Capital Budgeting

This file covers;

1. Extracting cash flows from a set of accounts (P&L and balance sheet), it looks at how to calculate the change in net working capital figure through a project. It shows a worked example of the above. It also looks at the choice between WACC/NPV and APV.

2. Lease or Buy analysis

3. Adjusted Present Value

4. Equivalent Annual Cost Analysis

5. Evaluating International projects

Cash Flows from Accounting figures

A company has a project that will have a life of three years after which all the assets would be liquidated. The fixed assets will be sold for £3,000 (all figures are in '000s) at the end of t3. The pro forma balance sheet and income statement are as follows:

Rothko: Income statement

Revenues	t0	t1	t2	t3
Operating revenue	0	4800	6150	5550
Less returns	0	0	90	300
Net operating revenue	0	4800	6060	5250
Operating expenses	0	2250	4050	3750
Operating profit	0	2550	2010	1500
Sale of fixed assets	0	0	0	3000
Depreciation	0	900	900	2700
Interest at 10%	0	390	300	240
Profit before tax	0	1260	810	1560
Tax at 30%	0	378	243	468
Profit after tax	0	882	567	1092

		t0	t1	t2	t3
Rothko: Balance Sheet					
Current assets					
	Cash & Marketable securities	1800	1800	1800	0
	Accounts receivable	0	1500	1500	450
	Inventory	1500	1950	660	0
Total current assets		3300	5250	3960	450
Fixed Assets					
	Plant & equipment	3900	4500	4500	4500
	Accumulated depreciation	0	900	1800	4500
Net Fixed Assets		3900	3600	2700	0
Total assets		7200	8850	6660	450
Current Liabilities					
	Accounts payable	0	900	2400	450
Total current liabilities		0	900	2400	450
Long term liabilities and equity					
	Debt	3900	3000	2400	0
	Equity: paid up equity capital	3300	4470	1860	0
	Equity: retained earnings	0	480	0	0
Total long term liabilities & equity		7200	7950	4260	0
Total liabilities & equity		7200	8850	6660	450

Extract the relevant cash flows from these accounts and conduct a net present value (NPV) analysis on the viability of the project. The cost of capital for the project is 15%.

Solution:

There are two routes to get cash flows from a set of accounts.

1. You need to start with the operating profits from the Profit and Loss Statement. You take the operating profits and add any change in capital expenditure (including asset sales), then add the change in net working capital (see below for calc. It is usually an outflow early in the project). Then you would subtract taxes. This will give you the free cash flows for the company. These are not the ungeared free cash flows (FCF*), because the tax figure will include the interest tax shield from borrowing. We need to work out the interest tax shield and subtract it to get the FCF*. The interest tax shield is the interest payment times the tax rate. This is done for each year.

[P&L] = Profit & Loss Statement, [B/S = Balance Sheet]

Cash flow =
Operating profit [P&L]
+/- Capital expenditure (or asset sales) [B/S] (P&L)
+/- Change in net working capital (Cur Assets outflow, CL inflow) [from B/S]
- Taxes [P&L]
= FCF
- Interest tax shield (interest payment * tax rate) [P&L]
= FCF*

The FCF* are the ungeared cash flows that you will use in WACC/NPV or APV analysis. With APV you would also discount the tax shield by the debt required rate (and the FCF* by the ru).

2. The second method of establishing the ungeared free cash flows builds the cash flow up, taking the necessary elements from the P&L and B/S statements.

First you would take the Capital Expenditure and enter any capital spending outflows in the first line (B/S). Then in the second line you would have the change in Net Working Capital (see below for calc). The next line would include any sale of fixed assets (P&L) and after that you would have the operating profits from the P&L statement.

Under the cash flow schedule start a tax calculation for the duration of the project. In that you will have operating profits and from that you will subtract the annual depreciation charge. Add any sale of fixed asset in the appropriate time period. Net this all off and tax at 30%. Take the tax cash flow up to the cash flow schedule.

Once you have the tax cash flow in the cash flow schedule you can net off all the cash flows to get the ungeared free cash flows (FCF*). In this method you do not have to

worry about the interest tax shield, because you have excluded interest payments from your calculations. You can now work out the NPV with the cost of capital (WACC).

The cash flows that you have calculated here, FCF* can be used for either a WACC/NPV calculation or an APV calculation. With the WACC/NPV you discount the FCF* with the WACC. With APV you discount the FCF* with *ru* (the ungeared equity return) and discount the interest tax shield (Debt x Interest x Tax rate for each year) by *rd* (the required return on debt – **not** rd* the after tax cost of debt). Both methods if applied correctly would give the same answer.

