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Notes on Project Evaluation

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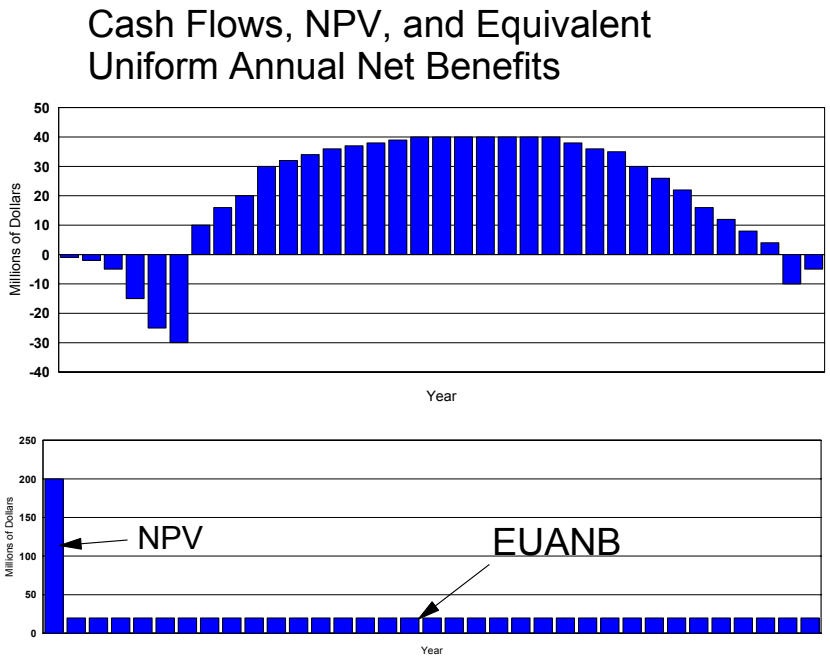
NPV Analysis for a Major CEE Project

This note assumes that the reader has an understanding of the mechanics of discounting and of the importance of equivalence. You should already know how to find the NPV of a stream of cash flows and you should be able the NPV into an equivalent future value or an annuity. If you are uncertain about how to do this, you should review my "Note on Equivalence of Cash Flows". This note considers the factors that affect the discount rate used by different participants in evaluating a major CEE project.



Choosing a Discount Rate:

Given a discount rate i%, it is straightforward to convert an arbitrary stream of cash flows into a present value, a future value, or an annuity. For example, the present value of a sum of money M received in N years is worth $M/(1+i)^N$ today. However, how do we choose the discount rate? Three main factors must be considered:

- Investment opportunities: what alternative opportunities are available for investment?
- Risk: is the proposed project more or less risky than the other options?

- Inflation: how much will inflation reduce the future purchasing power of of our money?

It is possible to think of the discount rate as being made up of three components related to these three factors:

- The rate-of-return for risk-free investments, such as bank accounts or government bonds (i%)
- A risk premium that reflects the amount of risk in the project (r%)
- A premium to offset the expected effects of inflation (inf%)

Each of these factors is used to "discount" or diminish the current value of future earnings.

$$\text{Present worth of } M = M/(1+i)^N(1+r)^N(1+inf)^N$$

If each of the three factors is small, then

$$\text{Present worth of } M \sim M/(1 + i + r + inf)^N$$

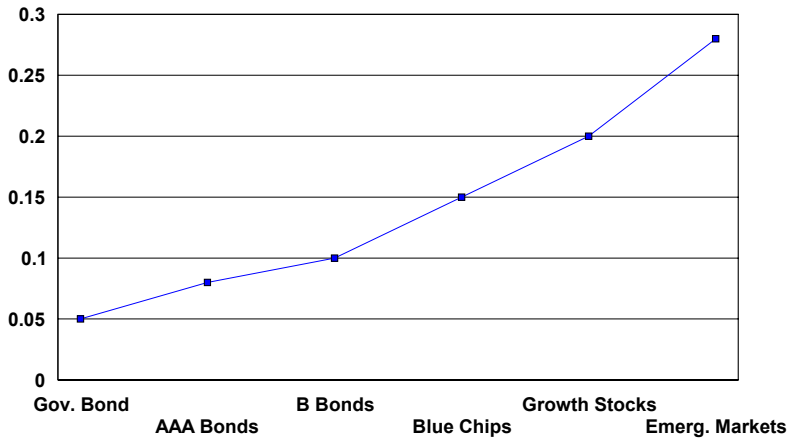
The discount rate, in this case, would be (i + r + inf).

