Net Income (NI) to Firm Free Cash Flow (FFCF)

- Direct versus indirect business and project valuation.
- Incremental analysis or the stand-alone principal.
- Accounting: accruals mess up the time value of money.
- How to transform net income (NI) into firm free cash flow (FFCF) using balance sheets and an income statement.
- Firm free cash flow equals equity and debt cash flow.
- Calculation example: project valuation
- Net operating profit after tax (NOPAT) and operating free cash flow (OFCF).
- Negative net income, taxes and carry-forward losses.

Indirect Valuation

A business's assets can be valued by summing the market capitalisation of equity (E) and debt (D).

$$V = D + E$$

$$= P_{bond}.n_{bonds} + P_{share}.n_{shares}$$

This works well for listed companies whose stock and debt trade in liquid markets.

We can assume that these markets are efficient and that the traded price is fair, so the price of the firm’s assets equals the price of all shares and debt.

Direct Valuation

But for private businesses whose equity and debt doesn't trade in an active liquid market, and for business projects, assets must be valued directly using:

- Discounted cash flows (DCF, same as NPV); or
- Multiples valuation techniques such as price-to-earnings or EV/EBITDA ratios.

We'll focus on DCF since it's more challenging.

The two main difficulties with business and project valuation are:

- Forecasting future **cash flows**. Often, even trying to calculate and classify past historical cash flows can be difficult due to the high level of aggregation in accounting statements.
- Forecasting future expected **required returns** which are related to systematic risk.

In this class we'll focus on **cash flows**, especially how to calculate the cash flows from the firm's assets using accounting statements.

When valuing public companies, most of our figures will come from the income statement and balance sheet which are the publically available reports published by all listed companies.

In a later class we'll discuss different ways to calculate the total required return of an asset which is related to the capital asset pricing model (CAPM) and the weighted average cost of capital (WACC).

Incremental Analysis or The Stand-alone Principal

One way to value a project is to value the whole business with and without the project and then calculate the difference.

$$V_{project} = V_{business\ with\ project} - V_{business\ without\ project}$$

But this is usually unfeasible because it is difficult and time-consuming to value the whole business.

An easier method is to only consider the incremental cash flows due to the project. That is, cash flows that will occur **only** if the project is accepted.

$$V_{project} = PV(\text{incremental cash flows due to project})$$

The 'stand-alone principle' allows us to analyse each project in isolation from the firm, simply by focusing on incremental cash flows.

Sunk costs should be ignored

Sunk costs are unrecoverable costs incurred in the past. They must be paid whether or not the project is accepted or rejected, or they have already been paid, so they are irrelevant to valuing the project going forward.

For example,

- a marketing survey that has already been completed to gauge consumer interest in a proposed new product.
- research and development of patents, processes or recipes which cannot be sold.

Opportunity costs should be subtracted

The opportunity cost of doing something is the cost of the next-best alternative forgone.

Question: Your business owns a truck which is unused. You have an idea to setup a truck delivery project to make some extra cash for the company. There's no payment to anyone for using the truck, so is it therefore free?

Answer: No. The truck could be sold if the project did not go ahead. Therefore the potential sale price of the truck should be included as a cost of the delivery project when finding its NPV.

Note that you could also rent the truck instead of selling it. If the present value of renting is more than selling then the

present value of the rent is the correct opportunity cost to subtract.

But you can't subtract all opportunity costs, only the largest one which is the **'next best alternative'** to the project.

Positive and Negative Side Effects should be added and subtracted

Positive side effects are benefits to other projects and should be added. For example, a project at a car dealer to expand the car yard and sell more cars will also lead to more car loans which is valuable, and this gain should be included.

Negative side effects are costs to other projects and should be subtracted. A typical example is **'cannibalisation'**, where the sale of a new product steals revenue from an existing product made by the same company. However, this only occurs in a non-competitive market where there is little danger of competitors introducing the new product. If the market is

competitive, and competitors are likely to bring the new product to market, then there is no cannibalisation since the old product was doomed regardless of the firm's actions.

Tax effects should be included

Tax deductible **expenses** should appear inside the brackets of the Net Income formula:

$$NI = (Rev - \boldsymbol{COGS} - \boldsymbol{FC} - \boldsymbol{Depr} - \boldsymbol{IntExp}).(1 - t_c)$$

Corporate tax t_c on profits is a flat (constant) rate of around 30% in Australia.