Why you are using WACC/NPV would be because the company has a target capital structure that it is committed to maintain. The WACC uses proportions of debt and equity in its calculation. With APV the capital structure is changing. It might be that a company has taken on a lot of debt to undertake a particular project (eg, a takeover) and that it intends to reduce the debt over the coming years. In this instance the APV method is more suitable as it can deal with the reducing level of debt each year. If you were using WACC/NPV you would have to work out a new WACC for each year to reflect the changed capital structure.

Calculating the Net Working Capital figure for the Cash Flow Schedule

The figure for net working capital (NWC) that you want in the cash flow is the change in NWC from one period to the next. In a basic capital budgeting analysis you will have working capital that is needed to start the project, this is an outflow. The question may then say that working capital will be maintained at that level through the project until the end when the project is finished. The mistake here would be to write in the same working capital figure for each year. What you want is the change in net working capital. If the NWC remains constant, then there is no change, so the entry would be zero for each year up unitl the end of the project, when the initial amount of working capital is returned as a positive cash flow. This is because the remaining inventory will be sold off and the accounts receivable and payable will be paid off. This is always the assumption in the capital budgeting calculations that you will get in Finance. In real life it is different, you may not be able to sell all the inventory and you may not be able to collect all the accounts receivable.

More complex working capital calculations where you have entries for Inventory (INV), Accounts Receivable (AR) and Accounts Payable (AP) for each year require a bit of calculation.

First you need to set out three rows of cash flows, one each for INV, AR and AP. INV and AR will be labeled as negative cash flows as they are uses of cash, ie, cash has been spent or is tied up in these items. AP will be a positive cash flow as you have not paid out this money, it is a source of cash.

With your table of three cash flows for each year you should then net off the cash flows. This is the sum of -INV, -AR and +AP for each year. What you now have is Net Working Capital. What we need is the change in NWC. Year 0 NWC will be the amount that you have just calculated. The figure for year 1 is the difference between year 0 and year 1. If this is a larger negative number it means you have increased the amount of working capital being used, so this will be a negative cash flow. Carry this on for year 2, ie, look at the difference between the year 1 NWC figure and the year 2 NWC figure. If that is a smaller figure than the year 1 figure then the change in NWC figure will be positive. Carry this on through to the end of the project. If you add the figures up for the change in NWC row they should balance to zero (in all the Finance cases and questions that is).

The calculation for this worked example is shown below;

Working capital calculation

	0	*1*	*2*	*3*
CA	*3300*	*5250*	*3960*	*450*
CL	*0*	*900*	*2400*	*450*
Net working capital	*-3300*	*-4350*	*-1560*	*0*
change in NWC	*-3300*	*-1050*	*2790*	*1560*

The solution for the whole question, ie, what are the FCF* and what is the NPV is shown below;

Method 1

				15%	**WACC**	
	Cash flows	*0*	*1*	*2*	*3*	
	Operating profit	0	2550	2010	1500	
-	Capex	-3900	-600		3000	
-	Change in NWC	-3300	-1050	2790	1560	
-	Tax	0	-378	-243	-468	
	FCF	-7200	522	4557	5592	
-	tax shield	0	-117	-90	-72	
	FCF*	-7200	405	4467	5520	
	Discount factor	1	0.870	0.756	0.658	**NPV**
	Discounted cash flows	-7200	352.2	3377.7	3629.5	**159.4**

The second method, where the cash flows are gradually built up and a separate tax calculation is done, is shown below;

Method 2

Cash flows	*0*	*1*	*2*	*3*	
Investment	-3900	-600			
Change in NWC	-3300	-1050	2790	1560	
Sale of fixed asset				3000	
Operating profit	0	2550	2010	1500	
Tax	0	-495	-333	-540	
FCF*	-7200	405	4467	5520	
Discount factor	1	0.8696	0.7561	0.6575	**NPV**
Discounted cash flows	-7200	352.2	3377.7	3629.5	**159.4**

Tax Calc				
Operating profit	0	2550	2010	1500
Depreciation	0	-900	-900	-2700
Sale of fixed asset				3000
Before tax	0	1650	1110	1800
Tax @ 30%	0	-495	-333	-540

Lease or Buy Analysis

Lease or buy analysis should be straightforward. The relevant cash flows are the cost of the equipment, the depreciation tax shield, the lease payment and the lease tax shield. These are the basic ingredients of the lease vs buy decision.

The analysis is done from the point of view that you are leasing. So the first cash flow is the cost of the equipment. In normal capital budgeting this will be a cash outflow, but in leasing you are not buying the equipment, so you are saving the equipment cost, so that first cash flow is positive.

