METHODOLOGIES FOR DETERMINING THE OPPORTUNITY COST OF CAPITAL: FINANCING IN THE SELECTION OF INVESTMENTS

ABSTRACT

Objective: The objective of this study is to determine the rate of opportunity cost of capital and analyse project financing, within the scope of concepts and techniques in investment analysis and evaluation.

Theoretical Framework: The concept of "opportunity cost of capital" is presented, as well as the methodologies for determining the rate of cost of capital for analyzing and evaluating investments that business management faces, whether in new investments or in financing the growth of its current activity.

Method: A descriptive method is appropriate to the objective and relates the theoretical framework for determining the cost of capital to decision-making and investment financing.

Results: How the cost of capital is calculated in the various methodologies is detailed, highlighting the adequacy of the methodologies to the specific circumstances. An example is given of how to consider financing in cost of capital methodologies, emphasizing that the value created by an investment does not derive from financing.

Conclusion: The methodologies for determining the cost of capital for different financing structures are discussed and clarified. The difference between methodologies for determining the cost of capital and determining the present value of tax benefits from financing is demonstrated, making it clear that value creation results from the investment and not tax benefits from financing.

Keywords: Opportunity Cost of Capital, Discount Rate, Beta, Risk, Market Return, NPV.

1 INTRODUCTION

Business management often must decide on alternatives to making investments, i.e. whether to invest or not, invest in ‘A’ or ‘B’, invest in the immediate future or not. Its decisions are based on economic assumptions and principles, such as evidence that resources are limited and the principle that resources should be spent on securing benefits greater than the sacrifices made in the long run. Therefore, the manager needs criteria to make his choices, and those criteria must reflect the scarcity of resources, generally and specifically in time.

The decision to invest entails risks, it must consider the opportunity cost of capital

(COC), which contains the economic notion of option and comparison between alternatives, do or not do, compare the cost of a choice with the gain left to realize the equivalent risk choice. The COC will be the determining factor in determining the present value (VP) of the future *cash flow* in each investee.

As a first step of analysis, it seeks to determine the cost of capital regardless of how the investment will be financed.

In a second step, the determination of the cost of capital will take into account how the investment is financed, i.e. where the capital comes from, given that different sources have different risks, for legal reasons influencing its cost and for reasons of financial risk, economic risk and decision-maker autonomy.

Methodologies for determining the cost of capital will be set out and clarified, and their use and usefulness will be discussed in the consideration of the investment financing decision.

Through an example, it will be discussed how to consider investment in project selection using the NPV indicator showing that the value creation derives from the project being carried out and not from the mode of financing used.

2 THEORETICAL FRAME

2.1 METHODOLOGIES FOR DETERMINING THE COST OF CAPITAL - FINANCIAL DISCOUNT RATE

Following the concept of *cash flow* addressed by Pereira et al (2024), *periodic cash flow* is not additionally available before converting into equivalent units. That transformation, by the mathematical operation of updating, stems from the time value of the money and the need to remunerate the resources mobilized to make an investment.

The determination of the discount rate is therefore crucial and depends on *i*) the desired return on capital; *ii*) the specific economic and financial risks of the investment project; and (iii) the expected annual inflation rate for the future.

The refresh rate (r) can then be obtained

$$= [(1 + i)\ x\ (1 + ii)\ x\ (1 + iii)] - 1 \qquad (1)$$

The inflation rate only influences the discount rate when *cash flow* is estimated at current prices. Therefore, using *cash flow* at constant prices would already deflate flows and there is no need to consider this effect when determining the discount rate. Despite this, inflation influences the level of the discount rate and the financial risk of projects.

There is therefore a need to estimate the rate of return on capital and the risk of

investment. For this purpose, the financial asset balancing model (CAPM) is often used and is worded as follows:

$$re = rf + \beta\ (rm - rf) \qquad (2)$$

Where:

re - Rate of return expected or required by the investor
rf - $Taxa\ de$ return on risk-free asset
β - Systematic risk level of the asset
rm - Profitability rate of a diversified, market-based portfolio
(rm-rf) - Market risk premium

The expected return is a function of the return on a risk-free asset (treasury securities), the return on a diversified portfolio (usually expressed as a stock exchange index) and the risk expressed by the linear (β) relationship between the yields of the asset with which the investment under review identifies and the market portfolio.

The β can be calculated according to equation three and considers the risk that should be remunerated, i.e. the portion of risk that cannot be diversified.

$$\beta = \frac{cov\ (rm,re)}{\sigma^2} \qquad (3)$$

Where:

cov = covariance.

rm = Rate of return on a diversified, market portfolio;

re = rate of return expected or required by the investor;

σ^2 = standard deviation.

This uses a beta of comparable assets, thereby introducing possible distortions arising from the level of indebtedness of these assets. To minimize this effect, Ross et al. (1999), suggests deleveraging the beta by removing the effects of that leverage:

$$\beta asset = \beta equity\ \left[\frac{1}{1+ ((1-t)\frac{D}{E})}\right] \qquad (4)$$

Where:

D - Represents the total debt of comparable assets;

E - Represents the total equity of the comparable company (or comparable assets);

t - Represents the tax rate (IRC) associated with these assets.

