PROJECT INVESTMENT ANALYSIS

1. Introduction

The identification and selection of good investment projects is a key element in developing a sustainable successful future. The decision to move forward with good or bad projects, more than impacting the economic profile of the firm in the short term, will tend to have a lasting impact in the long term profitability.

The analysis of a project has three quite different sequential dimensions. Firstly, we have a phase of gathering and assessing the data related to the project. In special, forecasted data (revenues, costs, etc.) need to be carefully analyzed as it will be cement of whatever criteria that will be used to evaluate the project. Just using the right methodology and tools to evaluate a given project will not help much to reach a good investment decision if the analysis is based in poor data. The robustness of the data employed is crucial in the evaluation process. Secondly we have the evaluation stage, in which we will assess the merits of the project to contribute for the value of the firm. Finally, we will have a third stage, of risk analysis, that will check the robustness of the evaluation results.

2. The evaluation methodology

The analysis of the projects will be based on their cash flows. We will compare the cash invested and the cash generated by the project. Therefore there won´t be any accounting or similar features that may influence the decision.

In the definition of the projects' cash flows there are some principles that will be taken into account, especially:

- The concept of incremental cash flows

  To evaluate a project, we will consider the cash flows driven by the project; for instance, if the project will use available staff (that wouldn´t be dismissed in the absence of the project) this cost shouldn´t be included in the project; by contrast, if the project sales produce a reduction in the sales of another product this side effect should be accounted for.

- The role of sunk costs

  A sunk cost is an item generated by the project, independently of the decision of moving forward with it or not; a classical example are the costs associated with several studies conducted in the project analysis (market research, product conception, etc.) that will always be incurred by the firm whatever final decision regarding the project; in these cases, the associated (sunk) costs shouldn´t be included in the project evaluation.

- The finite life

  The project will run for a given period. The more common criteria to establish this time horizon is the economic life of the major component of the investment, but other criteria may be used according to the project's characteristics (for instance, a concession period).

- Asset disposals

  Assuming that the project has a finite life, the sale of assets and realization of working capital balances will have to occur at the end of the project, being its final cash flows. The value of the sale of assets should, though, be estimated. Usually, and adopting a conservative view, assets disposals will be carried out in the year after the last operating cash flow occurs (or operational activity is completed).

- Nominal vs. real prices

  Project data can be prepared assuming a zero inflation (real prices) or considering a given scenario for the evolution of prices (and their impact in the project outputs and inputs); the latter is more common, while the former is more used in projects developed in countries with high and especially unpredictable inflation. The real prices approach creates an additional difficulty in the valuation process regarding the calculation of the discount rate: this needs to be established taking into account the theoretical zero inflation scenario.

Having computed the project's stream of cash flows, we will evaluate the project on a two-step approach. Firstly, we will assume that there is an all-equity financed case. The goal is to evaluate the project on its own merits, eliminating any advantage that can come from the financing side. For instance, it will be useful to know if a project that will have access to a Government subsidy is still viable without that endorsement. The final decision will be taken, naturally, in the second step of the evaluation process, in which the financing dimension will be considered.

3. Evaluation criteria

3.1. Net present value (NPV)

The NPV represents the present value of the stream of cash flows of the project:

$$\text{NPV} = -\text{CAPEX} + \frac{\text{CF}_1}{1+r} + \frac{\text{CF}_2}{(1+r)^2} + \ldots + \frac{\text{CF}_n}{(1+r)^n}$$

Being:

CAPEX – Capital expenditure (or initial investment) at the year zero of the project

r – The required rate of return for the project

A positive NPV represents (today) the amount of value generated by the project over the initial investment and over the required rate of return (the discount rate for which NPV is equal to zero, as explained below). A negative NPV indicates, if the project is taken, a situation of value destruction, as it does not meet the return required by the resources that will be allocated to the project nor compensates for the initial investment.

