

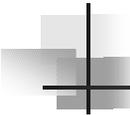
Capital Budgeting and the Cost of Capital



Finance 476
Week 2 Lecture
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Hello and welcome to the lecture for Week 2. This week, we will study the issue of capital budgeting and how to determine the cost of capital in budgeting decisions.



Overview

- Computing the cost of capital
 - WACC
 - Component costs
- Capital budgeting
 - NPV vs. IRR
 - Other methods
- Special considerations



This week has a lot of reading, but can be boiled down into three major issues.

The first issue in capital budgeting is determining the cost of capital. The most common way to determine the cost of capital is to use something called the weighted average cost of capital. This is found by looking at the balance sheet and determining the percentage of capital that is used in the business that can be considered debt, preferred stock and common stock. Once this is known, the cost of each component is determined as a percentage rate (like interest rate). These percentage costs are multiplied by their respective weighting on the balance sheet to determine the weighted average cost of capital.

The weighted average cost of capital (WACC) is the interest rate that is used to discount cash flows when determining what investment projects to accept. We will look at various ways to make the go-no go decision, but will concentrate on the discounted NPV (Net Present Value) method. We will compare this method to the widely used Internal Rate of Return (IRR) method as well as some other methods like payback period and Modified IRR.

Finally, some special considerations have to be considered when making go-no go decisions on capital projects, and we will examine a few of the more important ones in depth.

Weighted Average Cost of Capital

$$WACC = w_d k_d (1 - T) + w_p k_p + w_c k_s$$

- Reflects capital structure
- Cost of debt adjusted for tax rate (T)
- Cost of debt from bonds and bank loans
- Cost of stock from market data (CAPM)



The weighted average cost of capital (WACC) is the weighted average of the after-tax cost of debt, cost of preferred stock and cost of common stock. The weighted average cost of capital reflects the capital structure of the firm in that the percentage of debt to equity is a management decision that affects the risk profile of the firm with respect to all aspects of operations.

The cost of debt is easily determined by examining the interest rates that the firm has to pay to creditors. Since interest is considered a cost and is deducted prior to determining the taxable income of the firm, only the "after tax" cost of debt need be considered. If the firm is profitable, it must pay taxes at a rate of T%. T is about 40% for most US firms. If the firm is not profitable, however, no taxes are paid and T is zero (since no advantage is gained from the deductibility of interest to a non-taxpaying firm).

The actual cost of debt is determined by looking at the bank loans and bond costs that are paid by the firm. The cost of stock is more difficult to determine, but can be approximated by using historic data and the capital asset pricing model (CAPM) to determine the expected return of investors in the stock. This expected return is the cost of equity financing for the firm.

Cost of Debt

- Debt cost average of interest rates paid
- If firm makes losses (no taxes), $T=0$
- T is normally 0.40 for most profitable firms

$$k_d \equiv \text{InterestRate}$$

$$T \equiv \text{TaxRate}$$



The cost of debt is the average cost of debt to the firm. That is, take a weighted average of the cost of short term financing, long-term bank loans, bonds, commercial paper due and any other debt instrument that is held by investors obligating the firm to payment of interest.

As stated before, so long as the firm is generating income and pays taxes, the cost of debt must be adjusted to the after-tax cost of debt by multiplying by $(1-T)$, where T is the tax rate. For most firms, T is 40%, meaning that $1-T$ is 0.6.

To illustrate consider a firm that uses a 75/25 mixture of 10% long-term bonds and 5% bank lines of credit. Taking a weighted average, the cost of debt financing can be computed as $0.75 \times 10 + 0.25 \times 5$ for an average cost of debt of 8.75%. If the firm makes no income, then the cost of debt after taxes is $8.75 \times (1-0)$ or 8.75%. If the firm has positive taxable income, then the cost of debt is $8.75 \times (1-.4)$ or 5.25%. As you can see, Uncle Sam is paying part of the cost of debt in the form of lower taxes.