The β (Beta) coefficient is a measure of the systematic risk of an asset in relation to the same type of risk to the entire market. An asset with $\beta < 1$ has historically had a lower variability in profitability than the market portfolio. An asset with a high beta >1 has historically had a higher profitability variability than the market portfolio. An asset with the same variability in profitability as the market portfolio has Beta = 1 and a risk-free asset has Beta = 0.

The CAPM model is a pricing model for listed financial assets, in which case it is possible to identify the respective beta. Their quantification, however, requires access to information from long series of stock market indices and is therefore often based on estimates provided by consultants such as Damodaran (2016).

Alternative models (Onion, 2011) or the use of beta from listed organizations in the same sector of activity or from a diversified group of shares should be used to determine the cost of capital of medium- or micro-sized, unlisted companies, which characterize, for example, the Portuguese business fabric.

The use of the model to determine the discount rate of an investment within time periods has limitations:

First, because ex-post yields are assumed to analyze ex-ante determined flow generation with equal investment time periods for all investors.

The choice of the market portfolio, for *benchmark purposes*, must be international in that a small market generally does not have competition in the movement of capital. On the other hand, the model does not capture risk factors other than market prices, such as the level of interest rates, employment levels, inflation and the volatility of factor prices.

In response to these limitations, Stephen Ross (1976) developed the arbitration evaluation model. Stephen Ross (1976) assumes the basic premise that arbitration opportunities disappear in a market where there is unrestricted, free and instantaneous access to perfect and complete information. There is several mutually independent macroeconomic factors whose unanticipated change influences the yields of all CAPM multifactorial equivalent risk assets

These factors are not explicitly identified in the model specification (examples: unanticipated changes in the rate of output growth, the level of interest rate, the rate of inflation, ...). There is not a single β, as the CAPM suggests, but as many as the risk factors considered. The CAPM is a particular case of the Ross model (1976): if the expected risk premium, for a portfolio whose expected return depends on a single factor, is proportional to the market risk of the portfolio (β), then the two models are equivalent.

In the same vein, the multifactorial models of Fame & French emerge:

$$re = rf + bi\ (rm - rf) + ci\ (rSMB) + di\ (rHML) \qquad (5)$$

where:

rf = *Taxa de* return on risk-free asset
(rm - rf) = Market risk premium
bi = sensitivity of Action i to market portfolio profitability
ci = sensitivity of Action i to the dimension factor
di = sensitivity of Action i to the *book-to-market* factor
SMB = *Small minus Big*
HML = ***high minus low***

There are strong limitations on the use of the calculation options referenced in financial theory by small and medium-sized enterprises, however, it is necessary to define a model that is practical and has some objectivity, as well as a direct relationship with the specificities of each project to be developed (Onion, 2011). In this way, the author advocates a model for determining the discount rate *I* used in discounting *future cash flows* of projects:

$$i = Taxa\ de\ referência\ (rf) + Prémio\ de\ risco \qquad (6)$$

This model differs from the CAPM in the form of the calculation of the risk premium, which is not supported by the undertaking's beta, as it does not apply to this type of undertaking. This model suggests that the risk premium should be calculated considering a set of predetermined factors to which may be added other factors that are considered appropriate by the project analyst.

In summary, when making an investment, it has been implied that the expected rate of return will be at least as high as the opportunity cost of capital. Therefore, the *estimated cash flow* for an investment is discounted by a discount rate. That rate is the opportunity cost of capital, and its value is determined by the loss of profitability that an alternative investment of similar risk would generate.

However, financial markets are not perfect and efficient and therefore the cost of capital varies depending on the efficiency and competitiveness of the markets, the ability to raise capital, etc. Investments are generally financed with capital of different origins and different expectations of profitability. Thus, the manner and proportion of the capital to be used in making the investments determines the discount rate to be used in discounting the *estimated*

cash flow for the investment.

Several authors argue that companies should favor the use of debt as the first source of financing, due to the tax benefit it provides, since the interest paid is deductible from the taxable result, which allows to increase the net result of the company (Cole et al., 2015). It is an analysis perspective that ignores the risk of indebtedness, and in concrete cases, like Portugal, companies can use the Tax Incentive Scheme for Corporate Capitalization (ICE) entered in the State Budget (2024) and can consider a cost associated with the use of equity in financing their investments, including the financing of the needs in working capital.

The way in which investments are financed should therefore be assessed by considering the cost of the various types of capital involved (Clayman et al., 2012; Cole et al., 2015) and the associated risks (Cole et al., 2015; Hamid et al., 2015).

2.2 FUNDING MODES

Investments are rarely fully financed by equity. On the other hand, the functioning of the financial markets is not always competitive, and it is therefore necessary to examine how to assess the decision-making on the means of financing, i.e. the capital structure and its suitability in every circumstance in an investment, but also in the company promoting that investment (the works of Modigliani and Miller on the relevance or irrelevance of capital structure in value creation date back to 1958).

