Real investments

Corporate Finance and Incentives

Lars Jul Overby

Department of Economics
University of Copenhagen

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Real investments

- So far we have focused on pricing financial assets - stocks, bonds, derivatives
- We now move on the valuing real investments - basically valuing investments in all other assets (machinery, buildings, employees, advertising .... anything that requires an investment in order to generate future cash flows)
- The purpose of a company is to make investments which generate positive value i.e. positive net cash flows
- However, it is not enough to get positive net cash flows in the future - the return on the investment also has to be high enough to make the investment feasible.

Real investments

In effect, the idea is the same as that used for pricing financial assets.

- Find the expected future cash flows generated by the investment
- Discount the cash flows by an interest rate, which compensates for the riskiness of the expected cash flows
- Compare this value (the "value" of the investment) with the cost of the investment ("the market price" of the asset).

For simplicity, we start in a world with no taxes

Unlevered cash flows

- In our simplest world we assume that the cash flows generated from a project are not affected by the choice of financing i.e. debt or equity - we separate the financing and the investment decisions.
- We can thus treat the cash flows as being generated from an all equity financed operation - unlevered cash flows

Estimating cash flows

- We are only interested in the cash flows generated directly from the project - the incremental costs
- We want actual cash flows - not accounting values
- Since we are only interested in cash flows generated from the investment project specifically, sunk costs must be removed from the calculation.
- The net cash flow in any one period is the difference between the cash inflow and the cash outflow.

Investing in risk-free projects

The most popular method for evaluating investment projects is the net present value method (NPV)
Other options include

- Profitability index
- Internal rate of return (IRR)
- Payback method
- Accounting rate of return
- Economic value added (EVA)

Each of these methods can be used in specific situations - to use them correctly we must understand their implications

Net present value

- The net present value (NPV) of a project is the present value of the projects expected future cash flows minus the costs of implementing the project.

$$NPV = C_0 + \frac{C_1}{1 + r_1} + \frac{C_2}{(1 + r_2)^2} + ... + \frac{C_T}{(1 + r_T)^T}$$

- The present value is found by discounting future cash flows by a relevant rate of return.
- If the cash flows are risk-free (as we are assuming here) we discount by the risk-free rate of return.
- If the NPV is positive we invest.
- The positive NPV project can be seen as an arbitrage opportunity between the markets of real assets and financial assets.

Value additivity

Net present values are additive

$$NPV\,(A + B) = NPV\,(A) + NPV\,(B)$$

Thus, if we have no constraints we invest in all positive NPV projects.

Imposing constraints

If we must choose between two positive NPV projects, we choose the project with the highest NPV

- This is a rule with modifications
    - Projects that can be repeated over time - must evaluate the projects over equivalent time horizons
    - Capital constraints - we need a ranking method

Profitability ratio

So far we have assumed that the company should choose to invest in any project resulting a positive net present value.

However, if there are limitations preventing the company from undertaking all projects - capital rationing - we need a method which allows us to pick the package of projects resulting in the highest possible net present value. We need to choose the projects which give us the biggest bang for our buck - the highest net present value per unit initial outlay.

$$\text{Profitability index} = \frac{\text{net present value}}{\text{investment}}$$

Limitations

- The method breaks down if more than one resource is rationed (capital rationing in more than one period, mutually exclusive investment opportunities, dependent projects)
- It may also break down if it causes money to be left over - it may be better to spend all funds on a project with a slightly lower NPV

Internal rate of return

The internal rate of return (IRR) is the interest rate y that makes the net present value of a project equal zero (like the yield to maturity on a bond)

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

In order to decide whether to invest in a project, we compare the IRR with a relevant hurdle rate.

For risk-free investments the hurdle rate is the risk-free rate.

As a basis, the IRR rule is to invest when the IRR is higher than the hurdle rate.

The IRR rule will give the same result as the NPV methods, whenever the NPV of a project is a smoothly declining function of the discount rate.

Pitfalls - lending or borrowing?

Project	C_0	C_1	IRR	NPV at 20%
A	−1000	+1500	+50%	+250
B	+1000	−1500	+50%	−250

Project A will have positive NPV when $IRR >$ hurdle rate - we want high IRR

Project B will have positive NPV when $IRR <$ hurdle rate - we want low IRR

Pitfalls - multiple rates of return

$$\begin{array}{ccccc} C_0 & C_1 & C_2 & C_3 & C_4 \\ -30 & 17 & 17 & 17 & -15 \end{array}$$

This has two possible IRR's: 15.69% and −43.63%

There can be as many internal rates of return for a project as there are changes in the sign of the cash flows - follows from Descarte's "rule of signs" for polynomials.

Which IRR is the relevant one to compare with the hurdle rate? - simpler just to use NPV

Pitfalls - term structure issues

When choosing between projects of different scale or different time horizons, we must look at incremental cash flows not directly compare the IRR of the two projects.

In the IRR analysis so far, we implicitly assume we have one hurdle rate which is the same for all cash flows.

With a none-flat term structure of interest rates the hurdle rate for each cash flow will differ.

Here we must compare the IRR with the yield to maturity on a traded security with equivalent risk and the same pattern of cash flows as the investment project - may be easier just to use NPV rule.

Payback method

Some companies require the initial outlay on any project should be recovered within a specified period.

The payback period of a project is the number of years it takes before the cumulative cash flows equal the initial investment.

Problems

- The payback rule ignores all cash flows after the cutoff date.
- The payback rule gives equal weight to all cash flows before the cutoff date

Accounting rate of return

Compute the project's return on assets (ROA) - the accounting profit earned on the project divided by the book value of the assets under consideration

Compare the ROA with a relevant hurdle rate - if the ROA is higher than the hurdle rate we accept the project

Problems

- Accounting profits are often different from cash flows
- They depend on how different cash outflows are categorized - as capital investment or operating expenses fx.
- The chosen rate of depreciation is also an important element of book income
- These "accounting choices" don't affect the real profitability of a project

Investing in risky projects

There are two main methods for evaluating risky projects - i.e. projects where the future cash flows generated are uncertain
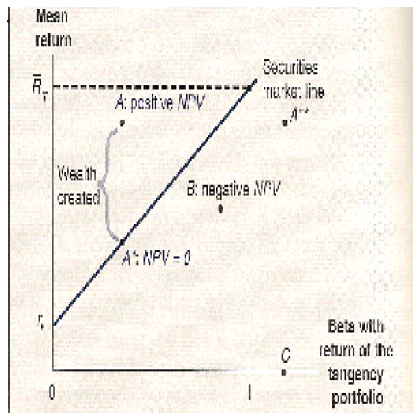
- The risk-adjusted discount rate method
  - Forecast expected cash flows
  - Find a risk-adjusted discount rate and discount the expected cash flows to find the PV

- The certainty equivalent method
  - Risk is accounted for by adjusting the expected cash flows
  - The PV is computed by discounting by the risk-free interest rate

The methods are theoretically identical, but applicable under different circumstances

Risk-adjusted discount rate method

Discount the projects expected future cash flows at the project's cost of capital.

The cost of capital is the expected return that investors require for holding an investment with the same risk as the project.

Risk-adjusted discount rate method

1. Compute expected future cash flows $E\left(\widetilde{C}\right)$
2. Compute the β of the project
3. Compute the expected return of the project from the security market line formula
4. Find the PV by discounting the expected cash flow by the expected return

$$PV = \frac{E\left(\widetilde{C}\right)}{1 + r_f + \beta\left(\bar{R}_T - r_f\right)}$$