3.2. Internal rate of return (IRR)

The IRR is the average annual rate generated by the project and is the discount rate which makes NPV=0:

$$0 = -\text{CAPEX} + \frac{\text{CF}_1}{1+\text{IRR}} + \frac{\text{CF}_2}{(1+\text{IRR})^2} + \ldots + \frac{\text{CF}_n}{(1+\text{IRR})^n}$$

The IRR should be compared with the required rate of return used in the computation of the NPV. If the investor's required rate of return is higher than the IRR, then the project will have negative NPV. If the investor's required rate of return is lower than the IRR, the project will have a positive NPV and so it can be accepted (from a strictly financial perspective). Therefore, one can see the IRR as equal to the maximum rate of return that an investor may require for a given project.

In the analysis of **a single project**, NPV and IRR lead to the same decision of accepting or rejecting a project (with a few odd exceptions, especially, if we have another negative cash flow during the life of the project that can create, from a mathematical point of view, multiple IRR).

3.3. Payback period

The payback period gives a different perspective of the project comparing with NPV and IRR. It tells us how much time it will take to recover the initial investment made in the project. It is, though, more a criteria of risk than a criterion of return measurement. Payback Period became popular in the 50´s within the multinational American firms that were starting, at that time, their international expansion into countries with unstable environments, in which the awareness of how fast the investment was recovered was more important than the absolute return.

It cannot be viewed as a measure of value or return as it ignores all the cash flows after the initial investment is recovered. In any case and, again, just looking **at a single project**, it will lead to the same decision of NPV or IRR unless we have negative cash flows after the recovery of the investment. In fact, if the initial investment is not recovered throughout the life of the project, this means that NPV will be negative. On the other hand, if the initial investment is recovered, this means that after that moment, all cash flows are a plus regarding the initial investment, and so project's NPV is positive. Interesting cases are the ones in which, at the end of the project, there is a negative cash flow such as in the case of the closure of a mine or of an electrical plant.

3.4. Profitability index (PI) and "Benefit-Cost Ratio"

The PI represents the generation of cash, reported at the present, per unit of investment:

$$PI = \frac{NPV}{CAPEX}$$

or

$$PI = \frac{PV}{CAPEX} - 1 = \text{Benefit-cost Ratio} - 1$$

The "Benefit-Cost ratio" will only be greater than one if the project has a positive NPV. The Profitability Index gives us how much NPV is generated by each unit of initial investment. When analysing a single project the Profitability Index doesn´t provide additional relevant information over NPV, IRR and Payback. It can be useful in a situation of capital rationing, that is, when we have more than 1 project and more good projects than the capital available. In this case, the PI will be a good criterion in the establishment of a picking order.

4. Alternative projects

In this context, we are not, anymore, in the process of making a decision regarding the approval, or not, of **a single project**. Instead, we have more than one good project, and we need to choose one of them. Two main problems may arise: alternative projects with different initial investments and with different lives.

If the difference is only in the amount of investment the solution is quite straightforward, we should pick the one with higher NPV. The rational lies in the fact that the difference between investment amounts will generate a zero NPV. In fact, if we had the chance to invest the difference in another project with positive NPV, then the alternative should be to invest in the smaller project plus this new project.

If we are analysing projects with different lives, the solution is a little bit more complex. Let´s start with the more simple case: two projects having a similar risk profile, thus using the same discount rate.

In these cases we can use the Equivalent Annual Cash Flow (EAC), or an average annual cash flow, weighted by the time value of money (given by the discount rate, r):

$$EAC = \frac{NPV}{\frac{1-(1+r)^{-n}}{r}}$$

This is to say that we have to find the annual constant cash flow which, multiplied by an annuity factor $A_{n;r}$ gives us the NPV. Thus, if NPV = EAC x $A_{n;r}$ then

$$EAC = \frac{NPV}{An;r}$$

The annuity factor, for "n" periods and discount rate "r", is equal to:

$$An,r = \frac{1}{r} - \frac{1}{r(1+r)^n} \;=\; \frac{1}{r}\left[1 - \frac{1}{(1+r)^n}\right] \;=\; \frac{1-(1+r)^{-n}}{r}$$

So, the EAC represents the average annual cash flow during the life of the project (n). The project with a larger EAC will be chosen.