In a country with strong capital markets, many different projects will be competing for capital and market forces will determine values for risk-free returns, the premiums required for different degrees of risk and the premium required to offset expected inflation. Anyone trying to raise capital for a project by selling stocks or bonds must issue a prospectus that shows potential investors the expected cash flows related to the project. How much they discount these cash flows depends upon their perceptions of their alternative investments, the risks of the project and the importance of inflation. The perceptions of the owner really do not count for much in this process. Market forces, not the owner's hopes, will determine the risk premiums that underlie the market's valuation of stocks, the interest rates offered by banks, the interest rates required to sell bonds. stors, and more generally, the owner or developers ability to raise money.

The next exhibit illustrates a hypothetical plot of risk vs. expected return. Government bonds that pay 5%/year have the lowest risk and the lowest return. This risk-free return does include the anticipated effects of inflation, and interest rates on government bonds will rise and fall with inflation. The next two types of investments are corporate bonds, which are less risky than the three categories of stocks shown on the chart. Various agencies rate bonds, which means that they evaluate the probabilities that the companies will in fact be able to pay the interest on the bonds. AAA is the highest rating, B-rated bonds have more risk, but are still an investment grade bond. A company must pay interest on bonds or go bankrupt; bondholders therefore get the first portion of a companies cash flow; stockholders own the company; they are not guaranteed any interest and the value of the stock can rise or fall dramatically. "Blue Chip" stocks are stocks issued by major, stable, profitable companies. "Growth" stocks are issues by

companies that are expected to have rapid growth, but may have low or no current profitability, e.g. biotechnology and electronics. Stocks from "Emerging Countries" are perceived to have very high risks because of instability in their governments, lack of infrastructure, uncertainty about demand, and general uncertainty about any new project. There are investment opportunities other than what is shown in this exhibit. For example, so-called junk bonds may be issued by companies even though there is a serious doubt that they will be able to cover interest payments. Because of the risks, interest rates are high, and they are not safe investments to an ordinary investor. However, by buying many different bonds, investors can spread their risks and may be able to get higher returns.

What is an Appropriate Discount Rate?
Risk vs. Expected Return



It is important to understand what this chart shows and what it does not show. It DOES show that investors will discount future cash flows much more severely if they believe that there is a lot of risk associated with a project. It does NOT show that investments in riskier projects will make more money. It DOES show that reducing risks allows a developer or a company to raise more money TODAY based upon its projected cash flows for TOMORROW.

It is even more important to understand that the above chart represents the market's evaluation of risks and investment opportunities. This is not the same as the owner's or developer's assessment of opportunities. Each individual and each company has their own "Minimal Acceptable Rate of Return (MARR)" and their own preferences for risk and return. My MARR for my project is based upon my opportunities, my perceptions of the riskiness of the project, and my preferences for risk and return. I will discount my projections of future cash flows in my project using my MARR for projects that I deem to have similar risk. Because of my own experience or knowledge or ignorance, I may well believe that a project can be completed as planned and that it will indeed achieve the cash

flows that I anticipate. Hence, I may see a project as being less risky (and therefore a better alternative) than it would be viewed by the market.

A company may also have a very successful record in routinely constructing and selling certain types of projects: it's MARR will have to be at least as high as the return it gets from those projects. It's MARR will also have to be at least as high as it's cost of capital.