Authors argue that there is a *trade-off* between debt and equity, to determine the cost of minimum capital through the combination of debt and *equity (Block, 2011).* This value will be the one where additional debt would cause a higher cost (insolvency costs) than benefit (tax-deductible interest) (Clayman et al., 2012). The *Trade-off* approach supports the idea that while debt brings benefits through the associated tax benefit, it also brings costs related to the risk of corporate failure, the more likely it is, the greater the degree of indebtedness of the company.

Myers and Majluf (1984) suggest that there is not an optimal capital structure, but a *pecking order* in the selection of sources of finance for new investments. Companies prefer to finance themselves through internally generated funds, and only then resort to external financing, in which case they first opt for indebtedness (Block, 2011).

Thus, it appears that, while the *Trade-off* approach suggests an optimal level of indebtedness that will be achieved by balancing tax benefits linked to the use of debt with the costs of bankruptcy, the *Pecking order* theory does not *concur with an optimal capital structure, favoring a ranking of funding sources according to their cost.*

Empirical studies in the Portuguese business world have shown that the capital structure used is mainly a result of the concrete functioning of the financial markets, at each juncture, and of the conditions that companies or promoters of investments manage to obtain at each moment, rather than a theoretical condition of ideal capital structure (Ramos et al., 2005).

But assuming that the project is financed by equity and foreign capital, regardless of the proportions, we can discuss again, how to assess the cost of capital, for mixed financing structures (CP+CA). It should be borne in mind that the objective is to determine the opportunity cost rate of capital, i.e. in this case the discount rate to be used to update the *estimated cash flow* of the project.

2.3 ASSESSMENT OF THE FINANCING DECISION AT WEIGHTED AVERAGE COST OF CAPITAL (WACC)

According to this theory, financing should only be provided for projects where the rate of return (IRR) is equal to or higher than the weighted and adjusted average cost of capital employed.

weighted average corrected cost (Wacc) is obtained at the nominal cost of all capital employed (own and external), weighted and adjusted for tax effects.

The cost of debt capital should consider explicit costs, interest rates, and implicit costs such as fees charged, guarantee costs, etc. and weighted, i.e. multiplied by (1-t) where t is the tax rate (IRC).

$$K_{ca} = K_d \, x \, (1 - t) \qquad (7)$$

Where:

K_{ca} = cost of outside capital

K_d = cost rate of debt.

t = IRC rate

The cost of equity capital could be obtained either by the CAPM method referred to above or by criteria appropriate to the situation. In concrete situations, dividends, future expectations for the growth of those dividends and implicit costs arising from lost opportunities are considered. The cost of equity is generally higher than the cost of capital debt, for tax, maturity and risk reasons, as shown in equation 8.

$$K_{cp} = K_c + P_r \qquad (8)$$

Where:

K_{cp} = cost of equity

K_{cp} = cost of equity rate

P_r = Risk premium.

In determining the cost of equity, too, the Gordon model is often used, especially for listed companies:

$$K_c = \frac{D_1}{V_0} + g \qquad (9)$$

Where:

K_c - Cost-of-capital rate.

D_1 - Dividend from period 1;

V_0 - Share value in period 0;

g - Dividend growth rate

The weighted and corrected average cost (WACC) then comes:

$$K_c = [K_d * (1 - t) * \frac{D}{(CP + D)}] + K_{cp} * \frac{CP}{(CP+D)} \qquad (10)$$

Where:

K_c = Weighted average cost of capital rate.

K_d = cost rate of outside capital

K_{cp} = cost of equity rate

t = IRC rate

D = Financing by outside capital

CP = Equity Financing

The use of this methodology aims to determine the discount rate to be used in updating the periodic *cash flow* of the project. That rate shall be equal to the weighted average capital cost.

The discount rate thus determined can be compared with the project IRR and whether

lower will be an indicator of the financial viability of the project.

The literature analyzes possible factors influencing the costs of outside capital such as the value of the assets held by the company, its level of indebtedness, the risk of its business, its profitability, solvency and liquidity, the sector in which it operates, its ownership structure. (Young, S., & O'Byrne, S., 2003). However, those analyses do not aim at determining specifically the level of third-party financing that a particular investee should have. But this issue is relevant in the analysis of an investment and should be analyzed in the framework of the project's treasury as at another opportunity we will see.

2.4 ASSESSMENT OF THE FINANCING DECISION AT THE MARGINAL COST OF CAPITAL

In the marginal cost of capital methodology, for the purpose of determining the discount rate, the cost to be considered as the cost of capital of the project is obtained by dividing the cost of capital increase arising from the project under consideration, by the capital increase involved, whether in-house or outside.

$$K_{mc} = \frac{(C_{tf} x\ K_{cf}) - (C_{ti} x\ K_{ci})}{\Delta CT} \qquad (11)$$

Where:

C_{tf} - Final total capital.

C_{ti} - Initial total capital.

K_{cf} - Cost of final capital.

K_{ci} - Cost of initial capital.

ΔCT - The total capital add-on involved.

For the application of this methodology, the cost of outside capital should be corrected for tax effects and the costs of financing should be taken into account in the need for financial resources. The application of this method may hide changes in the financial risk of the undertaking due to the change in the final capital structure. Its application to long-term projects in its implementation (several years) may prove inadequate.