Let's consider now that the two projects have different discount rates. In these cases the solution will be to assume the infinite replication of the two projects. We then use each project's EAC (computed using the specific discount rate of each project) and compute the present value of an annual EAC perpetuity:

$$NPV(with\ infinite\ replication) = \frac{EAC}{r_p}$$

Being r_p the discount rate of each project. We should note that the EAC is a simplification of this method (when both projects have the same discount rate), and therefore we can use the NPV with infinite replication to solve any case of alternative projects.

CAPITAL STRUCTURE CHOICES AND

REVISTING PROJECT EVALUATION

1. Introduction

The choice between equity and debt or, by other words, the definition of the capital structure, is a critical issue in the definition of the firm´s financial policy as it impacts in several relevant areas such as the risk profile of the company and, consequently the cost of funding, the gathering of resources to back up the firm´s future development and the timely response to opportunities, challenges and threats that a dynamic environment tend to regularly produce.

The theory of corporate finance, in these last 40 years, has made some progress toward the definition of a guiding framework, although still far from fully overcoming and incorporating the frictions and imperfections that continue to characterize the financial world.

In the following sections we try to provide some input that may help the decision-maker to understand better some key elements that may affect the choice of the right capital structure.

2. An initial straightforward and simplified concept: financial gearing (leverage)

This simple concept, much more based in accounting values rather than in market values links the impact of the capital structure in the Return on equity (ROE = Net Income/Equity).

The key message may be viewed in the following expression of ROE:

$$ROE = (GROSS\ ROA + (GROSS\ ROA - r_D) \times \frac{D}{E}) \times (1 - t)$$

Being:

Gross ROA - EBIT/ASSETS

r_D – Average cost of debt

D/E – Debt/Equity

t – Corporate tax rate

Looking at the formula we see that if GROSS ROA is higher than the cost of debt, more debt and less equity (increasing the D/E ratio) will increase the ROE of the firm, an effect usually called financial gearing (or leverage).

This simplified concept assumes two things:

- The cost of debt will not change with the increase of debt;
- Shareholders will be pleased with the nominal increase of ROE.

These assumptions are both related with the perception of risk. But, if the company significantly increases its level of debt, changing though its risk profile, creditors will demand a higher interest rate and investors will require a higher return (that, eventually, will represent an increase larger than the growth of the ROE). Consequently, the financial gearing may be a useful concept for small changes in the firm´s capital structure, but it is not a general framework to model it.

3. The Modigliani–Miller (MM) world

3.1. The initial framework

In 1958, Franco Modigliani and Merton Miller (later, both received the Nobel Prize), developed a theory regarding the optimal capital structure of the firm. They considered a perfect economy, without taxes, no transaction costs, information asymmetries, and investors' homogenous expectations regarding the return/risk measurement and trade-off. In this perfect world they proved the irrelevancy of the capital structure. All possible D/E alternatives will end up with the same WACC and therefore not changing the value of the firm.

The idea is quite straightforward. Let´s assume a firm that replaces equity by debt, replacing though, a costlier resource (equity) by a cheaper one (debt). In terms of the WACC this positive effect will be offset by two negative effects: creditors will require an increasing interest rate (if the firm already has debt) and investors will also require an increased return because for both, the risk profile of the firm has increased and shareholders are the last ones in the pecking order to receive anything in case of financial distress. Let´s present a simple illustration.

Let´s assume a risk free rate of 4% and a market risk premium of 8%. The firm is all-equity financed its Beta is 0.8 and therefore the required rate by investors, using the CAPM is 10.4% (4 + 0.8 x 8).

Let´s now assume that the firm decides to change its D/E to 1 (50% equity and 50% debt, the latter with a cost of 6%[1]).