Cost of Preferred Stock

- Preferred stock has preference to earnings over common, but at a fixed dividend
- Price of preferred stock determined by market
- Market, therefore, determines cost of preferred stock

$$k_p = \frac{D_p}{P_p}$$



Most firms have only a small amount of preferred stock at any time. Preferred stock is stock where a dividend is promised and paid on a regular basis and which takes preference (e.g. is "preferred") over common stock in the payment of dividends and in the assignment of assets in the event of a bankruptcy. Additionally, dividends owed to holders of preferred stock can be deferred but not eliminated by the company. If dividends are deferred, then any "back" dividends so deferred have to be paid in full to the preferred stockholders prior to any common stock dividend payments being made. Due to these features, preferred stock is treated like a debt instrument. The cost of the preferred stock is computed as the dividend yield of the stock as shown in this equation.

To illustrate this, consider a share of Ford Preferred Stock B, (NYSE: F_pb) trading at \$26.22 on July 26, 2002. With an annual dividend of \$2.06, the cost of the F_pb is then $2.06/26.22$ or 7.86%. Since dividends are taken from after-tax income, they are not an expense and should not be adjusted for taxes.

Companies issue preferred stock to give owners the security of high yields without the loss of voting rights. This is sometimes done to insulate the founder or founders from holding large blocks of a single stock (which would be more risky than smaller amounts of many stocks) while maintaining control over "their" firm.

Cost of Stock

- CAPM to determine cost of stock as a per-cent
- Other, less quantitative methods used
- Difficult to estimate

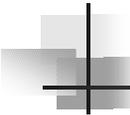
$$k_s = k_{rf} + (k_m - k_{rf})b_i$$



Most equity falls into the category of “common” stock. Common stockholders are the owners of the firm, but their returns are not guaranteed. As discussed in Finance 475, the capital asset pricing model allows estimation of the expected return required by investors in a given stock, adjusting for risk and general interest rate levels in the economy.

Values for beta can be found in the Value Line stock summary publications, and the risk free rate and market rates of return can be taken from the T-bond rates and the Value Line summary respectively.

CAPM, while quantitative on the face of it, has many drawbacks. For one, the required data to determine beta are investors expectations, which are not easily determined. Most analyses are based on use of historical data (as is Value Lines summary) to approximate investors expectations in both the market and the individual stock. This is a dangerous flaw in the analysis. As any mutual fund investor will tell you, past results are not a good predictor of future returns. They may, however, reasonably predict investor expectations of future returns, making the model stronger. Use of historical data brings up the question of how much data to use. Results from the last ten years and the last three years will give very different values for beta and therefore different results for the cost of common equity. This argument also applies to basing the risk free rate on the T-bill. It could also be based on the 10 or 30 year bond rates. The best way to think about CAPM is to understand that it will get us close to the answer we are looking for, but is not a precise measure of expected returns or cost of common equity in our model.



Capital Budgeting

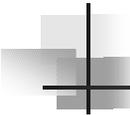
- Use WACC as discount rate
 - Estimate cash flows
 - Compute NPV of the flows under various scenarios
 - Compute expected value
- Other methods
 - Internal rate of return (IRR)
 - Payback period



The WACC, with all of its many flaws and problems, is a vital input to decision making at the corporate level. The WACC is used as the discount rate in determining the value of projects being evaluated by the firm.

Long ago (30 or 40 years), companies evaluated projects by computing how long it would take for the project, once implemented, to throw off enough cash income to pay back the initial investment. This so-called payback period method would then be evaluated against a set benchmark, say 2 years maximum. Shorter payback is obviously better. So a project with a payback of 1 year is preferred over a 2 year payback project.

Sophisticated companies today use something called the discounted cash flow method or the modified-IRR method of analysis. In discounted cash flow, you simply estimate the cash flows that the project will throw off and then discount them (compute their net present value) using the WACC. The IRR is similar in that you find the rate of return that yields a NPV of the cash flow equal to the initial investment and compare that rate to the WACC to determine if the project is a go or no-go.



