreciation reflects only the economic consumption of the assets).

The calculation of NPV using the FCFF technique, assuming unchanged discount rate (WACC), should be based on the following formula (Fernandez, 2007):

$$NPV = -CAPEX_0 + \sum_{t=0}^n \frac{FCFF_t}{(1+WACC)^t}$$

where: $CAPEX_0$ - capital investment expenditures incurred in period 0.

A common formula to calculate the Weighted Average Cost of Capital is (Fernandez, 2020):

$$WACC = EU * re + UD * rd * (1-TC),$$

where:

EU - the share of equity in the structure of funding,

re - the cost of equity,

UD - is the share of debt in the structure of funding,

rd - the cost of debt.

The methodology for calculating FCFF and FCFE is set out in Table 1.

When FCFE is used, the free cash flow generated by the project reflects the flows which are only due to the owners of the company. According to this method, the interest on the debt is taken into account in the calculation. The FCFE technique measures investment outlays

differently, considering only those incurred by the company's owners. The discount rate is also set differently. FCFE, unlike the FCFF method, is discounted at the rate of return required by the owners. FCFE can be calculated using the following formula (Cegłowski, Podgórski, 2012):

$$FCFE = EBIT(\text{adjusted}) - Int - Tax + A - CAPEX - DN - DR,$$

where:

INT (interest) - interest on external capital,

Tax - the value of income tax paid,

A (depreciation) - depreciation costs,

CAPEX (capital expenditures) – expenditure for investment,

DN (new assets) - external resources for each period,

DR (debt redemption) – repayment of external capital in subsequent periods.

Table 1.

Methodology for estimating the NPV using the FCFF and FCFE technique.

FCFF during the project period	FCFE during the project period
Revenue from sales - variable costs - fixed costs without depreciation depreciation costs (tax) = EBIT	Revenue from sales - variable costs - fixed costs without depreciation depreciation costs (tax) = EBIT
FCFF during the project period	FCFE during the project period
- income tax =NOPAT + depreciation (tax) - investments for net working capital - additional investment expenditure + residual value = FCFF	- interest on debt capital =Gross profit - income tax =Net profit + depreciation (tax) - investments for net working capital - additional investment expenditure + drawing of new credits/loans and other related charges - repayment of external debt + residual value (due to owners of the enterprise) = FCFE

Source: Own analysis.

An important element in distinguishing the FCFF method compared to FCFE is the residual value treatment (Copeland, Koller, Murrin, 2020). The FCFE technique considers only and exclusively the funds belonging to owners (Szczepanowski, 2004).

Economic added value has been developed by Stern Steward & Co. It is defined as NOPAT less the cost of capital invested (Behera, 2020):

$$Eva = NOPAT - WACC * CAPEX_{T-1},$$

where: *CAPEX* - additional capital expenditure, excluding those incurred during the period $T=0$, and expenditure on working capital requirement.

This method, like FCFE, assumes the calculation of the residual value attributable only to the owners of the company. EVA represents in a way the difference between the market value of the assets sold or liquidated and the value of the capital involved in the investment project in the last analysis period. It should also be noted that investment expenditure is treated differently.

They are not shown with a '-' and therefore EVA is adjusted by the weighted average cost of capital and additional investment costs (Maćkowiak, 2009).

4. Reconciliation of the NPV calculation using different calculation techniques: FCFF, FCFE and EVA

The process of estimating the NPV using the methods described in this article is illustrated by the following example.

The weighted average cost of capital for the example is as follows:

$$WACC = 0.4 * 4\% * (1 - 0.19) + 0.6 * 9\% = 6.69\%$$

Based on the presented in-put data, the FCFF, FCFE, EVA calculation algorithms, NPV, and IRR values were calculated.

Table 2.
Basic forecast data, for example

Data	Period			
	0	0-1	1-2	2-3
EBIT		1.100	1.500	1.800
Tax rate	19%			
CAPEX	2.700			
A		900	900	900
Investments for net working capital		40	50	60
Residual value for all financing parties				500
UD		0.4	0.4	0.4
EU		0.6	0.6	0.6
r_d		4%	4%	4%
r_e		9%	9%	9%

Source: Own calculations.

