Chapter 10: Risk-free Projects

Net present value (NPV) criterion defines whether it is profitable for an organization to adopt a project. If it is profitable, it offers an arbitrage opportunity.

A *mutually exclusive project* means that it excludes the possibility of adopting another project.

With the Discounted cash flow (DCF) method the NPV is computed by discounting all cash flows at the discount rate, and by adding this discounted cash flows. For computing the NPV, use the incremental cash flows, which are the cash flows with the project minus the cash flows without the project. This means that sunk costs are excluded from the calculation. Sunk costs are the costs that incur whether or not the project is adopted.

The NPV of a project is the present value of that project minus the initial costs of the project. When the present value is more than the costs, then the project creates value for the organization.

When it is a possibility to perfectly track an investment, we go long in the real asset investment and short in the tracking portfolio. With this, we achieve an arbitrage gain. This means that we do not have to pay money in advance to gain some money.

An example of an possibility to perfectly tracking, is that of the riskless projects.

Yield to maturity;

r_t that makes: $P = \frac{€1}{(1+r_t)^t}$

P = current bond price per €1 payment at maturity

t = number of periods to the maturity date of the bond

The discounted cash flow of a riskless project is: $DCF = C_0 + \frac{C_1}{1+r_1} + \frac{C_2}{(1+r_2)^2} + ... + \frac{C_T}{(1+r_T)^T}$

Where C_T = the cash flow at date *t.*

Positive numbers represent cash inflows and negative numbers represent cash outflows.

C_0 is normally a negative amount, because it stands for the initial investment in the project.

When a project has riskless cash flows, his NPV is the same as the discounted value of the cash flows.

Value additivity means that the value of an organization after adopting the project is the same as the net present value of all its cash flows (including the new project's cash flows) plus cash for future investment. Value additivity also entails that an organization should adopt, when there are mutual exclusive projects, the project with the highest NPV if it is only allowed to choose for one project.

The *profitability index* is the present value of the project's future cash flows divided by - C_0 . C_0 is the initial investment. When there is no capital constraint, an organization should adopt a project when its profitability index is greater than 1. The project with the largest profitability index is the best project for the organization.

The *net profitability rate* is the net present value stated as a rate of return, which is computed as follows:

Net profitability rate = (1+ risk-free rate) x (profitability index) – 1

EVA (Economic Value Added) takes the cost of capital into account when calculating profits. EVA also recognizes that a change in capital influences the cash flows.

Economic depreciation is the decrease in the salvage value of the capital, estimated by what the market is willing to pay for the project's capital assets at the end of a period compared with their value when the project is started. The NPV of a project has the same amount as the discounted value of a flow of EVAs.

$$EVA_T = C_T - I_{T-1}(1+r)$$

The internal rate of return is computed by calculating the y which makes the net present value of a project equal to zero. The formula:

$$0 = C_0 + \frac{C_1}{1+y} + \frac{C_2}{(1+y)^2} + \cdots + \frac{C_T}{(1+y)^T}$$

The *internal rate of return (IRR)* evaluates the IRR of a project to a *hurdle rate* to conclude on whether the project should be accepted. The hurdle rate is the risk-free rate, when the cash flows are riskless.

A *later cash flow stream* starts at with a negative cash flow at the beginning T=0, after that it gains positive cash flows. When a project has an IRR which is lower than the hurdle rate, the project is rejected.

An *early cash flow stream* is the opposite of the later stream. It looks like borrowing, so the IRR rule for this cash flow pattern is to reject projects that have an IRR that is higher than the hurdle rate.

With computing the IRR we use the technique numerical iteration most of the time. This technique is known as a trial and error technique. Normally, there is no quicker way for calculating the IRR, only is some cases there is. For example, when there are only cash flows at T=0 and T=1. In this occasion we can make use of the following equation:

$$y = -\frac{C_1}{C_0} - 1$$

Multiple IRR can arise when there is more than one sign reversal in the cash flow pattern (for example +, +, -, +, -).

The suitable hurdle rate for comparison with the IRR is that which makes the sum of the discounted future cash flows of the project equal to the selling price of the tracking portfolio of the future cash flows.

The correct IRR-based process for evaluating mutually exclusive projects is comparable to that used for the net present value rule. Take off the cash flows of the next best alternative. The project with the largest IRR is usually not the project with the highest NPV and thus is not the best project of the mutually exclusive projects.

The *payback method* assesses projects on the number of years needed to earn back the initial capital investment for a project. A disadvantage from this method is that it ignores cash flows that arise after the intial investment is earned back. The payback method is only a quick method for managers to make decisions.

The *accounting rate of return* assesses projects by contrasting the project's *return on assets*, which is the accounting profit earned on the project divided by the amount invested to acquire the project's assets. The accounting rate of return is then compared with the hurdle rate in a similar way as with the IRR.

The term structure of interest rates, or yield curve, is the pattern of yields to maturity for riskless bonds of all maturities.

1. The *annuity term structure* stands for the yields to maturity of riskless bonds with level payments.
2. There also is a *spot term structure*, which stands for the yields to maturity of zero-coupon bonds of various maturities.
3. *LIBOR term structures* are acquired from the Treasury term structures and swap spreads in the interest rate swap market.

The activities of central banks usually decide on the rates at the short end of the yield curve. They repeatedly have an opposite effect at the long end of the yield curve because inflationary expectations tend to drive the long end of the yield curve.

If the term structure of one of the three yield curves (spot, annuity, par) is consistently upward or downward sloping, the other two yields will slope in the same way. The spot yield curve will have the steepest slope, the par curve will have the second steepest slope, and the annuity yield curve will have the gentlest slope. If the yield curve is flat, all three yield curves will be the same.