Estimate Cash Flows

- Cash outflows: required investments
- Cash inflows: net cash generated by investment
 - Net not gross cash flows
 - Sunk costs don't count
- Use pro-forma income statements and cash flow statements
- Many areas for error
 - Sensitivity analysis
 - Risk analysis



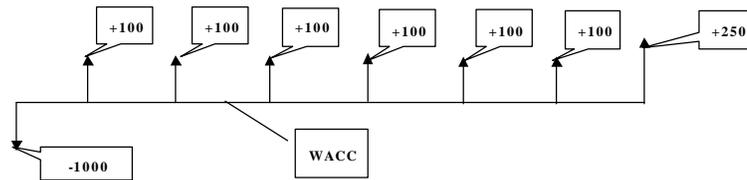
One of the hardest things to do in all of this is to estimate the cash flows thrown off by the project. Cash outflows are usually easy to estimate, they are the cost of the equipment and installation of the equipment required for the project. The inflows can be difficult to estimate. Estimation of the relevant inflows is important to making the right decision.

So-called sunk funds don't come into play in capital budget decisions. This is because sunk funds are already spent and will remain spent if you do the project or if you choose not to do the project. Examples would include funds spent to do a market analysis during the capital project estimation phase.

If the project is to replace an existing project, then the relevant flows are the net flows (difference between cash flow using the new equipment and using the existing equipment). If the project is new, then the flows should be 100% of the cash thrown off by the project.

To estimate flows, it is convenient to use pro-forma income statements and statements of cash flow for the firm or project. Like all pro-forma analyses, the cash flows estimated this way are prone to error. In order to determine the amount of risk in the forecast, you can do what-if type analyses using Excel or another spreadsheet program. Then you can spend time refining your forecast of the more sensitive variables rather than all possible variables in the analysis.

Compute NPV of Flows



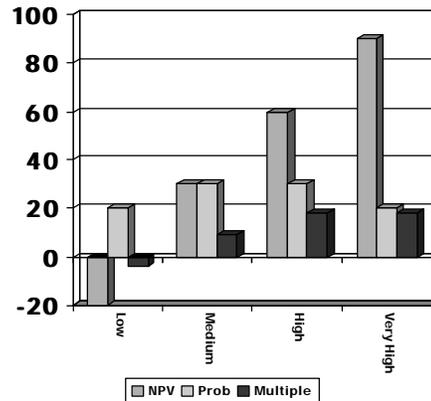
- Compare cash flows generated to the investment required.
- Add salvage value (if any at the end of the last period)
- Use discounting methods from charts or excel



This timeline shows a typical project. An initial investment of 1000 is required to generate the cash flows shown. If the WACC is about 10% for our firm, then the discounted cash flow is $100 \times 4.8684 + 150 \times .5132$ or \$563.82. Because this is less than the \$1000.00 initial investment, the project would be rejected. Note that the cash flows were divided into a seven-year annuity of \$100 and a single payment of \$150 at the end of the seventh period. If the flows are uneven, you will have to use multiple factors in determining the discounted cash flow, but the analysis is identical from there.

Compute Expected Value

- Redo estimated cash flows under varying assumptions.
- Estimate probability of each assumption
- Multiply NPV by probability and add to find expected value



As we have already said, the estimation of cash flows is tricky and relies on many judgments about future events. Therefore it is sometimes useful to estimate cash flows under varying scenarios ("poor market," "good market," "excellent market" for example) and the probability of each scenario. Using this technique, you can adjust your analysis for the risk inherent in your forecast. For example, you can compute a NPV of -\$100 in a poor market and \$100 in a good market. Say you estimate the probability of a good market at 60% and the probability of the poor market at 40%. Your expected NPV would then be $-40 + 60$ or $+\$20$, meaning that the project should go ahead. If, however, you estimate the poor market at 60% and the good at 40%, your expected NPV would then be $-\$20$ and the project should be a "no-go."