Remember to include the effect of capital gains tax (CGT) when assets are sold for a capital gain or loss.

Questions: Opportunity cost and sunk cost

http://www.fightfinance.com/?q=366,485,486,491,492,300,

Accounting

Accounting is important because:

- Most information about a company is published by accountants in annual reports and these are the inputs into our valuations.
- Taxes. Being mindful of taxes can save a lot of money.

The problem with accounting is its emphasis on historical certainty and accrual smoothing.

Market values are more relevant than historical cost, and accrual smoothing ignores the time value of money.

Opportunity costs, sunk costs and side-costs and benefits are also very important but difficult to quantify.

Cash Flows and Timing

In finance, the timing of cash flows is critical. For example, $100 now is better than $100 in one year when interest rates are 10% pa. $100 now would turn into $110 in one year.

In accounting, income measures such as Net Income (NI) and Earnings Before Interest and Tax (EBIT) are smoothed using accrual accounts including depreciation, amortization, provision for doubtful debts and others. This messes up the timing!

When valuing businesses based on balance sheet and income statement data, we must undo accountants' accruals to get back to cash flows which can then be present-valued.

Example: Cash Flows and Timing

Question: You contract a builder to construct a building. The builder and his accountant will accept a payment of:

- $1m now; or
- $0.1m at the end of each year for 10 years.

The builder doesn't care when you pay, either option is fine.

You can borrow and lend to and from the bank at **10**% pa.

The accountant says 10 annual payments of $0.1m is equivalent to $1m now, since that's how straight line depreciation expense works.

You have $1m of cash in the bank now. When would you choose to pay the builder?

Answer: We should keep the original $1m in our bank account and pay the builder $0.1m every year for 10 years.

This could actually be done by just paying him the $0.1m interest payments from the $1m in the bank. Then at the end of 10 years we could keep the $1m for ourselves!

Clearly, this is better than paying him the whole $1m now and having nothing left.

Timing is important.

Accrual thinking is bad, unless interest rates are zero.

The Income Statement for Just Jeans Group

Just Jeans Group Income Statement for period ending 26 July 2008	
Net sales	822
COGS	717
Depreciation	24
EBIT	81
Interest expense	11
Taxable income	70
Taxes	21
Net income	49

Note: all figures are given in millions of dollars ($m).

The Income Statement as an Equation

$$\boldsymbol{NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)}$$

Where: NI = Net Income, Rev = Revenue,

$COGS$ = Cost of Goods Sold, FC = Fixed Costs per yr

$Depr$ = Depreciation expense $IntExp$ = Interest expense

t_c = Corporate tax rate

Let's check that it works for Just Group. Assume a corporate tax rate of 30%.

$$NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)$$

$$= (822 - 717 - 0 - 24 - 11).(1 - 0.3)$$

$$= 49,$$ which is the same as the income statement.

Firm Free Cash Flow (FFCF)

$$\boldsymbol{FFCF = NI + Depr - CapEx - \Delta NOWC + IntExp}$$

$$\boldsymbol{NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)}$$

Firm free cash flow (FFCF), also called 'cash flow from assets' (CFFA), is the cash flow generated by the assets V (= D + E).

The main differences between FFCF and NI are that FFCF:

- Takes timing differences into account. For example, it adds back accruals such as depreciation (***Depr***) which were subtracted from NI, but subtracts the actual cash flows on buildings and other assets.
- Subtracts opportunity costs (***ΔNOWC* and CapEx**).
- Ignores financing expenses (such as coupons & dividends).

Net Capital Expenditure (CapEx)

Net Capital Expenditure (CapEx) is the cash spent buying (or upgrading) assets less the cash received from selling assets. The assets are supposed to be non-current assets like land, buildings, trucks, equipment, patents and so on. Note that a positive change is an increase and would correspond to a net buying of assets.

