Common Pitfalls in Capital Budgeting

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In this article, some common pitfalls surrounding capital budgeting or project appraisal are discussed. The pitfalls are considered common based on my own personal experience as a student, teacher, examiner, and a practitioner in the areas of corporate finance. The aim is to provide a ready reference to students and practitioners of corporate finance so as to encourage a consistent approach to project appraisal process. Bearing in mind that capital budgeting is as much an art as science, any set of prescriptions aimed at capital budgeting are unlikely to be exhaustive and this article is not an exception in this regard.

To make the discussion more manageable and structured, I have segregated the common shortcomings into two broad categories in this article: i) calculation of Free Cash Flows (FCFs) and ii) calculation and application of the discount rate.

Before proceeding further, it is useful to state some of the assumptions as follows:

- Project is being evaluated on the basis of free cash flows (FCFs) that is available to both equity holders and debtholders
- Market risks and leverage associated with a given project within a firm is similar to the risks and leverage of the overall firm
- There will always be taxable earnings for a given firm and applicable tax rates will remain constant.

The rest of the article proceeds as follows: Section 1 highlights some of the common pitfalls in calculation of FCFs; Section 2 highlights some of the common pitfalls associated with calculation and application of discount rates; and Section 3 provides concluding remarks.

1. Calculating FCFs

This section focuses on the common pitfalls associated with calculation of FCFs.

1.1. Interest on debt

Since this article considers the cash flows (CFs) to both equity holders and debt holders, interest expense on debt is generally ignored for the purpose of calculating FCFs. This is because these interest expenses are accounted for when the FCFs are discounted to present values using the weighted average cost of capital (WACC). When discounted by WACC, the interest tax shield offered by debt is already taken into account by using the firm's after-tax cost of capital. As such, it would be theoretical inconsistency to double discount the interest expense, first at the time of calculating cash flows and then at the time of finding the present value.

For practical purposes, if earnings before interest and tax (EBIT) is being treated as CFs, then further adjustment regarding debt interest would not be required.

Alternatively, if after-tax earnings (net earnings) of a firm is being treated as CFs, then the interest portion (less tax) should be added back to the earnings/CFs to calculate FCFs. In this way, it is somewhat similar to the way depreciation is added back to the CFs for the purpose of capital budgeting; but the difference vis-à-vis depreciation is that interest portion less tax is added back (unlike depreciation where full amount is added back to CFs).

1.2. Incremental cash flows

For the purpose of capital budgeting, only the incremental CFs from a project (and not necessarily all CFs) should be the focus of analysis. Incremental CFs are those amounts by which the company's cash flows are expected to change because of the capital project in question.

For example, let us imagine that a company, which has already been producing a certain product (say, cement in this case) for many years, needs to decide whether to invest in a new machine A or new machine B to continue its profitable cement production. Note that regardless of the choice of the machine, the quality of cement (and ultimately its sales) is expected to remain unaffected and all the machines on the menu have similar length of life. In this case, since the overall revenue is going to remain unaffected, the incremental revenue is zero and an analyst can focus on the differential cost of the machines for the purpose of capital budgeting. Unavailability of the firm's revenue figures for whatever reason should not be a hurdle in this case because the decision has to be made on whether to purchase machine A or machine B (as it is assumed that cement production will continue either way). This approach is useful when the information on revenue is not available. In this case, by focusing on the present value of the overall cost of the each of the machines over the years, an analyst could provide a basis to choose from the set of alternative machines with the highest NPV (or least negative NPV of costs).

However, when the alternative machines have different life span (for example, five years and seven years respectively), the NPVs so deduced are not comparable. The NPVs of such machines need to be deconstructed into annuities over their respective lives before a meaningful comparison can be made.