Internal Rate of Return

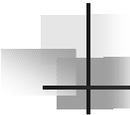
- Estimate cash flows
- Solve for interest rate
- Based on
PV(inflow)=PV(outflows)
- Not good if positive and negative flows mixed

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1 + IRR)^n}$$



Another way to look at the discounted cash flow is to ask the question, given the cash flows I have estimated and the investment required, what interest rate will yield a NPV that will equal my initial investment. The interest rate is determined by trial and error (or by use of Excel or a financial calculator) and compared to the WACC. If the WACC is less than the IRR, the project is a “go” if not it is a “no-go.”

If in some years the cash flows are negative, then the IRR method will yield multiple possible interest rates due to the laws governing the number of roots in a polynomial. The rational root theory states that the number of roots (or answers) to a polynomial of n degrees is equal to the number of sign changes in the polynomial. If there are two sign changes (e.g. positive to negative figures in the polynomial), then there are two possible “real” roots or answers to the problem. This is a flaw in the IRR method, making the NPV method preferred over IRR.



NPV Vs. IRR

NPV

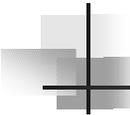
- Always gives right answer
- Not in wide use by top managers

IRR

- May be more than one "right" answer
- May give wrong answer for mutually exclusive projects
- Hard to compute without excel or calculator



As we just stated, the NPV method always yields the correct answer, but is not widely understood by top management. These managers prefer a number that is easy to understand, like IRR. As we have seen, while IRR is easy to understand, it has many drawbacks. Other than the many-answers possibility, the IRR may also give the wrong direction for mutually exclusive projects. Mutually exclusive projects are two projects where you pick one thereby eliminating the other as a possibility. An example would be use of a Windows Network or a Linux based Network. You can't do both, so the projects are mutually exclusive. In addition, the IRR method is hard to compute without the aid of a calculator or spreadsheet program, though this is less of an issue than in the past.



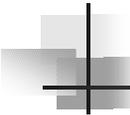
Other Issues

- Unequal lives
- Real (not financial) options
 - Shutdown
 - Wait for information
 - Growth
 - Flexibility



Other issues in capital budgeting are evaluating projects with unequal lives. One way to deal with this is to find the common lifetime between the projects and repeat projects as necessary to yield equal lives. This method assumes multiple investments in like equipment and may not be realistic depending on the circumstances involved. Use judgment in handling unequal lives, as you must will all of these techniques.

Finally, you should realize that projects are real options. This is different than a financial option, which we will study later in the course. Real options require more analysis to value than financial options. In addition, real options include the option of “walking away” at a later date, “waiting” for better or more information, “growth” options that affect other operations in the company and “flexibility” options that may reduce the risk of the company from many aspects.



Key Points

- WACC is used as discount rate
- Discounted cash flow (NPV) method best for capital budget decisions
- Estimation of cash flows and risk difficult and work intensive
- Project options must be evaluated prior to making decision



The key points to remember from this week are how to compute the WACC and that once computed it should be used as the discount rate in evaluating projects for capital budgeting. When evaluating projects for budgeting, the best method available is the discounted cash flow (NPV) method. While estimation of cash flows is difficult and prone to error or manipulation, failure to do so can lead to disaster for any company that relies on such investment for growth. Further, such analyses require an understanding of the “real” nature of capital budget options as they are distinct from financial options and financial instruments in general.

Discussion Questions

1. What are the drawbacks of the CAPM?
2. If NPV (discounted cash flow) methods always give the right answer, why not just use that technique and forget about the rest?
3. What are some of the ramifications of decisions made in capital budgeting? Have you ever been directly effected by such decisions? Could you understand the decision even if it adversely effected your situation? What is the role of the “human factor” in capital budgeting, given your experiences with the consequences?