Remember that CapEx is supposed to be a cash flow, so depreciation (Depr) must be ignored. There are two ways to calculate CapEx:

$$\boldsymbol{CapEx = GFA_{now} - GFA_{before}}$$

$$\boldsymbol{CapEx = NFA_{now} - NFA_{before} + Depr}$$

GFA is Gross Fixed Assets, usually just Gross PPE (Property, Plant and Equipment), and

NFA is Net Fixed Assets, usually just the carrying amount of PPE, also called NetPPE. So:

$$NFA = GFA - Accumulated\ Depreciation$$

CapEx and Asset Sales

Capital expenditure (CapEx) is:

- Positive when money is spent on non-current assets (NCA's);
- Negative when NCA's are sold.

Subtracting a negative capital expenditure is the same as adding a positive capital revenue:

$$FFCF = NI + Depr - \boldsymbol{CapEx} - \Delta NOWC + IntExp$$

$$FFCF = NI + Depr + \boldsymbol{CapRevenue} - \Delta NOWC + IntExp$$

Asset Sales and Capital Gains Tax (CGT)

Asset sales which cause negative CapEx (or positive Capital Revenues) should have capital gains tax (CGT) deducted.

$$\text{CapEx} = -1 \times \text{CapitalRevenue}$$

$$= -(P_{mkt} - \text{CGT})$$

$$= -(P_{mkt} - \text{CapitalGain}.\, t_c)$$

$$= -(P_{mkt} - (P_{mkt} - P_{book}).\, t_c)$$

Where:

P_{mkt} is the sale price;

P_{book} is the depreciated (net) asset book value on the balance sheet;

t_c is the corporate tax rate;

Calculation Example: CapEx on Asset Sale

Question: You just sold a truck for $70k. It was bought 3 years ago for $250k. Note that k stands for kilo or thousands.

The government tax office state that trucks are depreciable straight line to zero over 5 years.

Your accountant and engineer say the truck actually lasts for 10 years and should be straight line depreciated over that time to zero.

You're trying to find the CapEx for your firm this year.

How does the truck sale affect CapEx?

Answer: The depreciation stipulated by the government tax office is the important one since depreciation and book values are only interesting to finance professionals for tax reasons. Ignore what the accountant and engineer say.

Depreciation expense would 50k/year (=250k/5).

The truck asset's book value would now be:

$$P_{book} = GrossPPE - AccumulatedDepr = NetPPE$$

$$= 250k - 50k \times 3 = 100k$$

The market price that we just sold the truck for was $70k:

$$P_{mkt} = 70k$$

Now we can find the CapEx from the truck sale.

$$\text{CapEx} = -1 \times \text{CapitalRevenue}$$

$$= -(P_{mkt} - \text{CGT})$$

$$= -(P_{mkt} - \text{CapitalGain}.\, t_c)$$

$$= -(P_{mkt} - (P_{mkt} - P_{book}).\, t_c)$$

$$= -(70 - (70 - 100) \times 0.3)$$

$$= -79\text{k}$$

This is the after-tax sale price of the truck, a positive capital **revenue** and a negative CapEx.

Note that we made a capital loss of 30k (=70-100) on the truck since we sold it for 70k which was less than its book value of 100k.

Under the Australian tax system, this 30k capital loss can be deducted from capital gains on other assets that we sold, this year or in future years.

Assuming that there are other assets that we sold for a capital gain this year, the loss on disposal of the truck leads to a $9k (=$(70 - 100) \times 0.3$) capital gains tax benefit this year. This is an actual cash flow, not an accrual. So we include it.

The $79k capital revenue includes the $70k market sale price plus the $9k capital gains tax benefit.

We can add the 79k CapitalRevenue to FFCF, or subtract the -79k CapEx. Both will have the same effect of increasing FFCF by 79k.

$$FFCF = NI + Depr - \mathbf{-79k} - \Delta NOWC + IntExp$$

$$= NI + Depr + \mathbf{79k} - \Delta NOWC + IntExp$$

Why ΔNOWC is subtracted from FFCF

Think of ΔNOWC as CapEx on short term assets rather than long term assets.

A positive ΔNOWC occurs when NOWC **in**creases, due to an:

- **In**crease in inventory;
- **In**crease in accounts receivable so we're lending more to our customers (investing in their debt); or
- **De**crease in accounts payable so we're borrowing less from our suppliers (reducing our debt liabilities which is equivalent to investing in our own debt).