MM proved that the required rate of return by the investors (r_L) is a linear function of the D/E with the following expression:

$r_L = r_U + (r_U - r_D) \times D/E$

Being r_U the return required by investors of the unlevered firm and r_D the cost of debt).

In the new situation:

$r_L = 10.4 + (10.4 - 6) \times 1 = 14.8$

We could achieve the same result using a different path. It makes sense that the assets' beta (risk of the business) should not change with any modification of the capital structure and that the assets' beta should correspond to a weighted average of the Betas of the resources employed in the firm (equity + debt).

The cost of debt of 6% represents a debt Beta of 0.25. In fact, using CAPM: $6 = 4 + B_D \times 8$ implying that $B_D = 0.25$. Therefore if assets' beta (or unlevered beta) is 0.8 and the business itself will not change its risk profile, the new levered Beta of the investors will be 1.35 (1.35 x 0.5 + 0.25 x 0.5 = 0.8). Using the CAPM, the new required return will be:

$R_L = 4 + 1.35 \times 8 = 14.8$

The new capital structure will provide a WACC of:

WACC = 14.8 x 0.5 + 6 x 0.5 = 10.4

Therefore, the WACC, from the initial all-equity financed scenario to the D/E=1 scenario didn´t change, and so the introduction of debt did not create any

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[1] Here, it does not matter if this cost of debt is before or after taxes, because we are dealing with a world without taxes.

additional value for the firm (in a perfect world without taxes, transaction cost and with information asymmetries).

3.2. The revisited MM world with corporate taxes

In 1963, MM acknowledged the limitation of not having considered (corporate) taxes in their model. Introducing corporate taxes, which in practice reduce the effective cost of debt (as interest expense is tax deductible), the trade-off between equity and debt will favor the latter. In the previous illustration, considering a tax rate of 20%, the cost of debt will now be 4.8% (6 x (1-t)) and therefore the WACC will be only 9.8% (14.8 x 0.5 + 4.8 x 0.5), which is lower than in the all-equity financed initial case (10.4%). The conclusion is overwhelming: it would mean that the optimal capital structure is 100% debt. The consideration of taxes creates an addition to the value of the company equal to the present value of all tax savings due to debt. MM showed that Debt x tax rate corresponds to the size of this added value (the present value of a **perpetual** tax saving equal to debt x interest rate(r) x tax rate (t), using as discount rate the interest rate of debt, which means $\frac{Debt*r*t}{r} = Debt * t$).

3.3. The reality of the corporate world

If the MM model holds, we should see the wide majority of the firms highly levered. The reality is quite different with huge variations regarding the level of debt, across industries, size, profitability, indicating that there isn´t a clear pattern that may lead to the definition of an optimal single capital structure. There are several factors that may reinforce the use of equity or of debt, as described below.

Financial distress costs

A highly levered firm will have also a higher probability of entering in financial distress and eventually in bankruptcy, if its business, for some reason, faces a downturn. This possibility will start to produce many indirect costs (many not very visible at first sight) such as qualified employees who will seek a more secure job, more difficult hiring, suppliers who will be more demanding and offering less attractive conditions, customers leaving with the fear of the discontinuity of the firm, among several other examples. These additional costs recommend the avoidance of a highly levered situation.

Taxes

Corporate taxes are, naturally, an incentive to the use of debt. Increased taxes will favor the use of more debt. However, and more recently, there is a movement (as in France, Germany and Portugal) of the Governments to limit the tax advantage of debt (for instance, in Portugal, there is a limit of 70% of EBITDA of the amount of interest expense that can be considered as costs for tax purposes). These limitations are, in practice, a brake to use too much debt.

Nature of assets

Highly liquid (easy to trade) assets make easier (and less costly) the use of debt. For instance, firms with a relevant amount of intangible assets will find more difficult to raise debt (from a creditor perspective, illiquid assets will represent an additional risk in the case of bankruptcy, since they are not easily sold and thus exchanged for cash).