1.3. Cannibalisation

Cannibalisation refers to the phenomenon whereby existing revenue of a firm is reduced due to the launch of a new product; and the idea of incremental CFs discussed above can also be applied to cannibalisation. For example, when appraising a project for a new product, assume that the new product will generate a sale of €100 for the next five years; also assume that purely because of this new product, sales of existing products will decrease by €20 per year. In such a situation, for the purpose of the appraisal, the focus should be only on the incremental CF, which is €80 (=100-20) in this case. However, on the other hand, if the sales of existing products is expected to decrease by €20 regardless of the new product being launched, then the full revenue (€100) of the new product should be taken into consideration for calculating FCFs.

1.4. Sunk costs

Costs that have already been incurred, regardless of the project being undertaken, is a sunk cost and should not be included in the capital appraisal (as it can be considered an irrelevant cost). If €100 has been spent for environmental impact assessment of a potential project, that €100 is a sunk cost as it has already been expended whether the firm decides to go ahead with the project or not.

However, it should be noted that sunk costs do not necessarily have to be incurred in the past (Berk and DeMarzo, 2019, p-279). All cash flows, even the ones to take effect in the future, which will not be affected by the decision regarding the project are effectively sunk costs. If a company believes that

some of its existing sales will suffer regardless of it launching a new product, the expected loss in sales of existing products are also sunk costs and should not be a part of the capital appraisal process.

1.5. Working capital

Working capital refers to the net investment by a company towards operating current assets and liabilities. From the perspective of capital project appraisal, amount invested in working capital has an opportunity cost in that this investment could have been used to either retire debt or to pay back shareholders. A general definition of working capital includes short term assets – including cash - and short-term liabilities. For the purpose of calculating CFs, the focus should be on the non-cash net working capital, thus excluding cash. This is especially important when change in net working capital has to be derived from projected financial statements that also exhibit cash balances. Caution should be exercised to exclude this cash balance when calculating net change in working capital from one period to the next. Increase in net working capital should be treated as cash outflows whereas decrease in net working capital should be treated as inflows as it frees up cash.

Additionally, when a project has a definite life, it makes sense to make a determination on what happens to the working capital investment at the end of the project: if writing off of some or all of the working capital (e.g. account receivables, inventory) is expected, there might be tax implications that need to be taken into account; otherwise, reduction of net working capital to zero could signal cash inflows for the final year.

1.6. Profit / loss on salvage value

The book value (after accumulated depreciation) and expected salvage value of a given asset could be different. If the salvage value is greater than the book value, this is a profit generally leading to positive cash flows; but there is likely to be additional tax liability due to this profit. By the same token, if the salvage value is expected to be less than the book value, this could be treated as a loss for the given year and this helps to lower tax liability to some extent. In both cases, tax implications should be carefully considered while calculating FCFs.

1.7. Unused assets

If there is an asset (for example a warehouse) lying unused at the time of appraisal but would be put to use if a new project was undertaken, is the opportunity cost of the idle asset relevant or irrelevant for the purpose of project appraisal? One could argue that since the asset is lying idle anyway, its opportunity cost is zero and hence irrelevant for the purpose of capital budgeting. But this argument does not take into account the consideration that if the project is not undertaken, the idle asset could be disposed of or rented out or used for some other purposes thus generating positive cash flows. Hence, such unused assets generally should not be treated as sunk costs; and the opportunity cost should be incorporated in the capital budgeting process.

1.8. Depreciation / capital allowance

Even though depreciation is not an actual cash outflow, it has tax implications, and it generally lowers tax liability of a firm thus ultimately affecting FCFs. In some countries (e.g., UK), depreciation in itself may not be tax deductible in many cases but there might be ‘capital allowances’ that can be tax-deductible. Whichever the case, depreciation and/or capital allowances and any other such allowances that are not actual cash flows but expensed off for tax purposes should be considered purely for the purpose of determining tax liability (outflow); and then these ‘costs’ should be added back to after-tax cash flows to arrive at the FCFs.

2. Discounting

In this section, common pitfalls related to discount rates are highlighted. Two aspects of discounting are discussed: calculation of discount rate and application of discount rate.