These ΔNOWC are not expensed by accountants in net income (NI), but they all require more cash from investors.

Because NOWC requires funding, it has an **opportunity cost** (the WACC) that needs to be included.

Therefore ΔNOWC needs to be subtracted since it is a cash flow not included in Net Income (NI).

The Delta or Increase in Net Operating Working Capital (ΔNOWC)

The Change or **Increase** in Net Operating Working Capital ($\Delta NOWC$) is:

$$\Delta NOWC = \quad NOWC_{now} \quad - \quad NOWC_{before}$$

$$\Delta NOWC = \Delta CA - \Delta \text{ExcessCash} - (\Delta CL - \Delta InterestBearingCL)$$

Net **Operating** Working Capital (N**O**WC) is defined slightly differently to normal accounting NWC:

$$NWC = CA - CL$$

$$N\boldsymbol{O}WC = (CA - \text{ExcessCash}) - (CL - InterestBearingCL)$$

Remember to focus on the increase (Δ, Delta), not the level!

Why Subtract Excess Cash from CA?

$\Delta NOWC = \Delta CA - \mathbf{\Delta ExcessCash} - (\Delta CL - \Delta InterestBearingCL)$

Excess cash and marketable securities are excluded from Current Assets since their value is already known.

There's no need to present value their future income and capital gains by their required return to find their worth. We know it already.

This is related to the idea of finding enterprise value (EV):

$\text{EV} = \text{Assets} - (\text{ExcessCash} + \text{MarketableSecurities})$

Also, excess cash is usually (or should be) invested in money market debt such as treasury bills which earns a market interest rate and is therefore fairly priced.

How to Estimate Excess Cash?

Excess cash is the part of cash on the balance sheet that a firm does not need, it's in excess of requirements.

Some cash is needed to pay employees and suppliers on time and have notes and coins in the cash register. But some firms have more cash than necessary (perhaps tax reasons) and this is excess cash.

$$\textbf{CashOnBalanceSheet} = \textbf{NecessaryCash} + \textbf{ExcessCash}$$

Accountants don't break cash into the necessary and excess components on the balance sheet.

But excess cash is often estimated based on past levels and industry averages. For example, necessary cash is often estimated to be a set proportion (say 4%) of sales or total assets, and any extra cash is deemed to be excess cash.

Why Subtract Interest-Bearing Debt from CL?

$\Delta NOWC = \Delta CA - \Delta\text{ExcessCash} - (\Delta CL - \boldsymbol{\Delta InterestBearingCL})$

Interest-bearing debt is excluded from current liabilities (CL) since its financing cost will be included in the weighted average cost of capital (WACC) required return.

Including interest bearing debt in both the $\Delta NOWC$ and WACC will double-count its cost which is incorrect.

After ignoring changes in interest-bearing current liabilities, excess cash and marketable securities, $\Delta NOWC$ should include investment into the short term assets needed to run the business, similarly to how CapEx includes investment into the long term assets needed to run the business.

Why Interest Expense is Added to FFCF

Net income is polluted since it subtracts interest expense which is related to financing cash flows. That's why interest expense is added back in the FFCF equation:

$$NI = (Rev - COGS - FC - Depr - \boldsymbol{IntExp}).(1 - t_c)$$

$$FFCF = NI + Depr - CapEx\ -\ \Delta NOWC + \boldsymbol{IntExp}$$

Note that the interest expense still affects FFCF due to taxes: the 'interest tax shield' effect. We'll discuss this later.

Dividends are not subtracted or added in the NI equation, therefore they are not added back or subtracted from the FFCF equation. They are entirely ignored since they are a financing cash flow.

Interest Expense (IntExp)

Interest expense is calculated by accountants as the bond or loan price multiplied by the yield. This is called the 'effective interest method':

$$IntExp_1 = r_D . D_0$$

Important note: interest expense is unrelated to coupon or interest payments, so even a 5 year zero-coupon bond will have an annual interest expense.

Firm free cash flow (FFCF) should not add or subtract cash flows to the investors who finance the assets because otherwise FFCF would be zero. This is an interesting and non-obvious point.

