



# Capital budgeting



Corporate Finance

# The idea

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- A company creates value by investing in a new asset/project if the present value of *incremental cash-flows* at the appropriate discount rate exceeds the acquisition cost
- Discount rate: opportunity cost of capital (= return on foregone projects)



# Unlevered free cash flows to the firm

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$$\begin{aligned} \text{Unlevered FCFF} = & \\ & EBIT(1 - \tau) \\ & + Dep \\ & - Investment\ in\ fixed\ assets \\ & - \Delta Working\ Capital \end{aligned}$$

- $\tau$  is the tax rate the corporation faces on its income
- $I = Investment\ in\ fixed\ assets + \Delta Working\ Capital$
- These are the cash-flows a debt-free corporation would have available for distribution to all its stake-holders'



# Free cash flows to equity

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$$FCFE = \text{Unlevered } FCFE \\ - \text{Interest}(1-\tau) + \text{Net Borrowing}$$

- These are the cash-flows the corporation would have available for distribution to equity holders



# Project level incremental FCF (operations)

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$$\begin{aligned} \text{Incremental } \textit{Unlevered} \text{ FCFF} = & \\ & \text{Change in EBIT}(1-\tau) \\ & + \text{Change in Dep} \\ & - \text{Change in fixed investment} \\ & - \text{Change in } \Delta \text{WK} \end{aligned}$$



# Project level incremental FCFE (operations)

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$$\begin{aligned} \text{Incremental FCFE} = & \\ \text{Incremental } \textit{Unlevered} \text{ FCFF} & \\ - \text{Change in Interest}(1-\tau) & \\ - \text{Change in Net Borrowing} & \end{aligned}$$



# Cash flows from reversion

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Incremental *Unlevered* FCFF from reversion =

Net disposition/salvage price

- Transaction costs (broker fee, e.g.)
  - Capital gains taxes
  - Depreciation recapture taxes

Incremental FCFE from reversion =

Incremental *Unlevered* FCFF from reversion

- Debt principal due on sale



# Bottom line

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1. Invest if the present value of incremental *Unlevered FCFF* discounted at *WACC* exceeds the cost of the investment
2. Invest if the PV of incremental *FCFE* discounted at the required return on equity exceeds the equity cost (=cost of the investment – investment by debt-holders)
3. That is, either way you measure NPV, invest if:

$$NPV \text{ of the investment} \geq 0$$

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# Capital budgeting credo

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## 1. Ignore sunk costs

Ex: marketing study performed two years ago is not part of NPV calculation today

## 2. Include all opportunity costs

Ex: value of land the corporation already owns is part of NPV calculation today

## 3. Get a good tax accountant

Ex: cost segregation or default schedule?

## 4. Spend your time on make-or-break assumptions (= assumptions about which you are most uncertain AND move the dial)



# Example 1: building a plastic injection plant

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- Download case from my webpage
- Build the corresponding pro-forma



## Example 2: buy or lease

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- In our plastic injection plant example, assume that the corporation can lease the facility instead of building it
- Lease set-up (brokers, repurpose...) costs are \$1M
- Lease is \$1.2m a year
- Corporation could finance 100% of facility purchase at 8%
- Should the corporation buy or lease?
- Two steps (this part never changes):
  1. What are incremental cash flows?
  2. What is the appropriate discount rate?



# Example 3: Leveraged buy-outs (LBOs)

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# Multiple projects

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- Among mutually exclusive projects, pick the one with the highest NPV
- Even if the projects are of very different sizes, this is a (tautologically) sound decision rule as long as the opportunity cost of capital is properly measured
- Why?
- All independent projects with positive NPV should be undertaken



# Mid-point convention

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- We have treated (=discounted) cash-flows as if they come at the end of each accounting period
- In reality, of course, they come throughout the period
- If cash-flows are uniform during period  $[t, t + 1]$  the exact discount rate is

$$\int_t^{t+1} e^{-rs} ds = \frac{e^{-rt}}{r} (1 - e^{-r})$$

- For  $r$  small, this is decently approximated by

$$\frac{1}{(1+r)^{t-0.5}}$$



# Accuracy of mid-point convention