When using this methodology in the project evaluation, i.e. in determining the NPV, the discount rate shall be equal to the marginal cost of capital and the project IRR above this cost.

2.5 ASSESSMENT OF THE FINANCING DECISION AT THE CURRENT COST OF FUNDING SOURCES

The current cost of sources of financing is a methodology that compares the total capital

(own and external) used, with the cost of each installment, period by period, adjusted for tax effects, and with the repayments (of outside capital and equity used) at the time they occur.

In determining the rate that equates the discounted sum of cost flows and capital returns to the present value of the total capital employed, it is determining a rate of return on the capital that would be used in the present to make the investment. It is therefore determining the minimum rate of the cost of capital to be used in the analysis of the investment.

This methodology implies the definition of the remuneration conditions and the time of return of equity.

The IRR of the project under assessment should be equal to or higher than the IRR obtained by the current cost of funding sources methodology.

2.6 NET PRESENT VALUE OF THE FINANCING DECISION

Some Authors present the methodology "Net Present Value of Financing Decision" for the purpose of determining the cost of capital. However, the purpose of that methodology is not to determine the cost of capital to be used in the valuation of the investment, but to determine the present value of the net cost of outside capital used.

The net present value of the financing decision is intended to determine the tax effects resulting from the use of outside capital to finance all or part of the investment project.

The method is applied by discounting the cost flows of foreign capital, net of tax (IRC) at the market interest rate.

As can easily be seen, any use of outside capital whose net cost rate is lower than the market rate used to discount, generates a positive present value, the higher the cost of capital and the amount financed.

Moreover, this measure of effect cannot be disconnected from the project treasury, in particular to ensure the return of the capital taken, an aspect entirely unrelated to the presentation and use of this methodology.

As is widely explained in economic theory, the use of outside capital results in the payment of interest. A lender wishes to obtain a return that at least returns to him the present value of the capital lent. That return is a relative concept expressed by the quotient: result/capital that gave rise to the result.

Therefore, the use of outside capital to finance the realization of an investment has an effect on any investment project. This effect is called cost. This cost, for the shareholder, may be lower than the yield obtained by the lender, as a result of tax policies in force in the place or country where the transaction takes place. However, on a net basis, the use of such outside capital, such as equity, generates costs for the investment that is to be made.

Thus, the tax advantage obtained from the use of outside capital in the financing of an

investment must be taken into account for the purposes of determining the overall cost of capital used to finance that investment, that is to say, for the reduction of the cost of capital rate to be used in determining the NPV of the project.

In mathematical terms, by choosing to reduce the discount rate or by choosing to add the VA of the tax benefit to the project's NPV, we will be able to obtain the same numerical conclusion. However, we cannot reverse the factors and thereby reverse the idea of value creation by saying that value creation results from financing and not from investment.

Of course, authors, such as Menezes (1987), respect the economic principle defended here and are careful to separate the effects and warn of the dangers of concealing the financial risk by embarking on a dependence on the capital of others.

In addition, the analysis of how to finance has to be integrated with the project treasury, period by period, and includes the return of borrowed capital and also equity, which is rarely taught to finance students.

Generally, the analysis of funding a project is not independent of the funding structure of its promoters. Even in so-called *project finance* situations, the cost of outside capital always considers some link with the promoter.

The assessment of the financing decision should be made taking into account the costs of the money raised and of the financing operations (*all in cost*) and the time balance between the obtaining of funds (*project cash flow) and the borrowing requirement.* Otherwise, there will be a failure to meet the costs.

The analysis of tax benefits arising from financing, with foreign capital in the case (in some circumstances the cost of equity can also be considered as tax costs), is important for the owners of the company. These benefits occur by having profits (accounting concept) in the enterprise. The implementation of a particular project may have contributed to these profits. These benefits do not represent value creation, but only appropriation of the value created.

Other authors, some coterminous, study the effects of the financing decision on the present value of the flows of foreign capital obtained by updating the financial flows of the borrowings, interest incurred, net of taxes on profits, and repayments of the debt, at a discount rate that will correspond to the cost rate of the respective debt (Mota, 2008 p. 214).

Applying this method of analysis, the present value of the financing decision, to the example under study, would have the following situation, represented in Figure below

A positive present value, as it could not fail to be. It does not seem acceptable either for the reasons set out above, or because the cost of capital methodologies aim at determining the discount rate to be applied in the investment analysis and not at determining a value to ‘correct’ the NPV of the project.

The present value of a future *cash flow* does not mean value creation, but only the present value of a future value, i.e. the depreciation of capital over the time considered. A conclusion that is quite different from the one conveyed.

If financing situations were simulated with the repayment of the capital even further away, the present value would be even greater. In other words, it would only be enough to return the capital borrowed in a long period of time for us to have value creation. Such a conclusion does not seem correct, apart from the fact that, at present, not only does interest allow companies to obtain tax benefits in the corporate tax area, but with the creation of the Corporate [Capitalization Incentive Tax Scheme (ECI) in the State Budget for 2024][6], it has become possible to deduct a rate linked to equity capital.