From the balance sheet, we know that the debt holders and equity holders fund the firm's assets:

Assets = Debt + Equity

FFCF = DebtCF + EquityFCF

All of the FFCF generated by the assets is paid to the debtholders as (DebtCF) and equity holders (EFCF). So if we subtract all payments to debt and equity holders, there will be no FFCF left!

Equity dividends and buybacks, as well as debt interest and principal, should be ignored from FFCF. Though sometimes we include their tax effects in the FFCF or WACC required return.

Financing Cash Flows

Financing cash flows are:

- Debt-holders' cash flow ($DebtCF$) including coupons, principal and loan payments, less any new raisings such as debt issues (borrowing or selling new debt); **plus**
- Equity holders' free cash flow ($EquityFCF$) including dividends and buybacks, less any new raisings such as rights issues or placements (selling new shares).

$$FinancingCF = EquityFCF + DebtCF$$

Where:

$$EquityFCF = Dividends + Buybacks - EquityRaisings$$

$$DebtCF = Coupons + Principal - DebtRaisings$$

Why FFCF = Financing Cash Flows

FFCF must always equal equity-holders' dividends and buybacks plus debt-holders' coupon and principal payments, less any raisings (selling new equity or debt):

$$FFCF = EquityFCF + DebtCF$$

- Note that FFCF, EquityFCF and DebtCF are defined in the narrow sense as cash flow income only, not capital gains.

FFCF will always equal the net cash flows to debt and equity holders because who else should be paid the FFCF besides these rightful owners?

Example 1: FFCF = EquityFCF + DebtCF

Question: If the firm kept this year's FFCF in the bank, wouldn't FFCF be higher while neither the debt nor equity-holders receive the cash flows, breaking the above equality?

Answer: No, because if some FFCF is put in the bank and:

- Excess cash is excluded from ΔNOWC, keeping this cash in the bank will not affect ΔNOWC or FFCF at all. The equality holds.
- Excess cash is ***not*** excluded from ΔNWC (note the missing O for operating), then the cash kept in the bank would have increased ΔNWC which should have already been subtracted from the FFCF, so all FFCF will still be paid to debt and equity holders.

$$\Delta N\boldsymbol{O}WC = \Delta CA - \Delta\text{ExcessCash} - (\Delta CL - \Delta InterestBearingCL)$$

$$\Delta N\boldsymbol{O}WC = \Delta CA - \Delta\text{ExcessCash} - \Delta CL + \Delta InterestBearingCL$$

$$\Delta NWC = \Delta CA - \Delta CL$$

$$FFCF = NI + Depr - CapEx \; - \; \Delta NOWC + IntExp$$

$$FFCF = EFCF + DebtCF$$

$$NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)$$

Example 2: FFCF = EquityFCF + DebtCF

If the firm uses its FFCF to re-invest and buy more assets, it may appear that FFCF is higher while neither the debt nor equity-holders will receive the cash flows, breaking the equality.

But remember that any increase in the firm's assets will result in an:

- Increase in capital expenditure (CapEx) in the case of buying buildings or machines; or an
- Increase in net operating working capital (ΔNOWC) in the case of buying inventory.

Both should have already been subtracted from FFCF, so they should not increase FFCF at all. The equality holds.

$$FFCF = NI + Depr - CapEx \ - \ \Delta NOWC + IntExp$$

$$FFCF = EFCF + DebtCF$$

Why Financing Cash Flows are Ignored

If all financing costs such as equity dividends and buybacks together with debt coupons and principal were subtracted from FFCF, then there would be nothing left since:

$$FFCF = EquityFCF + DebtCF$$

So:

$$FFCF - EquityFCF - DebtCF = 0$$

Therefore it's best **not to subtract financing costs** such as dividends, buybacks, interest or principal payments from FFCF, otherwise the assets' FFCF will be zero and the present value of this will also be zero so your assets will appear worthless, when in fact they could be very valuable!

FFCF Equation

$$NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)$$

$$FFCF = NI + Depr - CapEx\ -\ \Delta NOWC + IntExp$$

FFCF equals Net Income…

- Plus Depreciation (Depr), because it is subtracted in NI . We reverse it because depreciation is not a cash flow.
- Less net Capital Expenditure (CapEx), since the cash flow from buying buildings must be subtracted.
- Less the Increase in Net Operating Working Capital (ΔNOWC).

