

Chapter 9: Capital Budgeting

The capital budgeting process

When analyzing various investment opportunities, the first step you have to make is compiling a list of potential projects. A capital budget lists all of the projects that a company plans to undertake during the next period. The process of analyzing investment opportunities and deciding which ones to accept is called capital budgeting. The goal of capital budgeting is to determine the effect of the decision to accept or reject a project on the cash flows of the firm, and to estimate the consequences of the decision for the value by evaluating the NPV.

The process of capital budgeting begins with forecasting, which is frequently challenging. By forecasting, you can rely on different experts or you can look at past projects of the firm or projects of other firms in the same industry. Another important part of forecasting is determining the incremental earnings: the amount by which a firm's earnings are expected to change as a result of an investment decision. Note that earnings are not actual cash flows.

Forecasting incremental earnings

Projects require some form of upfront investment (e.g. launch an ad campaign, design a prototype, marketing survey). You count these costs as operating costs in the year they are incurred. The investment in plant, property and equipment are capital costs. These capital costs are cash expenses, but you spread these costs over several years (depreciation). The straight-line depreciation is a method of depreciation in which an asset's costs is divided equally over its life. Note that a depreciation expense does not correspond to an actual cash outflow.

The goal of capital budgeting is to evaluate how the project will change the cash flows of the firm. For that reason, we're only looking at the incremental revenues and costs. This means that we only account for the additional sales and costs, generated by the project.

Incremental earnings before interest (EBIT) =
incremental revenue – incremental costs – depreciation.

We also have to account for corporate taxes. The marginal corporate tax rate is the tax rate a firm will pay on an incremental dollar of pre-tax income.

Incremental income tax expense = EBIT x firm's marginal corporate tax rate

Putting all the pieces together we can forecast the incremental earnings:

Incremental earnings
= (incremental revenues – incremental cost – depreciation) x (1 – tax rate)
= EBIT x (1 – tax rate)

The table of calculating incremental earnings is called a pro forma statement: a statement that is not based on actual data but rather depicts a firm's financials under a given set of hypothetical assumptions.

Interest expenses are not relevant in capital budgeting, because we evaluate the project as if the firm will not use any debt to finance the project.

Any incremental interest expenses will be related to the firm's decision regarding how to finance the project, which is a separate decision. We can calculate the unlevered net income: the net income that does not include interest expenses associated with debt.

Incremental free cash flow

Once we have determined the earnings, we have not determined the actual cash flow. If we want to evaluate a capital budgeting decision, we must determine the consequences of the decision for the available cash. The incremental free cash flow of a project is the incremental effect of a project on a firm's available cash.

There are important differences between earnings and actual cash flows. We have to adjust for these differences if we want to determine the free cash flow of a project from its incremental earnings.

Depreciation: isn't a cash flow, we have to add it back to the incremental earnings. But there is a cash flow associated with depreciation, because depreciation affects taxes.

Calculation of incremental free cash flow:

• Incremental gross profit	€	(positive cash flow)
• Depreciation	- €	
• EBIT	= €	
• Tax	- €	(negative cash flow)
• Incremental earnings	= €	
• <i>Add back</i> depreciation	+ €	
• Incremental free cash flow	= €	(positive cash flow)

Depreciation is not the only difference between incremental earnings and free cash flow: if there are changes in net working capital the earnings and cash will also differ.

Net working capital = current assets – current liabilities
= cash + inventory + receivables – payables

Trade credit is the difference between receivables and payables that is the net amount of a firm's capital consumed as a result of those credit transactions; the credit that a firm extends to its customers.

The change in net working capital (NWC) in year t = $NWC_t - NWC_{t-1}$

General rule: Increases in net working capital are deducted. Decreases in net working capital are added. Actual capital expenditures (CapEx) are deducted.

The capital budgeting process usually starts by forecasting earnings. We can calculate a project's free cash flow directly by using the following formula:

Free cash flow = (revenues – costs – depreciation) \times (1 – tax rate) + depreciation – CapEx – change in NWC.

$$= (\text{revenues} - \text{costs}) \times (1 - \text{tax rate}) - \text{CapEx} - \text{change in NWC} + \text{tax rate} \times \text{depreciation}$$

The last part 'Tax rate \times depreciation' is the depreciation tax shield: the tax savings that result from the ability to deduct depreciation. Depreciation has got a positive impact on the free cash flow.