Leveraging

In major projects, it is usually necessary to raise funds for construction from banks (loans) or financial markets (stocks and bonds). You present your estimates of costs and benefits and the banks and investors evaluate the risks and choose discount rates consistent with their MARR. If you promise to pay the banks before you pay interest on bonds or dividends on stocks, then the banks' investment in your project are less risky than the investments made by those buying stocks and bonds. If the project is being undertaken by a government agency or a large company, it may be possible to get a low interest rate for loans based upon the agency's or company's credit rating rather than a rate based upon the riskiness of the project.

If you can reduce the perceived risks of your project, you can raise more money because investors will apply a lower discount rate to the same future benefits. In particular, a project that has been completed or that has very clear commitments for cash flows (leases for a building; approved tolls for a highway) will have lower risks than a new project with uncertain time to completion and no guaranteed source of income.

"Leveraging" is a term used when you borrow money for your project and pledge to a) repay the loan or b) turn the project over to the lender if you fail to make payments. By borrowing, you put less of your money into the project and have a chance for a greater return on your investment, but also a greater risk.

Whose Cash Flows?

Each player will have different cash flows, risks, and MARRs. It is important to understand that the various players involved in a major project will have markedly different cash flows from each other and from what was shown above in the first exhibit. Let's assume that the developer/owner has secured a line of credit from Bank One for constructing a building. The bank will pay all the construction costs and charge the owner interest; no payments will be made on the loan until the project is completed, at which time loan payments will begin. The construction loan is likely to have a high interest rate, since there are risks related to the feasibility, time, and cost of construction. The owner plans to refinance the loan with Bank Two when the building is completed at the end of year 3. Refinancing should provide a lower interest rate because the building will in fact be completed and there will (hopefully) be tenants who are paying on long-term leases. If all goes well, the new loan will cover the construction loan and the monthly loan payments plus operating costs will be less than the revenue from the tenants.

The cash flows for the three major players will be as follows:

- Bank One – pays all construction costs as they are incurred over the three years of construction; receives reimbursement plus interest when the loan is refinanced at the end of year 3.
- Bank Two – gives the owner an amount large enough to pay off the construction loan at the end of year 3; receives monthly payments of principal and interest for the life of the mortgage.
- Owner – pays nothing during construction period, since all of those costs are covered by Bank One; receives a large amount from Bank Two at the end of 3 years but immediately uses that money to pay off the loan from Bank One; collects lease payments, pays for operations, and makes loan payments to Bank Two over the life of the loan.

Bank One has completed its role by the end of year 3. Bank Two just starts its role at that time. The owner, if all goes well, doesn't have to put up his own money to construct the building, and then has sufficient cash flow to cover the mortgage payments. Bank One prefers to earn high interest than to hold on to its cash; the owner prefers to have the cash as needed. Bank Two is willing to accept lower interest, but is also creating a long-term annuity for itself. The owner would rather pay the interest on a long-term loan than pay for the building when as it is constructed.

We could go into more detail and consider such things as the cash flow for the construction firms and suppliers or the possibility of selling the building upon completion. Each actor will have different perspectives on whether or not this is a good project, and each will have a different level of exposure to the risks that might be associated with the project.

Public Economic Benefits

In any large project, there are likely to be benefits and costs to the public that do not directly concern the developer or the banks. A government agency may assess a project in terms of the social, economic and environmental costs and benefits to the region. If approvals are needed, the public assessment of the project will be extremely important. For public projects, agencies will also be interested in the financial aspects of the project, i.e. how to pay for construction, maintenance and operation over the life of the project.

There are also instances where a public agency will be willing to provide funds for private projects with high public benefits. A toll bridge, for example, can save people time and make more land available for development. By allowing tolls, the government may be able to entice a private company to construct an operate the bridge. The developer or private owner of a bridge will view toll payments as the benefit, and the tolls can justify financing, but the tolls are not the benefits provided by the bridge.