Nature of the business and competitive position

In a more volatile business (prices, margins, returns) and/or in an industry with fierce competition, in which profits can easily be eroded, debt should be used in a more conservative perspective, as there is a higher chance of a firm entering in a financial distress situation (likelihood enhanced by an increased level of debt). In fact, increased financial leverage represents increased fixed costs, which must always be paid even when margins go down. Therefore, firms in highly competitive markets (and low margins) should keep their cost structure as much flexible (and variable) as possible, which is not compatible with high levels of debt.

Risk management

A firm that has an active risk management policy, that is, a company that is actively mitigating the impact of the variation of prices (commodities, currency rates, interest rates, etc.) in its cash flow and income, has an ability (other things equal) of raising more debt than a firm that faces the impact of price variation (favorable some times, unfavorable in others). Once again, and from a creditor perspective, a more stable stream of cash flows and profits will be rewarded with eased access to debt and in better conditions.

Ownership control

Especially in private companies (or in public companies with a majority shareholder), growth strategies, which demand more raise of funds, clash against the lack of equity capital to maintain the control of the firm. This situation leads to an increased use of debt or, even worst, to the sacrifice of attractive growth opportunities. This (cultural and social) inability to share ownership and the control of the firm is a well-established characteristic of the Southern European countries.

3.4. The perspective of top management

Stuart Myers argues that there is what he called a pecking order in raising funds for the firm. The pecking sequence is determined by the managers and their will to maximize their discretionary power over the use of funds. In this context, retained earnings will be the first to be picked, debt the second and new equity the last. In practice, the latter will have a higher level of scrutiny from outsiders: shareholders and markets in general will want know what is the purpose and rationale of the capital increase. This is a level of monitoring that will exist but with a lesser extent in terms of debt and even less with the retained earnings, being the payout ratio the key feature to be controlled by the shareholders meeting. In this line of reasoning Michael Jensen argued that earnings should be fully distributed as dividends, to force managers to ask (and justify) for new equity or debt instead of using, in a discretionary way, the retained earnings of the company.

4. Capital structure and project evaluation

4.1. The WACC method

This method represents the use of the WACC as the discount rate of the project's cash flows (before debt). It should be noted that the D/E associated with the computation of the WACC is the **targeted D/E for the whole firm** and not the D/E of the project. In fact if the company has, for instance a targeted D/E of 3 and the project has a D/E of 1, it means that in other financial decisions the firm will compensate the lesser use of debt of the project in order to track the targeted D/E of 3 and, therefore, the effect of the project in the capital structure of the whole firm will still be 3. If the firm has an evolving D/E target (within a process of leveraging or deleveraging the balance sheet), it should have a path to follow (D/E of 3 next year, 2.75 in the following year, etc.). In this case, we will use different D/E in the computation of each year's WACC. This means that we will have a different WACC per year, until D/E ratio is stabilized in a value of 3; after this, WACC remains unchanged.

The WACC will be computed using the required rate of return by investors (usually using the CAPM and the associated levered beta of the firm) and the cost of debt (reduced by the associated tax savings) as follows:

$$WACC = r_E \frac{E}{E+D} + r_D(1-t)\frac{D}{E+D}$$

Being:

r_E = required rate of return by investors

r_D = Cost of debt

t = corporate tax rate

4.2. The WACC, CAPM and the all-equity financed case

In the analysis of a project we defined a two-step approach, the first considering an all-equity financed project (to evaluate it on its own merits) and, then, considering the capital structure of the firm.

