FIN 325 Corporate Finance

L1 (Techniques): Cash Flows and Present Value

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Introduction to cash flows

- The amount of cash moving in/out of the firm.
- A main variable of interest for corporate finance; can be used by the firm to invest or remain solvent.
- Different from accounting items like net income.
  - You can't spend accounting earnings.
  - Ignores earnings that are yet to be received.
  - Cash flows are related to such accounting measures though.
- We treat a firm like a collection of **individual projects**.
- Cash flows arising from a project are treated like cash flows coming from a security, (e.g. a bond).

Time value of money

- Money today is not worth the same as money tomorrow!

- Consider receiving \$1 today. Say you can deposit that \$1 into a bank account and receive interest rate r% per year.
  - Will be worth \$(1+r) next year.
  - \$1 $\rightarrow$ \$(1+r).

- Now consider receiving \$1 next year.
  - Will be worth \$X today.
  - \$X $\leftarrow$ \$1.
  - \$X $= \frac{1}{1+r}$.
  - If put \$$\frac{1}{1+r}$ into the bank account for one year, it will give us \$1 next year.

- Notice that $\frac{1}{1+r} < 1$, meaning that \$1 tomorrow is worth less than \$1 today.

Present value: first principles

- First principles definition of present value

$$PV_0 = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + ... + \frac{C_T}{(1+r)^T}$$
$$= \sum_{t=0}^{T} \frac{C_t}{(1+r)^t}$$

  where C_t is the cash flow received at time t.

- T could be **finite** or **infinite**.

- When we assume that $C_t = C$ constant, we get a whole bunch of nice properties.

Present value: perpetuity

- Nice formula for an infinitely-received payment of C

$$
\begin{aligned}
PV_0 &= \sum_{t=1}^{\infty} \frac{C}{(1+r)^t} \\
&= \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \ldots \\
&= \frac{C}{r}
\end{aligned}
$$

- Derivation

$$
\begin{aligned}
(1+r)PV_0 &= (1+r)\left[\frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \ldots\right] \\
&= C + \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \ldots \\
\Rightarrow (1+r)PV_0 - PV_0 &= C \\
\Rightarrow PV_0 &= \frac{C}{r}
\end{aligned}
$$

Present value: growing perpetuity

- Start with a payment of \$C tomorrow and grow forever at a rate of g.

$$PV_0 = \frac{C}{r - g}$$

- Derivation: exercise!

Present value: annuities

- Start with a payment of \$C tomorrow and receive it for T years.

$$\begin{aligned} PV_0 &= \sum_{t=1}^{T} \frac{C}{(1+r)^t} \\ &= \frac{C}{r}\left[1 - \frac{1}{(1+r)^T}\right] \end{aligned}$$

- Derivation: the difference of two perpetuities.

$$\begin{aligned} PV_0 &= \left[\frac{C}{1+r} + \ldots + \frac{C}{(1+r)^T} + \ldots\right] - \left[\frac{C}{(1+r)^{T+1}} + \ldots\right] \\ &= \frac{C}{r} - \frac{1}{(1+r)^T}\left[\frac{C}{1+r} + \ldots + \frac{C}{(1+r)^T} + \ldots\right] \\ &= \frac{C}{r} - \frac{1}{(1+r)^T}\frac{C}{r} \\ &= \frac{C}{r}\left[1 - \frac{1}{(1+r)^T}\right] \end{aligned}$$

Present value: growing annuities

- Start with a payment of \$C tomorrow and receive it for T years; grows at rate g between years.

$$PV_0 = \sum_{t=1}^{T} \frac{C(1+g)^{t-1}}{(1+r)^t}$$
$$= \frac{C}{r-g}\left[1 - \frac{(1+g)^T}{(1+r)^T}\right]$$

- Derivation: same idea as with $g = 0$.

Inflation and discounting (1)

- A rise in the general price level in the economy.

- Nominal value in 1988 — $70,000 (AUD).
- Nominal value in 2016 — $1,000,000 (AUD).
- 1 AUD ≈ 0.72 USD (Feb. 2016).

Inflation and discounting (2)

- Real rate (r_r): after removing inflation.
- Nominal rate (r_n): unadjusted for inflation.
- The Fisher equation

$$(1 + r_n) = (1 + r_r)(1 + i)$$

- Must use **real discount rate** to discount **real cash flows**.
- Must use **nominal discount rate** to discount **nominal cash flows**.

Finance v.s. accounting (earnings v.s. cash flows)

- Net income is an accounting measure that can be manipulated.
    - E.g. not necessarily one correct way of writing-down depreciation expenses.
- Cash flows are less easy to manipulate.
    - Cash doesn't lie!
- Our approach will be to **start** with reported earnings and make certain adjustments until we get a measure of cash flows.

Defining cash flows (1)

- Main components of free cash flows:
    - Revenues, costs, investments and taxes.
- Depreciation is not a cash flow.
    - Affects taxes though, which are a cash flow.
- Assume for now that the firm is financed entirely with equity.
    - Means no interest expense yet.
- When evaluating a new project, we only care about **incremental** cash flows.
    - Rational agents only think at the margin.
    - **Marginal** benefit versus **marginal** cost.