2.1. Perpetual cash flows starting at a future date

It is quite normal for potential projects to have detailed cash flows projections calculated only for a given initial number of years, say five years in this case, despite the project having a 'going concern' indefinitely. This is done mainly for ease of calculation and also taking into consideration that projecting something accurately becomes much more difficult as the time horizon is stretched. To accommodate the indefinite nature of expected cash flows, a capital project may assume that from year six onwards the FCFs of year five will continue into the future indefinitely (with or without some constant growth rate). Calculating the PV of the FCFs for the first five years is possible in a straightforward manner by discounting each FCF one at a time using the appropriate discount rate. However, the FCFs assumed from year 6 onwards need to be dealt with caution, as the perpetuity formula (CF/r) by its very design assumes that constant CFs start from one time period from present (Year 0). Hence, some kind of adjustment to the standard perpetuity formula is warranted in this case. An analyst can proceed by imagining having a time machine that allows travel to Year 5, which is one time period ahead of the start of the perpetual CF; then the perpetuity formula (CF/r) can be used, but the 'present value' so obtained will actually be the value in Year 5 and not the value at Year 0. So, the analyst needs to imagine getting back to present in the time machine and further discount the value so obtained at Year 5 to get the real present value at Year 0.

To illustrate, consider a project with the following expected FCFs along with a WACC of 15%:

Year	0	1	2	3	4	5	6
FCF	-300	25	35	45	48	50	2% growth per year indefinitely…

Note than the FCF from Year 6 is expected to grow annually by 2%. Using the Gordon Growth Model, PV = CF*(1+g)/(r-g) [where ***r*** is the discount rate and ***g*** is the constant growth rate, and ***r*** is greater than ***g***], the combined value of indefinite FCFs from Year 6 can be restated as follows:

Year	0	1	2	3	4	5	6
FCF	-300	25	35	45	48	50	2% growth per year indefinitely…
						392.3	

*Note: 392.3 (=50*1.02/(0.15 – 0.02)*

As mentioned above, the growth model has been designed in such a way that it provides the 'present value' at one time period prior to the start of the constant growth rate. Hence, the value of 392.3 derived above is the present value at Year 5 and not at Year 6 or Year 0; and is thus represented in the timeline accordingly. Now, each of the above FCFs can be discounted to Year 0 in the normal way (i.e., PV = FCF_n/(1+r)^n) to find the NPV as shown below:

Year	0	1	2	3	4	5
PV	-300.0	21.7	26.5	29.6	27.4	24.9
						195.0
NPV	**25.1**					

2.2. Debt/equity ratio (D/E ratio)

Leverage is an important component of WACC. Hence, in this subsection, I discuss some of the issues related to D/E ratio when calculating WACC for capital budgeting.

2.2.1. Market value vs book value of debt and equity

While calculating WACC for a leveraged firm, D/E ratio of the firm is needed. It might be tempting to take the values of debt and equity as presented in financial statements where they are likely to be reflecting book values; but this is not the correct approach. The idea behind this is that investors are interested in the opportunity cost of capital. Take, for example, an investor who holds shares with a book value of €50 in a company; but assume the market value of these shares to be €100. In theory, if the investor is not happy with the expected return of the firm, he/she can sell the shares at the market price (for €100) and invest it somewhere else. Taking the book value and ignoring the market value does not help in this situation. Hence, market values of debt and equity (rather than the book values) for the firm should be taken into account for calculating WACC. However, it might be a challenge to find the correct market values of equity and debt especially when such securities are not frequently traded in the market. Additionally, since cash is negative leverage, it can be used to lower the amount of debt to arrive at debt-to-value ratio for the firm, which can then be used to calculate WACC.

2.2.2. Constant or changing D/E ratio

It is also worth remembering that when a unique WACC is used in a leveraged setting for project appraisal, one of the implied assumptions is that the D/E ratio remains constant throughout the life of the firm. Indeed, firms are known to make financial transactions - in certain situations - that take them towards a target debt/equity ratio (Hovakimian et al., 2001). This also implies that the actual D/E ratio of a firm is adjusted continuously over its lifetime.