The question is what should be the required rate of return by investors. It can´t be the same used in the WACC, as we are assuming no debt and therefore the firm´s risk profile is quite different. In order to solve this puzzle we will use the following relationships between the unlevered beta, B_U (a theoretical beta that the firm would have if it was all-equity financed) the levered beta, B_L,(the real beta, observed in the market) and the debt beta, B_D (reflecting the risk premium of the cost of debt over the risk free rate):

$$B_U = \frac{B_L + B_D \times \frac{D}{E} \times (1-t)}{1 + \frac{D}{E} \times (1-t)}$$

The debt beta can be computed using the CAPM, as follows:

Cost of debt = risk free rate + B_D x market risk premium

Often, practitioners simplify the B_U formula by assuming a debt beta of zero (a reasonable simplification when the level and cost of debt is **not** too high):

$$B_U = \frac{B_L}{1 + \frac{D}{E} \times (1-t)}$$

After computing the unlevered beta and using the CAPM we will obtain the required rate by investors assuming an all-equity financed case.

4.3. The APV method

The adjusted present value method reflects, in way, the MM world with taxes. It basically states that debt will benefit the project through the associated tax savings (in theory, it will also affect negatively the project with the costs of financial distress, but these are very difficult to compute). Therefore:

APV = NPV (all-equity financed case) + Present Value of the net benefits of debt (PVBD)

The benefits of debt are mainly tax savings and, in more rare cases, some sort of specific advantage, typically created by the Government (reduced interest rate, non-refundable subsidy, etc.).

The computation of the PVBD is quite straightforward. We identify all cash flows of debt (initial debt disbursement, payment of interest, principal and tax savings) and then we discount them at the firm's regular cost of debt. To understand the use of this discount rate, let´s assume that the company doesn´t pay taxes and therefore there are no tax savings. In this case PVBD should be zero, because debt is not generating tax benefits. We will only get this result (PVBD = 0) by discounting the loan's cash flows at the regular cost of debt. Another way of looking to the choice of this discount rate, is considering a zero interest loan. The advantage in this case, is the difference between zero and the regular cost of debt. The only way to capture this advantage is, again, to use the regular interest rate of the company as the discount rate.

5. The special case of evaluating project of unlisted firms

Let´s now consider the case of an unlisted firm or, even if listed with a reduced free float and/or liquidity in the stock exchange, being its beta less representative.

In these cases, we should use a proxy (benchmark) of the firm´s beta and there are two main alternatives: to pick a twin company (less frequent because it is very difficult to find a company very similar to the one we are evaluating) or to use an industry average or a selected peer average (more common).

All-equity financed case

As a starting point we have the $B_{L,}$ D/E and tax rate of the benchmark. We then compute the theoretical B_U of the benchmark.

Assuming B_D equal to zero

$$B_U = \frac{B_L}{1 + \frac{D}{E} \times (1 - t)}$$

Not assuming B_D equal to zero:

We need to have, additionally, an average cost of debt of the benchmark in order to compute the implicit B_D (using the CAPM)

Cost of debt = risk free rate + B_D x market risk premium

Now we can compute the B_U:

$$B_U = \frac{B_L + B_D \times \frac{D}{E} \times (1-t)}{1 + \frac{D}{E} \times (1-t)}$$

Having computed the B_U, we now use the CAPM to compute the required rate of return by investors:

$R_E = R_f + B_U$ x market risk premium

<u>Levered case</u>

The first step is similar to the all-equity financed case: compute the B_U of the benchmark. From this B_U we compute the B_L of the firm taking into account the target D/E, cost of debt ant tax rate of the firm. In practice, we make the re-leveraging of the benchmark's B_U to account for the firm's capital structure.

<u>Assuming B_D is equal to zero:</u>

$$B_L = B_U \times (1 + \frac{D}{E} \times (1-t))$$

<u>Not assuming B_D equal to zero:</u>

Using the cost of debt we compute the associated B_D , using, as usual, the CAPM. Having computed B_D, we can now compute B_L:

$$B_L = B_U + (B_U - B_D) \times \frac{D}{E} \times (1-t)$$

Again, using the CAPM and the computed B_L we can compute the required rate of return by investors (r_E).

Finally, we can compute the WACC, the discount rate of the project's cash flows:

$$WACC = r_E \times \frac{E}{D+E} + r_D \times (1-t) \times \frac{D}{D+E}$$