In this case, it is a floating rate on equity, corresponding to the average of the 12-month Euribor rate in the tax period, plus a *spread* of 1,5 pps, or, where the taxable person is an SME or *Small Mid Cap*, 2 pps.

To establishing the tax advantage, the amount of eligible net equity increases now includes the increase for the year itself and for the previous six periods (previously, for the year itself and for the last nine). The deduction shall be increased by 50%, 30% and 20% in the tax periods of 2024, 2025 and 2026 respectively.

3 METHODOLOGY

This study uses the descriptive method as to its objective, going through a literature review on the subject addressed. Its purpose is to provide a reflection on concepts and techniques for the determination of the cost of capital used in the analysis and evaluation of investments with the aim of contributing to their clarification.

The **descriptive** search method was used**, as it is the most suitable for the purpose, making it possible to analyze the technical expressions for determining the cost of capital in general and for the method of financing in particular.**

4 RESULTS AND DISCUSSION

The opportunity cost of capital, expressed as a rate, is the benchmark for updating the *cash flow* of investments in order to evaluate it.

We have set out and explained the methods for determining the opportunity cost rate for an analysis regardless of how investments are financed and for financing methods with mixed financing structures, equity and debt. We believe that the weighted average cost of capital is the best fit for projects that develop in less competitive markets.

The three criteria set out (Cost of capital; Marginal cost of capital and Current cost of sources of funding) aim to determine the cost of capital, i.e. the discount rate to be used in calculating the Net Present Value (NPV) of an investment project. All the *criteria for determining the cost of capital underline the fact that making investments involves sacrifices and that the decision to make investments is assessed by reference to the comparison of those sacrifices (cost of capital) with the benefits generated by the investment measured by the NPV of that investment.* The NPV is the most used criterion for assessing the value creation of a given investment and corresponds to the present value of the discounted *future cash flow* with a discount rate chosen by the methods set out above.

Example - Use of the NPV criterion for project selection

NPV is the net present value, i.e. the sum of the *discounted cash flow*, over all periods considered in the investment analysis, at a discount rate (r) defined as above:

$$\text{VAL} = \sum_{k=0}^{n} \frac{C_k}{(1+r)^k} \qquad (12)$$

Where:

r - Discount rate.

C_k - Cash flow for periods k, from 0 to n.

Mathematically, we can find 3 situations: VAL>0, VAL=0, or VAL<0.

If NPV>0 means that the project has a return higher than the minimum required to remunerate the invested capital covering the risks considered and also the creation of monetary surpluses and therefore an indication of economic value, i.e. the capacity to generate additional value to the sacrifices incurred for its realization.

If the NPV=0, i.e. the sum of the *discounted* future cash flow, is zero, this means that the project is aiming at achieving the desired profitability. However, the analysis is ex-ante and focus on estimates for the future and therefore NPV=0 situations require further analysis. In the situation where NPV=0, the internal rate of return of the project (IRR) equals the opportunity cost of capital.

If the NPV<0 the realization of the investment shows no benefits. Its profitability will be below the cost of capital employed in its realization.

The NPV criterion is an economic decision criterion, it is the result of assumptions used in making *Cash Flow* estimates and the discounting rate of these flows. It is not enough for investment projects to have an NPV>0 to be carried out. Its implementation depends on other considerations, such as the existence of financial resources, which, as we know, are scarce resources and their uses are decided instead, given the options available.

In the calculation of the NPV, some authors state that there are two ways of increasing the NPV, i.e. two ways of creating value by investing. One share is associated with the *cash flow generated* and another associated with the discount rate reduction, (Soares et al. 2020), however, the discount rate is an assumed assumption for assessing the present value of *cash flows* and not a dependent variable. For this reason, the choice of size should be duly justified and not adjusted in the light of the intended results.

A quantitative example is constructed to illustrate three possible situations resulting from a *cash flow upgrade* of an investment. It is an investment, intended to create products that are intended to be traded on the market. It should also be assumed that the life of the project and the company is 30 years, i.e. after 30 years the project will cease to exist and the company implementing it will also cease to exist (Condition designed to eliminate differences in the effects of projects on the company and vice versa). It is accepted that all necessary steps, and before the estimation of *cash flow*, have been subject to appropriate procedures. Consider then the following *cash flow* map*:*

Figure 2

Cash Flow Map

Descrição	Implementação	1	2	3	4	5	6	7	14	21	29	30
						Unidades: 10^3 euros						
Investimentos		700	100	5	3	2				80		
Rend. de desinvestimento												
Gastos de desinvestimento												1 100
Cash Flow de Investimento		-700	-100	-5	-3	-2	0	0	0	-80	0	-1 100
Exploração:												
Rendimentos			700	1 200	1 500	2 000	2 000	2 000	2 000	2 000	2 000	2 000
Gastos			610	1 050	1 230	1 600	1 600	1 600	1 600	1 600	1 600	1 600
Cash Flow de Exploração			90	150	270	400	400	400	400	400	400	400
Cash Flow do projecto		-700	-10	145	267	398	400	400	400	320	400	-700

Assume an opportunity cost of capital of 15%. This gives an NPV of the *discounted cash flow* of 1071 currency units corresponding to an IRR of 33% as shown below.