- Plus Interest Expense (IntExp), because it is subtracted in NI . We reverse it because Interest Expense is a finance or funding related expense which has nothing to do with the assets themselves.
  Also, interest expense is an accrual, it is not a cash flow.
  This is apparent when considering that zero-coupon bonds incur interest expense. Accountants define interest expense as the debt price at the start multiplied by its current yield.

Equation Summary

$$NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)$$

$$FFCF = NI + Depr - CapEx \ - \ \Delta NOWC + IntExp$$

$$FFCF = EquityFCF + \ DebtCF$$

$$EquityFCF = Dividends + Buybacks - Raisings$$

$$DebtCF = Coupon + Principal - Raisings$$

$$CapEx = NFA_{now} - NFA_{before} + Depr = GFA_{now} - GFA_{before}$$

$$\Delta NOWC = \Delta CA - \Delta CL - \Delta ExcessCash + \Delta InterestBearingCL$$

Notes:

Cash Flow From Assets (CFFA) is another name for FFCF.

FFCF equals Equity Free Cash Flow (EFCF) plus Debt Cash Flow (DebtCF) payments to debt holders.

Payments to debt holders should be actual cash flows of principal and coupon or loan payments, not interest expense which is an accrual. For example, a 10 year zero-coupon bond with a positive non-zero yield to maturity (r_D) that's 2 years old has a positive interest expense ($IntExp_2 = D_1.r_{D1\rightarrow 2}$), even though no cash flows are paid or received ($DebtCF_2 = 0$).

Calculation Example: FFCF of Just Group

Just Jeans Group Income Statement for period ending 26 July 2008	
Net sales	822
COGS	717
Depreciation	24
EBIT	81
Interest expense	11
Taxable income	70
Taxes	21
Net income	49

Just Jeans Group Balance Sheet as at 26 July		
	2008	2007
Current A	92	105
Non-current A	195	178
Total A	287	259
Current L	208	72
Non-current L	22	134
Owners Equity	57	53
Total L and OE	287	259

Note: all figures are given in millions of dollars ($m).

Question: Find the FFCF using the income statement and balance sheets

Assume that:

- Non-current assets (NCA) is completely made up of Net Fixed Assets;
- All current liabilities are non-interest bearing;
- Current assets includes no excess cash or marketable securities.

Answer:

$$FFCF = NI + Depr - CapEx\ - \Delta NOWC + IntExp$$

We need to calculate $CapEx$ and $\Delta NOWC$ from the changes in the balance sheet.

$$CapEx = NFA_{now} - NFA_{before} + Depreciation$$

$$CapEx = 195 - 178 + 24$$

$= 41$, so net capital expenditure rose over the year.

$$\Delta NOWC = \Delta CA - \Delta CL - \Delta ExcessCash + \Delta InterestBearingCL$$

$= (\mathrm{CA_{now}} - \mathrm{CA_{before}}) - (\mathrm{CL_{now}} - \mathrm{CL_{before}}) - \Delta EC + \Delta IBCL$

$= (92 - 105) - (208 - 72) - 0 + 0$

$= -149$, so net working capital fell over the year.

$$FFCF = NI + Depr - CapEx \; - \; \Delta NOWC + IntExp$$

$= 49 + 24 - 41 \; - \; -149 + 11$

$= 192$

Questions: Firm Free Cash Flow (FFCF) or Cash Flow From Assets (CFFA)

http://www.fightfinance.com/?q=173,176,224,225,238,349,350,351,359,360,361,504,188,208,209,226,291,

Calculation Example: Project Valuation

Question: You've estimated the costs and benefits of producing a product. Should you proceed with the project? What's the Net Present Value of the cash flows?

