MACQUARIE UNIVERSITY
SYDNEY ~ AUSTRALIA

Financial Management
ACCG253

Lecture 4
Cash Flows and Project Valuation

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Cash Flows and Timing

In finance, the timing of cash flows is critical.

$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) or Earnings Before Interest and Tax (EBIT) are smoothed using accrual methods. This messes up the timing!

For valuation, we calculate cash flows by adjusting accounting data for timing differences.

Example: Cash Flows and Timing

When a building is bought for $100k now, an accountant would allocate a yearly expense over its 20 year life. The depreciation expense would be $5k per year.

But taking timing into account, a cost of $100k now is much more than $5k per year for 20 years.

Say we could keep the $100k and only pay $5k per year. Then the $100k can be put in the bank and after 20 years of paying $5k we would have a lot of interest left over which we could keep!

In fact, if interest rates were 5% pa then the yearly interest payments would cover the $5k payments each year, so the $100k in the bank would be left for us after 20 years.

The timing of cash flows is very important.

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

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

Where: NI = Net Income, Rev = Revenue,

$COGS$ = Cost of Goods Sold, $Depr$ = 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%.

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

$$= (822 - 717 - 24 - 11) \times (1 - 0.3)$$

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

EBIT and NI

$$\boldsymbol{EBIT = Rev - COGS - Depr}$$

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

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

Let's check that it works for Just Group:

$$EBIT = Rev - COGS - Depr$$

$$= 822 - 717 - 24$$

$$= 81$$

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

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

Net Capital Expenditure (CapEx)

Net Capital Expenditure (CapEx) is the change in capital expenditure. Note that a positive change is an increase.

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

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

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

where 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. So:

$$NFA = GFA - Accumulated\ Depreciation$$

Increase in Net Working Capital (ΔNWC)

Net Working Capital (NWC) is current assets (CA) less current liabilities (CL):

$$NWC = CA - CL$$

The change in Net Working Capital (ΔNWC) is the increase in the stock of NWC:

$$\Delta NWC = \quad NWC_{now} \quad - \quad NWC_{before}$$

$$\Delta NWC = (CA_{now} - CL_{now}) - (CA_{before} - CL_{before})$$

Cash Flow From Assets (CFFA)

$$\boldsymbol{CFFA = NI + Depr - CapEx - \Delta NWC + IntExp}$$

$$\boldsymbol{CFFA = \quad CF\ to\ equity\ holders \quad + CF\ to\ creditors}$$

CFFA is the cash flow from the assets of the firm, assets as in

A = L + OE.

Since it is a cash flow it excludes accrual items such as depreciation on buildings for example, but includes the capital spending on the buildings.

CFFA excludes financing cash flows such as interest and dividend payments. But CFFA is equal to those financing cash flows which consist of the cash flow to creditors (owners of L) and equity holders (owners of equity, OE).

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

$$CFFA = NI + Depr - CapEx - \Delta NWC + IntExp$$

CFFA equals Net income…

- Plus Depreciation, because it is subtracted in NI . We reverse it because depreciation is not a cash flow.
- Less Net Capital Expenditure, since the cash flow from buying buildings must be subtracted. Net Capital Expenditure is the change in Gross Fixed Assets. In other words, cash spent on buying fixed assets less cash received from selling fixed assets.
- Less the increase in Net Working Capital.
- Plus Interest Expense, because it is subtracted in NI . We reverse it because Interest Expense is a financing cash flow.

Why Dividends are not added or subtracted from CFFA

Dividends are a financing cash flow just like interest expense.

Dividends are not included in net income. Therefore they can be safely ignored when calculating CFFA.

On the other hand, interest expense is subtracted from net income, that's why it must be added back in CFFA to cancel it out.

When we value the assets of the firm, we will discount the cash flow from the assets. We don't want to mix up the business assets' cash flows with cash flows to the debt or equity holders which are the interest and dividend payments.

Why the Increase in NWC is subtracted from CFFA

NWC will increase when, say, inventories bulge, or more money ends up in the cash register, or when any other current asset increases (or current liability decreases).

Increases in the amount of cash sitting in the register is not an expense, but it is money that could be in the bank earning interest. Similarly for inventory sitting around. Inventory is only expensed when sold, but the money spent on unsold idle inventory could have been put in the bank.

Therefore any increase in net working capital needs to be subtracted since it is a cash flow not included in NI.

CFFA and CF to Equity and Debt Holders

Remember A=L+OE, so looking at it from the assets side:

$$CFFA = NI + Depr - CapEx - \Delta NWC + IntExp$$

Looking at it from the L+OE side:

$$CFFA = CF\ to\ creditors + CF\ to\ equity\ holders$$

The cash flow to creditors is:

$$\begin{aligned} \begin{matrix} CF\ to\ debt \\ holders \\ (creditors) \end{matrix} &= \begin{matrix} Interest \\ paid \end{matrix} + \begin{matrix} Principal \\ paid \end{matrix} - \begin{matrix} Price\ of\ new \\ debt\ issued \end{matrix} \\ &= \begin{matrix} Interest \\ paid \end{matrix} - \begin{matrix} Increase\ in \\ debt\ outstanding \end{matrix} \end{aligned}$$

The cash flow to equity holders is:

$$\begin{aligned} \text{CF to equity holders} &= \text{Dividends paid} + \text{Equity repurchased} - \text{Equity issued} \\ &= \text{Dividends paid} - \text{Increase in equity outstanding} \end{aligned}$$

Calculation Example: CFFA 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 1: Find the CFFA using the income statement and balance sheets

Assume that non-current assets is completely made up of Net Fixed Assets.