Figure 3

Discounted Cash Flow and IRR

Descrição	Implementação		1	2	3	4	5	6	7	14	21	29	30
								Unidades: 10^3 euros					
Cash Flow do projecto			-700	-10	145	267	398	400	400	400	320	400	-700
	15%												
1/(1+i)^t		1	0,869565	0,756144	0,657516	0,571753	0,497177	0,432328	0,375937	0,141329	0,053131	0,017369	0,015103
CFD			-609	-8	95	153	198	173	150	57	17	7	-11
CFD acumulado			-609	-616	-521	-368	-170	3	153	755	986	1 081	1 071
VAL		1 071											
TIR		33%											

This is an investment which, if the assumptions underlying the construction of the *cash flow* are verified, provides significant added value, with a rate of return well above the rate of cost of capital used for its determination. However, this investment will only be implemented if there are financial resources to implement it, which is not always the case. Even if the promoters had the resources, they rarely have the full resources or rarely want to spend all their resources on one project or do not want to run all the risks inherent in making an investment on their own.

Let us now admit that in the example given, incomes were overvalued, a situation which is very common. The review yielded the following *cash flow* and NPV<0 for a capital opportunity cost of 15%.

Figure 4

Revised *Cash Flow*

Descrição	Implementação	1	2	3	4	5	6	7	14	21	29	30
						Unidades: 10^ 3 euros						
Cash Flow do projecto		-700	-110	-105	117	148	150	200	200	120	200	-900
15%												
1/(1+i)^t	1	0,869565	0,756144	0,657516	0,571753	0,497177	0,432328	0,375937	0,141329	0,053131	0,017369	0,015103
CFD		-609	-83	-69	67	74	65	75	28	6	3	-14
CFD acumulado		-609	-692	-761	-694	-620	-556	-480	-191	-78	-30	-44
VAL	-44											
TIR	14%											

As the NPV is negative (NPV<0), this means that the value added of the investment will correspond to a rate of return lower than the rate of return desired by the promoters.

It must therefore be examined whether, with a funding structure made up of equity and debt, the project would add more value.

According to the methodologies for assessing the cost of capital, as explained above, for a given capital structure and obtained a rate of cost of capital less than 14% the project would present a NPV>0. That is, the reduction of opportunity cost depreciates less future *cash flow* by achieving a higher NPV. Other theories, such as the 'net present value of the financing decision' methodology, would be sufficient to finance the project with a volume of outside capital that would provide an updated tax advantage in excess of the negative NPV value of the project, so that the project would move from a situation of insufficient value created to a situation of value created sufficient to be considered for implementation.

It is in these circumstances that some authors (e.g. Charreaux (1996, p.210). In line with the second assumption of MM) they argue that the NPV of the project should be corrected by adding the present value of the net financial burden tax benefits (NPV + A) arising from debt financing used in the financing of the investment. It is not disputed that with the reduction of the cost of capital the viability of the project can be considered, as indeed occurs in an environment of economic stability and low interest rates. What is disputed is that this stems from debt financing, when this stems from a tax issue that also applies to equity would ultimately result in no opportunity cost by eliminating the NPV criterion as a criterion for project selection.

It is not acceptable to consider, on the same level, the creation of capital by investment and tax benefits, which do not create value but merely redistribute it.

Therefore, the feasibility, that is, the possibility of carrying out a project, by lowering interest rates and therefore the cost of capital, should not be confused with the creation of value. The creation of value, if any, derives from the goods or services generated by the investment in

question. The funding makes it possible to implement them. The mode of financing operates by a redistribution of the value created by the investment. The value generated by an investment is intended for users, beneficiaries of the investment, the restoration of productive conditions, the payment of taxes, the remuneration of equity and debt capital if they exist.

It is not a question of devaluing the importance of funding; on the contrary, the methods of financing are often the cause of the success or failure of investments. The mobilization of stranded financial resources, if carried out ethically, within the established regulatory framework, by financial intermediaries and capital markets, is a valuable contribution to economic growth, financing investments, enabling anticipation of the use of goods and welfare conditions that would otherwise not be possible.

The issue of investment financing should be addressed with detailed knowledge of the project treasury, in addition to many other strategic aspects. Restricting for now the observation of the project treasury to determine, in each period, the needs for means, clarifying how much and when financial resources are needed or how much and when they become available. We must not forget that we are working with estimates that, under certain conditions, are admitted to occur in the future. Restricting the analysis of funding to mere tax gains, as well as confusing the determinants of value creation, overshadows the whole complexity of the issue of funding the project.

Resuming the example - for project treasury analysis:

Consider, then, a capital structure appropriate to the needs evidenced, to finance its implementation. Assuming 50% of the capital needs of others and considering an interest rate of 10%, with a 3-year grace period and amortization of the loan in 4 equal installments. The remaining 50% of the financing needs would be covered by equity, with dividends at the rate of 15%, constant throughout the duration of the project and payable when the treasury allows it.