Project Data	
Project life	10 yrs
Initial investment in factory that lasts for 10 yrs	$10m
Depreciation of factory per year	$1m
Expected sale price of factory at end of project	$1.7m
Unit sales per year	0.9m
Sale price per unit	$10
Variable cost per unit	$6
Fixed costs per year, paid at the end of each year	$1.5m
Interest expense per year	0
Tax rate	30%
Discount rate	10%

Notes:

- An inventory (current assets) purchase of $0.1m will occur at the very **start** of the first year (t=0), and inventories will be kept at that level for the life of the project. At the very **end** of the project (t=10), all inventories will be sold. Assume that as inventory is sold every year, it will be replaced with new stock so inventories will always remain at the same constant level. The project will not affect the firm's other current assets and liabilities.
- The factory that the project will use is temporarily empty, but in the past the business owner next door has rented it from you. This year he offered you $0.5m/yr to use it as a warehouse. This year, your grandma also made an offer! She offered you $100/yr to use it as a car park for her friends.
- All cash flows occur at the start or end of the year as appropriate, not in the middle or throughout the year.

- All rates and cash flows are real. The inflation rate is 3% pa.
- All rates are given as effective annual rates.

Formulas:

$$NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c), \text{ or alternatively}$$

$$NI = (Q.(P - VC) - FC - Depr - IntExp).(1 - t_c)$$

$$\Delta NOWC = \Delta CA - \Delta ExcessCash - \Delta CL$$

$$FFCF = NI + Depr - CapEx - \Delta NOWC + IntExp$$

$$NPV = \text{Net Present Value of FFCF}$$

Answer:

The opportunity cost of renting the factory to the next door business owner should be included. Note that only the highest opportunity cost is included. Your grandmas' offer is not included since you can't rent the factory to her and the next door business owner at the same time, so we only include the higher opportunity cost.

Note that if we did rent the factory, then the $0.5m would have been added to revenue and thus would be taxed. Therefore, the opportunity cost should be the after-tax amount, not the whole $0.5m. There are two ways to include the opportunity cost. We can subtract the after-tax cost ($0.5m \times (1 - t_c)$) from yearly FFCF or we can subtract it from revenues in the net income (NI) equation which achieves the same effect. Here we subtract the $0.5m

opportunity cost in the net income equation by adding it to fixed costs (FC) per year.

$$\begin{aligned} NI &= (Q(P - VC) - FC - Depr - IntExp)(1 - t_c) \\ &= (0.9m(10 - 6) - (1.5m + 0.5m) - 1m - 0)(1 - 0.3) \\ &= \$0.42m \end{aligned}$$

This net income will be received at the end of each year for the next ten years. Some adjustments are needed to get FFCF:

$$FFCF = NI + Depr - CapEx - \Delta NOWC + IntExp$$

Capital expenditure (CapEx) is only incurred at the very beginning which is the 'Initial investment in factory', and at the end when the factory is sold. There is no yearly capital expenditure.

The increase in net operating working capital (ΔNOWC) will be \$0.1m at t=0 and then a decrease (negative increase) at t=10.

$$FFCF_{t=0} = NI + Depr - CapEx - \Delta NOWC + IntExp$$

$$= 0 + 0 - 10m - 0.1m + 0$$

$$= -10.1m$$

$$FFCF_{t=1,2,\ldots 9} = NI + Depr - CapEx - \Delta NOWC + IntExp$$

$$= 0.42m + 1m - 0 - 0 + 0$$

$$= 1.42m \text{ each year}$$

The factory is expected to be sold at t=10 which will have an impact on CapEx. A complicating factor is capital gains tax (CGT).

Note that selling a capital asset is a positive cash flow which is negative CapEx expenditure.

$$\begin{aligned}\text{CapEx} &= -(\text{P}_{\text{mkt}} - \text{CGT}) \\ &= -(\text{P}_{\text{mkt}} - (\text{P}_{\text{mkt}} - \text{P}_{\text{book}}).\,\text{t}_{\text{c}}) \\ &= -(1.7\text{m} - (1.7\text{m} - 0) \times 0.3) \\ &= -1.19\text{m}\end{aligned}$$

P_{mkt} is the market sale price of the factory.

P_{book} is the book price of the factory according to the govt tax office.