Defining cash flows (2)

- Definition of cash flows (CF)

$$\begin{aligned} \text{CF} &= (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - \tau^C) + \text{Depreciation} \\ &- \text{CapEX} - \Delta\text{NWC} \\ &= (\text{Revenue} - \text{Costs}) \times (1 - \tau^C) - \text{CapEX} - \Delta\text{NWC} + \\ &(\tau^C) \times \text{Depreciation} \end{aligned}$$

- Notice I've **added** depreciation back into the earnings since it's not a cash flow.

- Net working capital (NWC) is basically a measure of liquid assets that the firm can use in the short-term.
  - E.g. you expect high demand for your product next week so you invest more in inventories — cash outflow.

$$\begin{aligned} \text{NWC} &= \text{current assets} - \text{current liabilities} \\ &= \text{inventories} + \text{accounts receivable} - \text{accounts payable} \end{aligned}$$

Defining cash flows (3)

- Consider the following example, (with no taxes or NWC).

Year	**2016**	**2017**	**2018**
Revenues	0	550	550
Costs	0	0	0
Depreciation	0	500	500
Net income	0	50	50
CapEx	1000	0	0
FCF	-1000	550	550

- When would we see a scenario with **positive net income** yet **negative CF**?
  - Financial mismanagement (e.g. poor management of NWC).
  - Rapid growth, (e.g. lots of capital expenditures).

Income statement v.s. cash flow statement

- We can relate CF to earnings measures.
- CF = EBIAT + Depreciation - CapEx - Δ NWC.
- EBIAT = (Revenues - Costs - Depreciation)x(1-τ^C).
- Net income = EBIAT - (Interest)x(1-τ^C).

Costs

- CapEx (capital expenditures) versus OpEx (operating expenditures).
  - CapEx is investment spending on things that will generate us benefits in the future.
  - OpEx is incurred through day-to-day operations of the company; direct spending on things like wages, utilities or maintenance.
  - OpEx directly enters earnings expressions; CapEx does not.

- Selling, General and Administrative (SG&A).
  - Sales, management and administration costs.
  - Can be looked at as measure of corporate waste.

Sunk costs and decision making

- Sunk costs should be **ignored**!
- Your current and future decision-making doesn't affect these, so they shouldn't be taken into consideration.
- E.g. say you really want to go to Freakfest.
  - You bought your ticket days ago.
  - But you lost it!
  - It is annoying.
  - But if you really want to go, you should buy another ticket, (the lost ticket's purchase cost is sunk).
  - If you keep losing your ticket you should keep buying a new one!

Terminal value

- You're trying to evaluate a potential project.
- How do you treat the project at the horizon's end?
- **Liquidation method:** assumes that you will sell the project at the end; salvage value.
- **Perpetuity method:** assumes that the project will continue indefinitely; continuation value.

Liquidation method (1)

- You'll need an estimate of the project's resale value **after** the final forecast cash flow.
  - Can't sell the project before you're finished using it!
- The market value/selling price of the project relative to the accounting book value will have implications for taxes.
  - Selling price > book value $\Rightarrow$ capital gains $\Rightarrow$ positive taxes!
  - Selling price < book value $\Rightarrow$ capital losses $\Rightarrow$ negative taxes!
- Book value = purchase price - accumulated depreciation

Liquidation method (2)

- Consider the following example.
  - Assume that the project initially cost \$200 in 2016.
  - Say the sale value is \$50.
  - Assume a corporate tax rate of 35%.

	2016	**2017**	**2018**	**2019**	**2020**
CF excluding terminal value	-200	70	70	70	70
Depreciation	0	4	4	4	4
Accumulated depreciation	0	4	8	12	16
Book value	200	196	192	188	184
Sale value	N/A	N/A	N/A	N/A	50
Tax obligations from termination	N/A	N/A	N/A	N/A	-46.9
Total CF	-200	70	70	70	166.9

- The tax obligation is found as $(0.35) \times (50 - 184)$.
- Total CF is CF excluding TV plus sale value minus tax obligations.

Perpetuity method (1)

- This method assumes that the project will continue forever into the future, (beyond the forecastable future).
- Often also referred to as continuation (rather than terminal) value.
- Our growing perpetuity formula comes in handy here!
- We can apply the growing perpetuity formula to the cash flows realised at the last period in our forecast model.

Perpetuity method (2)

- Consider the following example.
  - Assume that the project will grow at a rate of 2% per year from 2021 onwards.
  - Growth will be applied to **incremental** cash flows.
  - Assume 4% discount rate.

	2016	**2017**	**2018**	**2019**	**2020**
CF excluding terminal value	-200	70	70	70	70
Continuation value (CV)	N/A	N/A	N/A	N/A	3470
Total CF	-200	70	70	70	3640

- Continuation value $= \frac{70(1.02)}{0.04-0.02}$.
- Total CF = CF excluding TV + CV.
- The continuation value is usually incurred at the **end** of the final period in the forecast model as above.

Takeaways

- Cash flows are our main object of interest.
- They are not the same as accounting earnings.
- Only look at **incremental** cash flows.
- Ignore sunk costs.
- Terminal values can be found using liquidation or perpetuity methods.
- House prices in Melbourne are damn expensive!