

Chapter 11. Capital Budgeting

*Do you recall why we are in business? To make money
-What do we need? Idea(s), then capital (money)

*4 major decisions to be made?

1. Examine the idea(s) under consideration to take or reject the idea (=project)
-capital budgeting
2. Then need to come up with money, equity (internal vs. external?) or debt, how much each?
-capital structure
3. Short-term management (working capital mgt) and long-term management
4. How much to pay out to shareholders in the form of dividends and how much to keep within the firm in the form of additional retained earnings—dividend policy

To do capital budgeting, we have to estimate

1. The size of initial investment (initial outlay)
2. (NET) future cash flows on a timeline (note cash flows are different from (net) earnings. We are interested in cash flows.)
3. Determine appropriate weighted cost of capital (WA(M)CC, which can be used as a discount rate or the required rate of return on the project)

Note: Different types of projects: independent (take all “good” projects), mutually exclusive (only the “best” one among the “good” ones).

* 5 Alternative Methods (Payback, Discounted Payback, NPV, IRR, MIRR)

Example:

A: IO=10k	B: IO=10k
Future Cash Flows	
C1=5k	C1=2k
C2=5k	C2=3k
C3=5k	C3=4k
	C4=5k
	C5=6k

1. Payback Period: How many periods to recover IO (your investment) - no discount rate used (ie, no TVM),
(Cumulative future cash flows) (p.353 – p.355)
 $PB_a = 2$ periods
 $PB_b = 3.2$ periods
Decision Rule: Accept the project if $PB < \text{Max period allowed}$ for independent projects or choose the one with a shorter payback period for mutually exclusive projects. If Max allowed = 3 periods? (A only) 4 periods (take both)?, If these are mutually exclusive with Max allowed=4 periods (A)?

Advantage: Intuitive and simple, popular choice, good for measuring the “initial risk”
Disadvantage: Ignores cash flows beyond payback period, No TVM

2. Discounted Payback

Use discounted PVs ~ taking care of TVM

3. Net Present Value (NPV)

Recall from Chapter 7 and 9 to buy a security from an individual investor's perspective, $PV > \text{Price} \Rightarrow \text{Buy/Invest}$.

Here, IO is like a price of a project and we need to consider buying a project from a corporate perspective.

Here, PV from C_1, C_2, \dots, C_n given $r = \text{discount rate, required rate of return, opportunity cost, WACC}$.

Define $NPV = PV - IO$

Then, $PV > IO$ (or price) $\Leftrightarrow NPV > 0$ (or $+NPV$)

Decision Rule: Accept all $+NPV$ projects for independent projects or choose the project with the largest $+NPV$ if mutually exclusive.

Given $r=10\%$, $NPV_a = 2.43k$, $NPV_b = 4.44k \Rightarrow \text{take both or only B}$

Given $r=23.3\%$, $NPV_a = 0.011k$, $NPV_b = -0.002k \Rightarrow \text{take A (pretty weak, though) and reject B}$.

(Note: As r (discount rate) increases, PV and NPV declines. NPV profile is a trace of the NPV for different discount rates)

- Note: NPV function on Excel is actually a PV function. Therefore you need to use $NPV(\text{discount rate}, C_1 \text{ cell address}: C_n \text{ cell address}) - IO$ to determine NPV.

4. Internal Rate of Return (IRR): Special discount rate which makes $PV = IO$ (price) or $NPV = 0$.

Note: $YTM = \text{Bond's IRR}$

Here, $-IO$ vs C_1, C_2, \dots, C_n

$\Rightarrow \text{trade-off, ROI} = \text{IRR}$

How to compute? What is " r " which satisfies $PV = IO$ or $NPV = 0$.

Aside) " r " is given for NPV. We need to find out the "special r called IRR" which makes PV equal to the given IO.

Decision Rule: Accept if $IRR > \text{hurdle rate}$ (=discount rate, required rate, $WA(M)CC$) for independent projects or choose the one with the highest IRR in case of mutually exclusive projects (this rule works in most cases, but may not work in some situations).

$PV_a = 5 * PVIFA(r\%, 3)$ set equal to $IO = 10$, what is the special r (discount rate) which satisfies this equation? This special r is the IRR (return on the investment) for the project

$\Rightarrow PVIFA(r\%, 3) = 2$. Using the PVIF table, we can find out IRR should be approximately 23%~24%

\Rightarrow Using the financial calculator $-10 \text{ PV}, 5 \text{ PMT}, 3 \text{ N} \Rightarrow i/Y = 23.38\%$ (this is simple, since the cash flow stream is an ordinary annuity)

$PV_b = 2 * PVIF(r\%, 1) + 3 * PVIF(r\%, 2) + 4 * PVIF(r\%, 3) + 5 * PVIF(r\%, 4) + 6 * PVIF(r\%, 5)$ set equal to $IO = 10$, How to solve? Trial & Error

Or a Financial Calculator if you know how to deal of uneven cash flows

Or Excel Spreadsheet $IRR(-IO \text{ cell address}: C_n \text{ cell address}) \Rightarrow 23.29\%$

Sometimes, IRR may not work well when we have non-normal cash flows (multiple IRRs). **IRR assumes that the reinvestment rate for intermediate cash flows is IRR, which may be unrealistic. The best capital budgeting method is NPV approach**, although IRR is widely used in the real world.

* Crossover rate and its significance (See p.351 Fig. 11-6)

* Modified Internal Rate of Return (MIRR) ~ IRR assumes that the reinvestment rate of return is the same at IRR for all cash flows. If IRR is high, it may be unrealistic. We use instead WACC as the reinvestment rate to determine FV sum of the all future cash flows. Get the cash flows organized with Cash Outflows in PVs and Cash Inflows in Terminal FVs. Then try to determine IRR to make the revised IO = PV using – Total PV and + Total Terminal FV.

IO \$600m => Co=-600m
Y1 \$400m
Y2 -\$100m
Y3 \$500m

IRR = 15%, IO = PV

MIRR with WACC=10%?

Cash Outflows in PVs = $-600m - 100m/1.1^2 = -600m - 82.65m = -682.65m$

Cash Inflows in Terminal FVs = $400m*(1.1)^2 + 500m = 484m + 500m = 984m$

MIRR is from the revised IO of \$682.65m and one single cash inflow of 984m at the end of 3rd period => Now Apply Excel "IRR" to -682.65, 0, 0, 984 => 12.96%

Using a financial calculator

-682.65 PV, 984 FV, 3 n => CPT i/y = 12.96%