The increase in NOWC at t=10 will be negative since NOWC will fall when the inventory is sold. So $\Delta\text{NOWC}_{10} = -0.1\text{m}$

These figures should be added to the FFCF equation at t=10.

$$\begin{aligned}\text{FFCF}_{t=10} &= \text{NI} + \text{Depr} - \text{CapEx} - \Delta\text{NOWC} + \text{IntExp} \\ &= 0.42\text{m} + 1\text{m} - (-1.19\text{m}) - (-0.1\text{m}) + 0 \\ &= 2.71\text{m}\end{aligned}$$

Since all cash flows are real, and the discount rate is also real, there is no need to convert rates using the Fisher equation and inflation. If the cash flows and discount rate was nominal, that would also be fine, no need to convert rates or cash flows. We can go ahead and discount cash flows to find the NPV of the project.

$$\begin{aligned}
\text{NPV} &= \text{PV}(\text{FFCF}_{t=0}) + \text{PV}\left(\text{FFCF}_{t=1,2,\ldots 9}\right) + \text{PV}(\text{FFCF}_{t=10}) \\
&= \text{FFCF}_{t=0} + \text{FFCF}_{t=1,2,\ldots 9} \times \frac{1}{r}\left(1 - \frac{1}{(1+r)^{T}}\right) + \frac{\text{FFCF}_{t=10}}{(1+r)^{T}} \\
&= -10.1\text{m} + 1.42\text{m} \times \frac{1}{0.1}\left(1 - \frac{1}{(1+0.1)^{9}}\right) + \frac{2.71\text{m}}{(1+0.1)^{10}} \\
&= -10.1\text{m} + 8.1778\text{m} + 1.0448\text{m} \\
&= -0.8774\text{m}
\end{aligned}$$

Since the NPV is negative, reject the project.

This is an interesting result because the net income is positive every year so an accountant might think that this is a good project, but clearly it is not.

Questions: Capital budgeting and business project valuation

http://www.fightfinance.com/?q=511,512,273,

OFCF and NOPAT rather than FFCF and NI

Some practitioners and textbooks discuss net operating profit after tax (NOPAT) and operating free cash flow (OFCF), defined as:

$$NOPAT = (Rev - COGS - FC - Depr - \mathbf{0}).(1 - t_c)$$

$$OFCF = NOPAT + Depr - CapEx - \Delta NOWC + \mathbf{0}$$

These formulas are the same as the NI and FFCF formulas, but with interest expense set to zero (**IntExp=0**).

$$NI = (Rev - COGS - FC - Depr - \boldsymbol{IntExp}).(1 - t_c) = NPAT$$

$$FFCF = NI + Depr - CapEx - \Delta NOWC + \boldsymbol{IntExp}$$

Formulas: NOPAT & OFCF vs NI & FFCF

$$NOPAT = (Rev - COGS - FC - Depr - \mathbf{0}).(1 - t_c)$$

$$= NI + \boldsymbol{IntExp}.(1 - t_c)$$

Substitute into OFCF formula to see relationship with FFCF:

$$OFCF = NOPAT + Depr - CapEx - \Delta NOWC + \mathbf{0}$$

$$= NI + Depr - CapEx - \Delta NOWC + \boldsymbol{IntExp}.(1 - t_c)$$

$$= FFCF - \boldsymbol{IntExp}.t_c$$

So the OFCF equals the FFCF, but without the benefit of the interest tax shield per year: $\boldsymbol{IntExp}.t_c$

EBIT and NI

Earnings before interest and tax (EBIT) is sometimes used to construct similar formulas.

$$EBIT = Rev - COGS - FC - Depr$$

$$NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)$$

$$NI = (\quad EBIT \quad - IntExp).(1 - t_c)$$

Let's check that it works for Just Group:

$$EBIT = Rev - COGS - Depr$$

$$= 822 - 717 - 24 = 81$$

$$NI = (EBIT - IntExp).(1 - t_c)$$

$$= (\ 81 - 11\ ) \times (1 - 0.3) = 49$$

Negative Net Income, Taxes and Carry-Forward Losses

$$\boldsymbol{NI = (Rev - COGS - FC - Depr - IntExp).(1 - t_c)}$$

The Net Income (NI) equation above works for positive before-tax income: $\boldsymbol{Rev - COGS - FC - Depr - IntExp} > 0$.

But if a business's NI is negative then it's actually a loss.

The loss is not reduced by one minus the tax rate $\boldsymbol{(1 - t_c)}$ unless the loss can be deducted from another part of the business's profit.

If this is not the case, then the loss will be a 'carry-forward tax loss' and can be offset against any future profits, causing a time difference of when the tax saving is received.