Table 3.
FCFF calculation

Data	Period			
	0	0-1	1-2	2-3
EBIT		1.100	1.500	1.800
Tax		209	285	342
= NOPAT		891	1.215	1,458
+ depreciation		900	900	900
Investments for net working capital		40	50	60
CAPEX				2.700
+ residual value for all financing parties				500
FCFF	-2.700	1.751	2.065	2.798
Discounted FCFF	-2.700	1.641	1.813	2.303
NPV	3.058			
IRR	46%			

Source: Own calculations.

According to Modigliani-Miller theory, which forms the basis for science on the valuation of companies, the value of the weighted average cost of equity should be calculated based on the market values of equity and debt (Grzywacz, 2012). In the assumption that the sample figures reflect the market values of individual equity and if the project will not change and constant structure of the company, it is possible to calculate the implicit values of debt and equity for the periods. For moment 0, we can therefore calculate:

$$D_0 = 5.759 * 0.4 = 2.303,$$

where: D_0 - Value of the debt in period 0.

The results of the calculation of the project value and the implied debt at the end of each period are shown in the table below.

Table 4.

Calculation of the value of the project and the debt at the different stages of its duration

Data	Symbol	0	1	2	3
The value of the project at the end of the period	$V(FCFF)$	5.759	4.129	2.622	500
The value of the debt at the end of the period	D	2.303	1.652	1.049	200

Source: Own calculations.

The financing costs of the project using the FCFE method are calculated as the result of the capital cost and the value of the debt at the beginning of the period.

Table 5.

FCFE calculation

Data	Period			
	0	0-1	1-2	2-3
EBIT		1.100	1.500	1.800
financing costs		92.14	70.29	41.96
= gross profit		1.008	1.430	1.758
Tax		191	272	334
= net profit		816	1.158	1.424
+ depreciation		900	900	900
Investments for net working capital		40	50	60
CAPEX				2.700
+/- borrowing/repayment of credits	2.303	-546	-708	-849
+ residual value for owners				300
FCFE	-397	1.130	1.300	1.715
Discounted FCFE	-397	1.037	1.094	1.324
NPV	3.058			
IRR	263%			

Source: Own calculations.

Calculating NPV based on the EVA methodology requires an estimate of the capital invested at the beginning of the period. It reflects the value of fixed assets and investments in net working capital, less depreciation costs. The calculation for period 1 is as follows:

$$EVA_1 = 891 - 6.69\% * 2700 = 710.$$

Table 6.
EVA calculation

Data	Period			
	0	0-1	1-2	2-3
Capital invested	0	2.700	1.840	990
Depreciation		900	900	900
+ capital expenditure	2.700	0	0	0
+ expenditure on net working capital		40	50	60
= capital invested at the end of the period	2.700	1.840	990	150
NOPAT		891	1.215	1,458
Economic added values		710	1.092	1.392
Residual value (EVA)				350
Economic value added + residual value		710	1.092	1.742
Discounted EVA		665	959	1.434
NPV	3.058			

Source: Own calculations.

The presented example shows that using the market values of the capital involved in the WACC calculation leads to identical NPV results using different calculation techniques. Such a concept can lead to the conclusion that, in principle, the choice of the technique is irrelevant. According to the authors, this line of reasoning is wrong.

In the first instance, the authors of the paper decided to answer the question: Why FCFE method should not be used in the assessment of investment projects?

The first assumption is the scale of the company's business activity – from this point of view, it can be said that the presented example of investment project is relatively small. Therefore, a possible increase in debt should not significantly cause an increase in expected rates of return required by investors. The investment was financed with external capital at effective rate of 4% per annum, repaid over the next 5 years. The tax rate is 19%, while the rate of return expected by the owner is 9%. Three options for financing the project were considered:

1. No external capital.
2. A loan financing 75% of the initial capital expenditure.
3. A loan financing 100% of the initial capital expenditure.