The following cash would be obtained for the first 9 periods, i.e. until the total depreciation of the capital of others.

Figure 5

Project treasury, first 9 periods

Tesouraria		1	2	3	4	5	6	7	8	9
						Unidades: 10^3 euros				
Entradas:										
Capitais próprios		380	75	75						
Capitais alheios		380	75	75						
Rendimentos			600	950	1 350	1 750	1 750	1 800	1 800	1 800
Total de entradas		760	750	1 100	1 350	1 750	1 750	1 800	1 800	1 800
Saídas:										
Investimentos		700	100	5	3	2	0	0	0	0
Gastos		0	610	1 050	1 230	1 600	1 600	1 600	1 600	1 600
Juros		38	46	53	53	44	32	19	6	1,875
Impostos	30%	-11	-38	-70	-4	8	11	30	34	35
Amort. Capital Alheio					95	114	133	133	38	19
Dividendos		0	0	0	0	0	0	0	80	137
Total de saídas		727	718	1 038	1 377	1 767	1 776	1 781	1 757	1 792
Saldo do período		33	32	62	-27	-17	-26	19	43	8
Saldo acumulado		33	66	127	101	84	58	76	120	128

Taxes were considered as received when the operational result of the project was negative (rather optimistic hypothesis).

Figure 6 looks at the entire period, 30 years, during which there will be payment of labor duties and return of equity:

Figure 2

Project treasury, 30 years

Tesouraria		1	2	3	4	5	6	12	18	21	29	30
						Unidades: 10^3 euros						
Entradas:												
Capitais próprios		380	75	75								
Capitais alheios		380	75	75								
Rendimentos			600	950	1 350	1 750	1 750	1 800	1 800	1 800	1 800	1 800
Total de entradas		760	750	1 100	1 350	1 750	1 750	1 800	1 800	1 800	1 800	1 800
Saídas:												
Investimentos		700	100	5	3	2	0	10	0	80	0	1 100
Gastos		0	610	1 050	1 230	1 600	1 600	1 600	1 600	1 600	1 600	1 600
Juros		38	46	53	53	44	32					
Impostos	30%	-11	-38	-70	-4	8	11	54	57	60	57	57
Amort. Capital Alheio					95	114	133					
Dividendos		0	0	0	0	0	0	159	80	80	80	610
Total de saídas		727	718	1 038	1 377	1 767	1 776	1 823	1 737	1 820	1 737	3 367
Saldo do período		33	32	62	-27	-17	-26	-23	64	-20	63	-1 567
Saldo acumulado		33	66	127	101	84	58	27	170	278	774	-792

As can be seen, the project has not released sufficient means to return the equity or to pay the workers' rights.

What would be the answer if the VALA 'methodology' were adopted?

Would stay: NPV of the project -44 u.m.; and present value of tax benefits 144,49 u.m. and NPV+A=+100,49 monetary units.

Figure 7

VA of tax benefits

Valor actual dos benefícios fiscais										
		1	2	3	4	5	6	7	8	9
Juros:		38	46	53	53	44	32	19	6	2
Taxa de IRC	30%									
Taxa de actualiz	10%									
juros líquidos		26,6	31,85	37,1	37,1	30,45	22,49	13,2125	3,9375	1,3125
Coef. Act.		0,909091	0,826446	0,751315	0,683013	0,620921	0,564474	0,513158	0,466507	0,42409762
VA	144,49	24,18	26,32	27,87	25,34	18,91	12,69	6,78	1,84	0,56

Thus, a project that would be refused by the NPV<0 criterion would be turned into a project accepted because it has a NPV>0. This result can be questioned by: (i) the financing does not directly create value; (ii) the financing of investment that is not linked to the project's treasury can not be analyzed; (iii) it cannot be admitted a priori that there is a tax advantage, as there may be no profit and in this case the tax advantage does not occur, at least in the respective period; the amount of the financing with outside capital cannot be disconnected from the risk, which is not considered in this situation.

The assessment of projects must be carried out independently of the capital structure used to implement them. A capital structure incorporating both equity and debt capital can reduce the cost of capital employed and make it possible to carry out projects with lower returns on all capital invested. In such circumstances, the financing study must be framed in the timing of the project's specific treasury so that the parties (equity and debt) can analyze the risk. In particular, the risk of outside capital cannot be determined without knowledge of the project's ability to release *cash flow* in the periods foreseen for the payment of interest and principal. Even so, the financing of a project does not directly generate value and therefore any benefits cannot be added to the NPV of the project as of value generated by it if it were.

Looking at the example, in the situation of NPV<0, the realization of such an investment would imply less value creation than would be comparable in terms of opportunity cost. Or, to put it another way, it would consume the resources that could be applied in a higher value generating alternative. However, in the analysis advocated by the VALA "methodology", the project generated value and would move on.

Choice of projects for implementation and funding

Only projects with value creation according to the generally accepted criteria should be financed, the NPV criterion set out here, calculated with capital opportunity cost rates, appropriate to the type of project. For these, the financing needs should be met according to a study of risk and opportunity sharing in financial markets, always with the limitation that

the cost of financing does not absorb more value than considered in the study that provided the validation of the investment.