The second cash flow is the depreciation tax shield. If this was a normal project, this would be a positive cash flow to the project, because the asset would be owned. But in the lease the asset is not owned, so the depreciation tax shield is lost, you don't get it, so it is a negative cash flow.

The third cash flow is the lease payment. This is a negative cash flow, you pay this each period to use the asset. The fourth cash flow is the lease tax shield, which is simply the lease payment times the tax rate. This is a positive cash flow.

You have to note the timing of the cash flows. The depreciation tax shield will be from period one until the end of the lease. The lease payment may however be from today (year 0) for *x* years.

The cash flows are set out in tabular form similar to a normal capital budgeting problem. The cash flows are netted off and the lease cash flows will be discounted by the after tax cost of debt , *rd**. It is wrong to discount the cash flows with the WACC. The cash flows are not risky company cash flows, but are safe, certain contractual cash flows.

The cash flows are discounted and if the result is negative, it means the cost of leasing is greater than the cost of buying, so you should just buy.

That is an explanation of the basic lease. There can be added complications. You may have a lease question where if you buy you face maintenance charges. The maintenance charges are operating cash flows, so would be discounted by the WACC, on an after tax basis. These cash flows can be valued as a separate annuity (on the after tax basis) and the resulting PV of the cash flow would be added to the NPV of the lease. This is a positive cash flow because the lease does not have to pay the maintenance charges.

There is a second complication, if there is a salvage value to the machine. The salvage value goes to the owner, which is the lessor. So this will be a negative cash flow to the lease. The salvage value will be after tax and is discounted by the WACC as it is a risky cash flow.

Lease Worked Example

Moffat Weaving is a stock market listed small Scottish knitwear company. It assembles jumpers and other forms of knitwear clothing. Despite an adverse economic background, Moffat has been doing well and is seeking to expand production.

Moffat is considering acquiring a new piece of machinery, which will increase production. The company can either purchase the machinery or lease it. If it purchases the machinery it will have to borrow the cash needed. The company can borrow at a rate of 9%. The machine costs £60,000 and will have a useful life of 6 years. It will be depreciated down to zero value on a straight line basis. The company faces a tax rate of 30%. If the company leases the machine it will have to make seven lease payments of £10,750 with the first payment being made now.

The company has a target debt to total capital ratio of 0.4. The company has an equity beta of 1.25, its share price is 360p and the dividends have been growing at a rate of 5% per annum recently. The risk free rate of interest is 5% and the stock market equity risk premium is 6%.

- Calculate the discount rate you would use for the lease evaluation and explain your workings.

- Calculate whether the company should lease or buy the machinery. Show all workings.

- If the machinery could be sold at the end of the lease for £4000, and explain how would this impact the lease decision.

Lease Worked example – solution

- The discount rate is the after tax cost of borrowing for the company. This will be 9% * (1 – 0.30) = 6.3%. The lease cash flows are contractual cash flows like the debt cash flows so they should be discounted at that rate. Do not use the WACC.

- Lease or buy cash flows are shown below

					after tax	Annuity factor:	
Tax = 30%	Depn basis =	10000	Debt int rate =	9%	**6.3%**	4.8713	
	0	***1***	***2***	***3***	***4***	***5***	***6***
Cost of asset	60,000						
loss of dep tax shields		-3000	-3000	-3000	-3000	-3000	-3000
lease payment	-10750	-10750	-10750	-10750	-10750	-10750	-10750
lease payment tax shld	3225	3225	3225	3225	3225	3225	3225
Lease cash flows	**52475**	**-10525**	**-10525**	**-10525**	**-10525**	**-10525**	**-10525**
Discount factor	1	0.9407	0.8850	0.8325	0.7832	0.7368	0.6931
Discounted lease c/f	52475	-9901	-9314	-8762	-8243	-7755	-7295

NPV
1,204 if positive lease, if negative buy

The lease cash flows are positive, so Moffat should lease the equipment.

- The salvage value of £4000 is a capital gain because the asset has zero book value. The after tax salvage value is £2800. This is a value at the end of year 6, so it needs to be discounted back using the WACC.

- The WACC is 10.02%
  = (0.4*6.3)+(0.6 * (5+1.25(6))
  = 2.52 + 7.5

- The present value of the salvage value is $2800/1.1002^6 = 1578.8$.
  The 1578.8 is a negative value as the lessee does not get that value. So this will be subtracted from the lease NPV.

  Final NPV = 1204 – 1578.8

  = -374.8

  Don't lease.