The goal of forecasting the incremental free cash flow was to calculate the NPV of the project. We can

calculate the present value of each free cash flow in the future as follows:

$$PV(FCF_t) = \frac{FCF_t}{(1+r)^t}$$

The t-year discount factor is: $\frac{1}{(1+r)^t}$

So this results in the formula $PV(FCF_t) = FCF_t \times (t - \text{year discount factor})$

Other effects

There are more differences between the cash flows of a firm with the project and cash flows of a firm without the project:

1. Firms often use a resource that the company already owns for a project. Because the firm does not need to pay cash to acquire this resource for a new project, it is tempting to assume that the resource is available for free. The Opportunity costs: the value a resource could have provided in its best alternative use. When you use the resource by another project, the value will be lost.
2. Project externalities: are the indirect effects of a project that may increase or decrease the profits of other business activities of a firm. Cannibalization is the situation when sales of a firm's new product displace sales of one of its existing products. The lost sales are an incremental cost to the firm.
3. A Sunk cost is any unrecoverable cost for which a firm is already liable. Sunk costs have been or will be paid regardless of the decision whether or not to proceed with the project. A rule to remember: "if your decision does not affect a cash flow, then the cash flow should not affect your decision".

Two examples of sunk costs:

- Overhead expenses: those expenses associated with activities that are not directly attributable to a single business activity but instead effect many different areas of a corporation.
- Past research and development expenditures.

4. Estimating a project's free cash flow, the complications:

- Timing of cash flow: cash flows will be spread throughout the year. We can forecast at an annual level, a monthly level or even a weekly level. How riskier the project, how shorter the intervals.
- Accelerated depreciation: a firm wants to use the most accelerated depreciation method, because depreciation contributes positively to the cash flows. An example: MACRS depreciation: the most accelerated cost recovery system allowed by the IRS. The system is based on the recovery period, MACRS depreciation tables assign a fraction of the purchase price that the firm can depreciate each year.
- Liquidation or salvage value: when you sell an asset, you have to adjust the free cash flow to account for the after-tax cash flow that would result.
Capital gain = sale price – book value.
Book value = purchase price – accumulated depreciation.

After-tax cash flow from an asset sale = sale price – (tax rate x capital gain).

- Tax carryforwards: tax loss carryforwards and carrybacks are two features of the U.S. tax code that allow corporations to take losses during a current year and offset them against gains in nearby years. Since 1997, companies can carry back losses for two years and carry forward losses for twenty years.

Analyzing the project

Estimating the cash flows and cost of capital is the most difficult and uncertain part of capital budgeting. Now we're going to look at methods that assess the importance of this uncertainty and identify the drivers of value in the project.

A sensitivity analysis is an important capital budgeting tool that determines how the NPV varies as a single underlying assumption is changed. A sensitivity analysis breaks the NPV calculation into its component assumptions. The NPV profile is a type of sensitivity analysis.

We can extend the sensitivity analysis by asking at what level of each parameter the project would just break-even. Break-even is the level for which an investment has an NPV of zero. The break-even analysis is a calculation of the value of each parameter for which the NPV of the project is zero. We can graph the NPV as a function of each of the critical assumptions (parameters).

Another break-even is the EBIT break-even: the level of a particular parameter for which a project's EBIT is zero. $EBIT = 0$

$\text{Units sold} \times (\text{sale price} - \text{cost per unit}) - \text{SG\&A} - \text{depreciation} = 0.$

SG&A are the selling, general and administrative expenses.

Scenario analysis is an important capital budgeting tool that determines how the NPV varies as a number of the underlying assumptions are changing simultaneously.

Real options

Most projects contain real options. Real options are options to make a business decision, often after gathering more information. It's the right to make this decision. The presence of real options in a project increases the project's NPV, because you can build greater flexibility into your project.

Common real options:

- Option to delay commitment: the option to time a particular investment. It is almost always present.
- Option to expand: the option to start with limited production and expand only if the project is successful.
- Abandonment option: an option for an investor to cease making investments in a project. Abandonment options can add value to a project because a firm can drop a project if it turns out to be unsuccessful.