Table 7.
Basic forecast for Example 1

Period	0	1	2	3	4	5
Investment expenditures	-2,700					
FCFF	-2,700	650	650	650	650	650

Source: Own calculations.

In the absence of external financing, the NPV is: – 171.73.

The calculation of NPV with 75% loan financing allowed to increase the NPV value of the project, without changing its real profitability. This phenomenon is a consequence of the use of cheaper external capital instead of more expensive capital of the owners and the assumed lack of reaction from investors to a small increase in debt.

Table 8.*NPV calculation based on FCFE technique for Example 2*

Data	Symbol	0	1	2	3	4	5
Free cash flow for all business financing parties	FCFF	-2,700	650	650	650	650	650
+ drawing credits	D_N	2,025					
- credit pay-offs	D_R		405	405	405	405	405
- interest after the tax shield	$Int*(1-t)$		65.61	63.48	61.43	59.44	57.51
= free cash flow to equity	FCFE	-675.00	179.39	181.52	183.57	185.56	187.49
Discounted FCFE		-675.00	164.58	152.78	141.75	131.46	121.85
NPV		37.42					

Source: Own calculations.

Calculations of the NPV value in the case of financing the project with 100% debt allowed to almost triple the NPV value compared to the involvement of external capital at the level of 75%. Thanks to incurring debt, the initial capital involvement of the owners decreases. This results in lower capital expenditures in the NPV calculation conducted using the FCFE technique. The loan is repaid later, but its cost is lower than the cost of equity. Thus, distant debt repayment is discounted at the expected rate of return by the owners i.e., rate of return higher than the cost of debt. According to the principles of financial mathematics, increasing the discount rate reduces the impact of distant cash flows on the valuation result. As a result, the NPV increases, and this effect is greater, the greater the difference between the cost of debt and equity is.

Table 9.*NPV calculation based on FCFE technique for Example 3*

Data	Symbol	0	1	2	3	4	5
Free cash flow for all business financing parties	FCFF	-2,700.00	650.00	650.00	650.00	650.00	650.00
+ drawing credits	D_n	2,700.00					
- credit pay-offs	D_r		540.00	540.00	540.00	540.00	540.00
- interest after the tax shield	$Int*(1-t)$		87.48	84.65	81.90	79.25	76.68
= free cash flow to equity	FCFE	0.00	22.52	25.35	28.10	30.75	33.32
Discounted FCFE		0.00	20.66	21.34	21.70	21.78	21.65
NPV		107.14					

Source: Own calculations.

Nevertheless, the authors of the paper would like to emphasize that debt financing of further investments is consistent with the concept of value-based management, if the company has not yet reached the optimal level of debt. However, this approach carries some risks. The use of the FCFE technique may lead to the effect of displacement of projects for the implementation of which it is difficult to take bank loans. Therefore, it should be concluded that the use of the FCFE technique in the assessment of standard projects is not an effective solution from the perspective of the company's value management objectives.

The issue of traps related to the improper use of FCFE and EVA techniques using WACC associated with the project is another scenario which negatively impact on the entity value in the long-time horizon. NPV value was estimated using:

1. WACC at the level of the cost of capital from the perspective of company.
2. WACC of the investment project, if the company finances the project with 100% debt from the issue of bonds. It was assumed that the issue would be rolled, until the end of the project period.

The WACC calculation from the perspective of company is 6.98%. The NPV value of an investment can be calculated by using perpetual pension method.

$$NPV = -2.700 + 650/0.0698 = 6.612.$$

The WACC associated with the project is 3.24%:

$$WACC = 0*9\% + 1*4\%*(1-0.19) = 3.24\%.$$

The NPV value is:

$$NPV = -2700 + 650/0.0324 = 17.361.$$

The calculation of NPV based on the WACC associated with the investment project, as opposed to the calculations based on the company WACC, indicates that the project is much more profitable. The result obtained is the effect of applying a lower discount rate in the case of a WACC calculation based on the structure of the project's capital. Such a result may suggest that the use of WACC associated with the project in the analysis allows to increase the attractiveness of the investment. The argument for rejecting such a line of thinking is exactly the same as that presented when discussing the problem of the failure to adapt the FCFE technique to the assessment of investment projects. The use of WACC calculated based on the project financing structure encourages the increasing indebtedness of the company. As a consequence, there may be a situation in which further loans will lead to an increase in the risk of the functioning of the entire enterprise, and thus to an increase in the company's WACC and, as a result, to a decrease in its value.