Most, if not all, of the projects are financed, at least in part, from outside capital. The decision to carry out the projects is therefore subject to the study of the method of financing. Not to supplement the previous analysis supported by the NPV criterion, but to follow up or not to carry out a project that has been studied and which is economically and financially viable. The economic-financial analysis and the decision to finance are sequential, not cumulative.

For the project promoter, it is important to analyze the costs of borrowing debt to finance a project, arising from the financial risk to the financiers. In the short and long term, considering the size of the resources needed and the most appropriate way to obtain them. Generally, the analysis of funding a project is not independent of the funding structure of its promoters. Even in so-called '*project finance*' *situations,* the cost of outside capital always takes account of some link with the promoter.

The assessment of the financing decision should be made taking into account the costs of the money raised and of the financing operations (*all in cost*) and the balance between the obtaining of funds (*project cash flow) and the borrowing requirement.* Otherwise, we will have a situation of default and the costs involved.

The analysis of tax benefits arising from financing, with capital from outside in this case, is important for the owners of the company. These benefits occur by having profits (accounting concept) in the enterprise. The implementation of a particular project may have contributed to these profits. These benefits do not represent value creation, but only appropriation of the value created.

Present value of funding

Some authors study the effects of the financing decision on the present value of the flows of foreign capital obtained by updating the financial flows of borrowings, interest incurred, net of taxes on profits, and repayments of debt, at a discount rate that will correspond to the cost rate of the respective debt Mota (2008), p. 214.

Applying this method of analysis, the present value of the financing decision, for the example under study, would have been the values shown in Figure 8.

Figure 3

Present value of funding sources

	0	1	2	3	4	5	6	7	8	9
Capital socilitad	530									
Juros:		-38	-46	-53	-53	-44	-32	-19	-6	-2
Taxa de IRC	30%									
Taxa de actualiz	10%									
juros líquidos		-26,6	-31,85	-37,1	-37,1	-30,45	-22,49	-13,21	-3,94	
Devolução do capital					-95	-114	-133	-133	-38	-19
Coef. Act.		0,9091	0,8264	0,7513	0,6830	0,6209	0,5645	0,5132	0,4665	0,4241
VA	82,32	-24,18	-26,32	-27,87	-90,23	-89,54	-87,49	-74,77	-19,33	-7,95

The present value of a future *cash flow* does not mean value creation, but only the present value of a future value, i.e. the depreciation of capital over the time considered.

If financing situations were simulated with the repayment of the capital even further away, the present value would be even greater. In other words, it would only be enough to pay back the capital borrowed over a long period of time to create value, which could be misleading.

Creation of value and Breakdown of value created

It is also important to look at the fate of the value created. The *cash flow* of the project is intended, or should be intended, to: (i) renew the operating conditions; (ii) pay the direct taxes; (iii) remunerate and return the capital of others involved in its financing; and (iii) remunerate and return the promoters' capital.

The *cash flow* intended to renew the operating conditions, which may be referred to as self-financing, should be given special attention by the investment managers as the renewal of the operating conditions is carried out in a different time from the generation of *cash flow* which makes it possible to divert them to other purposes and when they are necessary for that purpose no longer exist.

Another part of the *cash flow* is earmarked for the remuneration of the capital of others and the return of that capital to the market or to financial intermediaries. It should be programmed appropriately, in a very articulate way between the conditions underlying its procurement and the conditions underlying the implementation of the project. In other words, from the point of view of the project, the risk assumed by the capital should be measured by the comparison between the actual execution and the forecasts underlying the contracting of the financing.

Another part of the *cash flow* is earmarked for the return on equity. Their amount should not exceed the remuneration rate considered in the NPV studies or be lower if the performance of the investment falls short of what is expected. The timing and occurrence of

Such remuneration should also be programmed according to the investment treasury, avoiding operational financial difficulties.

If, after the redistribution mentioned, there are *cash flows*, they should be aimed at rewarding the human resources involved and the innovation and development of new products, services or technologies.

5 CONCLUSION

It can be concluded that in the ex-ante study of investment projects, the NPV, if determined with an appropriate capital opportunity cost rate, is an indicator of the value added of the investment under study. The determination of the opportunity cost of capital is indispensable for carrying out an evaluation of investments according to the economic principles of scarce resources and alternative applications of available resources.

The realization of investments presupposes different financing, which implies the need to determine the opportunity cost for validating decisions according to the specific funding mix. The Weighted Average Cost of Capital is the most appropriate under certain circumstances.

Financing is of great importance for the realization of investments. This importance stems from the possibility of carrying out projects and the realization of the generation of value. High leverage rates discourage funding and discourage investments themselves. The financing to be provided should be adjusted to the project treasury to safeguard the remuneration and recovery of the capital invested. The value created comes from investment and not from financing. The value created by the investments is distributed among the *stakeholders at* present and should make it possible to replenish capital for new investments.

The ‘correction’ of the NPV of the project by adjustments due to tax or other benefits stemming from the mode of financing should be considered from the perspective of investors, but not to correct the NPV of the project.

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