Adjusted Present Value

Adjusted Present Value (APV) is an alternative method of working out the wealth generated by a project. You are working out the NPV effectively.

There are two parts to any capital budgeting process. The first is establishing the relevant cash flows and the second is discounting these cash flows at the appropriate rate.

With WACC/NPV and APV the first part is exactly the same. The cash flows in each method are exactly the same (the ungeared free cash flows, FCF*). The difference arises when we come to the discounting part.

With WACC/NPV you discount the FCF* with the WACC. With APV you discount FCF* with the ungeared equity rate, *ru* and discount the interest tax shield with *rd*. These rates are given in the questions. With APV the debt level varies over the project life, whereas with WACC/NPV, there is a target capital structure (so the interest tax shield is constant).

The complicated part of APV is working out the interest tax shields for each year. A question may give you an initial debt level for the company and then give a repayment schedule. From that you can work out how much debt the company will have each year. And given the interest rate on the debt and the tax rate, you can then work out the interest tax shield for each year. Then you present value the tax shields.

The final APV will be;

APV = NPV of the ungeared cash flows + PV of interest tax shield

APV worked example

Noble plc has a project, the cash flows are -1000, 150, 250, 400, and 500. The unlevered cost of equity is 10%.

- What is the NPVand what would you do (this is also known as the base case NPV)?

- Noble plc proposes to use £600m of 8% debt to finance the project. They face a tax rate of 30%. The debt will be reduced by £150m at the end of each year.

  What is the APV of the project?

APV Worked example – solution

				Tax rate	*30%*		
				cost of equity	*10%*	*ru*	
	0	*1*	*2*	*3*	*4*		
Cash flows	-1000	150	250	400	500	**NPVu**	
Disc c/f	-1000	136.4	206.6	300.5	341.5	**-15.0**	*reject project*

PV of tax shield

Years 4
Debt £m 600
Interest rate 8%
Tax 30%

NPVu = NPV of ungeared firm
NPVf = PV of tax shield

	Year					
	1	*2*	*3*	*4*		
Debt level	600	450	300	150		
Interest	48	36	24	12		
Tax shield	14.4	10.8	7.2	3.6		
PVTS	13.33	9.26	5.72	2.65	**30.95**	**PV tax shield (NPVf)**

APV =	-15.0	+	30.95	=	**15.96**	***accept project***

APV = NPVu + NPVf = -15.0 + 30.95 = 15.96

The APV works out the base case NPV, as if the project was funded purely by equity. This is how attractive the project would look if there was no debt funding. Then the APV works out the present value of the interest tax shield. This shows the value benefit from the tax shield to the company. It might be just this that makes the project attractive.

The APV method highlights the benefit that borrowing brings to the project, splitting the result in two, showing the actual benefit of debt separately, whereas the WACC/NPV method just shows it as a single result.

Equivalent Annual Cost

EAC is used when you have to make a choice between competing pieces of equipment that have varying lives and different running costs. For example, Machine X costs £10,000 lasts 6 years and costs £3,000 per annum to run. Machine Y costs £8,000 lasts 4 years and costs £2,500 per annum to run. The interest rate is 10% which machine should be chosen?

The best method to use to solve this is the EAC method, there is an alternative, the common replacement year method, where you work out the present values for a period where the replacement cycles coincide. In this example it is after 12 years. If the machines lives were 6 and 8 years, the common period would be 24 years. Too many calculations.

The EAC gives a result that is the present value of the running costs, expressed as an annualised cost. This means the two machines can be compared directly on the basis of annual costs.

We first need to work out the present value of one operating cycle for reach machine, including the purchase price. We then divide that present value by the annuity factor for that machine life in years with the discount rate, for Machine X, it would be 6 years and 10%, look up Table 2 in the statistical tables at the back of the text (Present Value Annuity table). This gives the annualised running cost, known as EAC.

This is shown below;

Equivalent Annual Cost						Annuity factor
		nominal		1	0.909	0.909
	Year 0	ann cost	years	2	0.826	1.736
X	10000	3000	6	3	0.751	2.487
Y	8000	2500	4	4	0.683	3.170
	interest rate:	10%		5	0.621	3.791
				6	0.564	**4.355**
PV of X's cash flows =		23065.78	take initial cost + (annual cost * annuity factor)			
PV of Y's cash flows =		15924.66				
EAC for X =		**£5,296**				
EAC for Y =		**£5,024**				
		these are costs so are given a minus sign in the spreadsheet calculation				
		adjusting cheaper machine to cost				

This is a simple example. The cash flows just go straight into the calculation. A fuller example would have operating cash flows of the machine that should be put on an after tax basis. If a depreciation schedule is given for the machine, the depreciation tax shield should be included (a positive cash flow). These after tax cash flows would be netted off and a calculation very similar to the one above calculated.