The following are arguments that indicate the danger associated with the assumption of full interchangeability of individual techniques.

- The compatibility of NPV results does not apply to the IRR calculated on the basis on FCFE, which is expected to be a return rate only for owners. Therefore, to get a full picture of profitability, the authors recommend that NPV calculations be made using the FCFE technique where the resulting IRR reflects the calculated rate of return for all parties involved in the financing. It must be noted that IRR technique has internal features that limit the possibility of its use in the evaluation of investment projects in accordance with the concept of value management. The IRR assumes a reinvestment rate detached from market realities. The discount rate, and thus also the reinvestment, is not the rate of return that can be obtained under current conditions. This is the result of the mathematical exclusion of the discount rate equal to positive and negative cash flows.

- Whereas the EVA technique makes it impossible to calculate the IRR.
- The use of FCFE creates risks in making investment decisions that do not meet the expectations of the company owners. By applying an additional external debt, it decreases the capital exposure of the owners. The repayment of the debt is discounted at the rate of return requested by the owners (in principle higher than the cost of the debt). According to the principles of financial mathematics, an increase in the discount rate reduces the impact of distant cash flows. As a result, NPV increases. The greater the effect, the greater the difference between the cost of debt and equity are.
- Implementation in the NPV calculation process, WACC adequate just for the project, may suggest increasing the project's profitability. The mechanism when using the weighted average cost of capital budgeted based on the project financing structure carries similar risks as when using FCFE. In other words, the use of the WACC project in the cost-effectiveness analysis encourages the company to increase its debt. As a result, this can prove the risk of the whole business, increase the company's WACC, and decrease its company value.

It should be noted that, in a time of increasing globalization and changing environment, accurate investment decisions require flexibility. The answer to these requirements may be to expand the standard analyzes presented in this work by adding an analysis of the 'real options' (Gnap, 2017).

5. Conclusions and Discussions

In the study, the authors paid attention to the technical aspect of the calculation of free cash flows. Each technique has limitations, but the most important thing is the ability to identify these inaccuracies. Although the NPV estimation indicates the profitability of a specific investment project, this option may vary without the consequences of applying the initial assumptions. To present comprehensive profitability for different investors, one should calculate NPV and IRR based on FCFF technique. The EVA technique does not allow for calculating IRR, its algorithm is not commonly known.

When using WACC instead of marginal cost of the whole company leads to higher risk of over/underinvesting company. Furthermore, the discounted FCFF by the WACC company rather than the project should be pointed out as the appropriate solution.

Among the many methods, the FCFF technique appears to be the most 'secure' in terms of creating additional value for a company by carrying out the most profitable projects.

From the other hand, increase of WACC of the special purpose vehicle (SPV) does not rise WACC of the holding entity. In other words, the level of investment diversification by holding entity should allow using project WACC rather than superior entity WACC due to fact that potential operating losses could be amortized amongst other investments (high level of debt in SPV).

Choosing appropriate NPV technique is pivotal from the perspective of corporate sustainability. Presented results were derived from the qualitative analysis. Used methodology of computing free cash flow is align with studies referred to capital budgeting decision making. Presented by the authors methodological approach showed that there could be a good and productive partnership between the practitioners and academicians to develop capital budgeting knowledge. The following implications are noteworthy to report:

- Practitioners must develop their knowledge about the application of the appropriate technique to apprise the investment projects. Systematic training about valuation techniques is critical for a sustainable capital budget under uncertain economic environment.
- Complex and uncertain environment where entity operates should cause requirement of real option implementations into the profitability analysis.

Future scope of the research could be expended on: ESG concept (Environmental, Social and Corporate Governance) on modern projects investments, or post-covid-19 inflation impact on innovation projects which are facing with unstable macroeconomically factors.

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