Hence, if the assumption related to constant D/E ratio is relaxed, then the WACC for the firm will not remain constant over time. This can make the calculation of NPV using the WACC approach more tedious and cumbersome.

2.2.3. D/E ratio of the firm vs D/E ratio of a specific new project

A distinction needs to be made between the D/E ratio of the firm and D/E ratio of a specific new investment project within the firm, which might be different. The optimal D/E ratio for the specific project will be dependent on both firm and project characteristics. However, under the abovementioned assumption of constant D/E ratio for the firm, we can still use the firm's overall D/E ratio even if the D/E ratio for the specific capital project within the firm is different. This is because of the expectation that the firm will keep its overall D/E ratio close to its target by adjusting its D/E ratio in other projects. However, in the absence of an assumed target D/E ratio for the firm, the D/E ratio of the new project (and hence the WACC) is different if the new project's D/E ratio diverges from that of the existing firm.

2.3. Real or nominal discount rate

When using certain discount rate for capital budgeting, should the discount rate be real (i.e., net of inflation) or nominal (with inflation)? The choice of real vs nominal rate depends on how the CFs projections have been made. If the CFs are projected in present day money terms (i.e., without inflation), then it makes sense to discount at the real rate; however, if inflation is already embedded in the projected cash flows, then it makes sense to use nominal discount rate. Otherwise, using real

discount rate with nominal CFs and vice versa could lead to incorrect decisions. Generally, Fisher's equation can be used to convert real rate to nominal rate and vice versa by using the equation of the following form:

1+N = (1+R)*(1+i), where *N* and *R* are nominal and real rates respectively and *i* is the expected inflation rate.

2.4. Unique discount rate for firms with multiple business units

Generally, a new project to be undertaken is on the same line of business as the core business of a given firm, thus allowing analysts to use a unique discount rate specific to the firm. In fact, many large firms are found to use a firm-level discount rate rather than project-specific discount rates (Graham and Harvey, 2001). This is a fair approach when the market risk of the new capital project is similar to the market risk of the firm's core business. But what if the intended project for a firm is in a different industry exposed to a different level of market risk (hence a different beta) than the core line of business? In such cases, using the same discount rate as the main line of business could lead to wrong decisions because projects with higher level of risk might look investable due to the use of lower discount rate (and hence a positive NPV) whereas a lower-risk project might not seem feasible due to the use of the higher discount rate. Kruger et al. (2015) show that conglomerates engaging in different lines of businesses fail to account for proper level of risk in their project-specific investment decisions. Hence, wherever justifiable, using different discount rates commensurate with the riskiness of the new project is recommended.

It is also worth noting at this point that tax rate is also a component of WACC. As such, use of constant WACC implies that applicable tax rate will remain unchanged throughout the life of the project. Relaxing this assumption could again warrant the use of WACC that is changing.

3. Concluding remarks

This article provides a discussion on some common pitfalls related to capital project appraisal process that uses WACC method. The pitfalls are broadly categorized into two classes: first, calculation of FCFs; and second, discount rate and its application.

Common issues related to calculating FCFs discussed herein include treatment of interest on debt, incremental CFs, sunk costs, change in working capital, salvage value, unused assets, and depreciation/capital allowances.

Similarly, common issues around discounting include discounting of perpetual CFs, D/E ratio for the purpose of calculating discount rates, choice between real vs nominal rates, and whether to apply unique discount rates to all projects within a firm.

It is worth reiterating that this article highlights the more common pitfalls as identified by the author and is not aimed at providing an exhaustive list of shortcomings observed in capital budgeting. While it is important to be as theoretically consistent as possible while doing project appraisals, we should also not lose sight of the subjective assessments that may be needed in an appraisal process.

References:

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