International Project

You may be asked about the attractiveness of a foreign project for a particular company. For example, it could be a UK company wishing to undertake a project in the USA. The company will have a cost of capital based in the UK, but has project cash flows in US$. How do you evaluate this project?

There are two methods, the preferred method involves the calculation of a UK (domestic) WACC and adjusting that for the risk of doing business in the US (FORN). What you then have is a US WACC and US$ cash flows. These cash flows can be discounted using

the US discount rate. This gives a US$ NPV which can then be converted into £ using the current $/£ spot exchange rate.

The second method involves working out the forward exchange rates for each of the years of the project and then converting the US$ cash flows into £ and then discounting with a UK WACC. Companies prefer the first method, because they are worried about the unpredictability of exchange rates over time.

International Project – Worked example

Valvona plc. is a UK specialist retailer and is considering a project in the US. There is no similar US company to Valvona. Valvona has determined that the required return on equity for the project would be 12% in the UK. Valvona's target debt-equity ratio is 1: 2. The pre-tax cost of debt is 7%. The UK has a one year risk free rate of 2.75% and it is 1.75% in the US. Valvona's tax rate is 30% (assume US tax rate also 30%).

(a) What is the overall required rate of return (%) on the project denominated in US dollars?

(b) Assume that the above risk free interest rates hold for the next five years. The incremental cash flows for the next five years are $40m, $50m, $60m, $70m, and $50m respectively. The current spot rate is £1 = $1.4619 The initial outlay for the project is $180m, what is the NPV? (Do the calculation using both methods.)

International Project – Worked example – solution

The first thing to do is to work out the cost of capital in the UK and then adjust for the risk of operating in the US.

Cost of capital calculation:

		Weighted cost	After tax	
Cost of equity	12%	0.08	0.0800	
Cost of debt	7%	0.02	0.0163	
Tax rate	30%		0.0963	**UK cost of capital**
Equity weight	0.667			9.63%
Debt weight	0.333			

US cost of capital = $\frac{(1+\text{Foreign Interest Rate})}{(1+\text{Domestic Interest Rate})} * (1+ \text{UKwacc}) - 1$

US cost of capital = $\frac{(1+0.0175)}{(1+0.0275)} * (1+ 0.0963) - 1$

US cost of capital = 1.0857 - 1

US cost of capital = 0.0857 **8.57%**

Then you can lay out the cash flows in US$ and discount by 8.57% to get a US$ NPV. Convert that at the spot exchange rate to obtain the UK £ NPV.

Method 1: discount US$ cash flows by a US interest rate, then convert NPV into £

Cash flows in $			*US Discount rate =*	*8.57%*				
year	*0*	*1*	*2*	*3*	*4*	*5*		
Cash flow US$	-180	40	50	60	70	50	**US $ cash flows**	
US discount rate	*1*	*0.921*	*0.848*	*0.781*	*0.720*	*0.663*	US $	**UK £**
Disc cash flows	-180	36.84	42.42	46.89	50.39	33.15	$29.69	**£20.31**
							$NPV	**£NPV**

The second method involves calculating the forward exchange rates for the next five years, converting the US$ cash flows into £ and discounting by the UK WACC.

Forward exchange rate calculations:

	spot rate	*Forward x/r - (two methods of calculating forward rates)*					
year	*0*	*1*	*2*	*3*	*4*	*5*	
Exchange rate $/£1:	**1.4619**	1.448	1.434	1.420	1.406	1.392	*calc is 1.4619* ((1.0175)^n)/(1.0275)^n)*

1.0175 *US interest rate ie. (1 + FORN)*

1.0275 *UK interest rate ie. (1 + DOM)*

Int rate differential:	1.4619	1.448	1.434	1.420	1.406	1.392	*Calc is 1.4619* int rate differential for yr1*
0.9903							*then each fwd rate * int rate differential thereafter.*

Method 2: Convert US$ cash flows into £ using spot & fwd rates for years 0 - 5, then discount with UK discount rate.

Cash flows in £			*UK Discount rate =*	*9.63%*			
year	*0*	*1*	*2*	*3*	*4*	*5*	
Cash flow £	-123.13	27.63	34.88	42.26	49.79	35.92	**UK £ cash flows**
UK discount rate	*1*	*0.912*	*0.832*	*0.759*	*0.692*	*0.631*	*discount factor*
Disc cash flows	-123.13	25.20	29.02	32.07	34.47	22.68	**£20.31**
							£NPV