Answer:

$$CFFA = NI + Depr - CapEx\ -\ \Delta NWC + IntExp$$

We need to calculate $CapEx$ and ΔNWC from the changes in the balance sheet.

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

$$CapEx = 195 - 178 + 24$$

$$= 41, \text{ so net capital expenditure rose over the year.}$$

$$\Delta NWC = (CA_{now} - CL_{now}) - (CA_{before} - CL_{before})$$

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

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

$$CFFA = NI + Depr - CapEx \; - \; \Delta NWC + IntExp$$

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

$$= 192$$

Question 2: Find the dividends paid over 2008. You may assume:

- Non-current liabilities is all comprised of long term debt.
- No new equity was raised, but $24m of equity was bought back over the year.

Answer:

$$CFFA = CF\ to\ equity\ holders + CF\ to\ creditors$$

$$\begin{aligned}
\text{CF to debt holders (creditors)} &= \text{Interest paid} + \text{Principal paid} - \text{Price of new debt issued} \\
&= \text{Interest paid} - \text{Increase in debt outstanding} \\
&= \text{Interest paid} - \left(Debt_{now} - Debt_{before}\right) \\
&= 11 - (22 - 134) \\
&= 123
\end{aligned}$$

$$CFFA = \begin{matrix} CF\ to\ equity \\ holders \end{matrix} + \begin{matrix} CF\ to\ debt \\ holders \end{matrix}$$

$$192 = \begin{matrix} CF\ to\ equity \\ holders \end{matrix} + 123$$

$$\begin{matrix} CF\ to\ equity \\ holders \end{matrix} = 69$$

$$\begin{matrix} CF\ to\ equity \\ holders \end{matrix} = \begin{matrix} Dividends \\ paid \end{matrix} + \begin{matrix} Equity \\ repurchased \end{matrix} - \begin{matrix} Equity \\ issued \end{matrix}$$

$$69 = \begin{matrix} Dividends \\ paid \end{matrix} + 24 - 0$$

$$\begin{matrix} Dividends \\ paid \end{matrix} = 45$$

Equation Summary

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

$$EBIT = Rev - COGS - Depr$$

$$CFFA = NI + Depr - CapEx - \Delta NWC + IntExp$$

$$CFFA = \text{CF to equity holders} + \text{CF to creditors}$$

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

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

$$\Delta NWC = (CA_{now} - CL_{now}) - (CA_{before} - CL_{before})$$

$$CFFA = CF \text{ to equity holders} + CF \text{ to creditors}$$

$$\begin{aligned}
\text{CF to debt holders (creditors)} &= \text{Interest paid} + \text{Principal paid} - \text{Price of new debt issued} \\
&= \text{Interest paid} - \text{Increase in debt outstanding} \\
&= \text{Interest paid} - \left(Debt_{now} - Debt_{before}\right) \\
\text{CF to equity holders} &= \text{Dividends paid} + \text{Equity repurchased} - \text{Equity issued} \\
&= \text{Dividends paid} - \text{Increase in equity outstanding}
\end{aligned}$$

CFFA is often called 'Firm Free Cash Flow' (FFCF). Cash flow to equity holders is often called 'Equity Free Cash Flow' (EFCF).

Book Values

Book values are accounting figures usually taken from a balance sheet. Since most balance sheet items are recorded at historical cost, book values are:

- accurate, but
- old, stale and out of date.

Market Values

Market value is the current price that an asset is actually traded at. If the asset was sold, then the market value would be the cash flow received. Market values are:

- timely and useful but
- can be difficult to measure, especially if the asset is illiquid (doesn't trade often). Also,
- if market price can't be observed, then estimation is needed which is inaccurate.

Book Values, Market Values and the Accounting Identity

The accounting identity says that the book value of assets (A) equals the book value of liabilities (L) plus the book value of owners equity (OE):

$$A = L + OE$$

The finance version is very similar, but it uses market values instead of book values. The market value of assets (V) equals the market value of debt (D) plus the market value of equity (E):

$$V = D + E$$

Book Value of Equity (OE)

$$OE = Contributed\ equity + retained\ profits + reserves$$

The book value of equity (OE) is 'Contributed Equity' plus 'Retained Profits' plus 'Reserves'.

Contributed Equity is the amount of shares first bought when the company floated or had its IPO (Initial Public Offering).

Retained Profits is the accumulation of net income less dividends since the IPO.

Reserves include items such as the Asset Revaluation Reserve and Foreign Currency Translation Reserve.

Market Value of Equity (E)

$$E = share\ price \times number\ of\ shares\ outstanding$$

The market value of equity (E) is the share price trading on the ASX multiplied by the total number of shares outstanding.

The market value of equity is also called the market capitalisation of equity or just 'market cap'.

Equity Value of Just Jeans Group

Just Jeans' share price was about $4.00 in July 2008 and there were around 201 million shares outstanding.

Just Jeans' market value of equity was:

$$E = share\ price \times number\ of\ shares\ outstanding$$

$$= \$4 \times 201m = \$804m$$

From its detailed financial statements, book equity was:

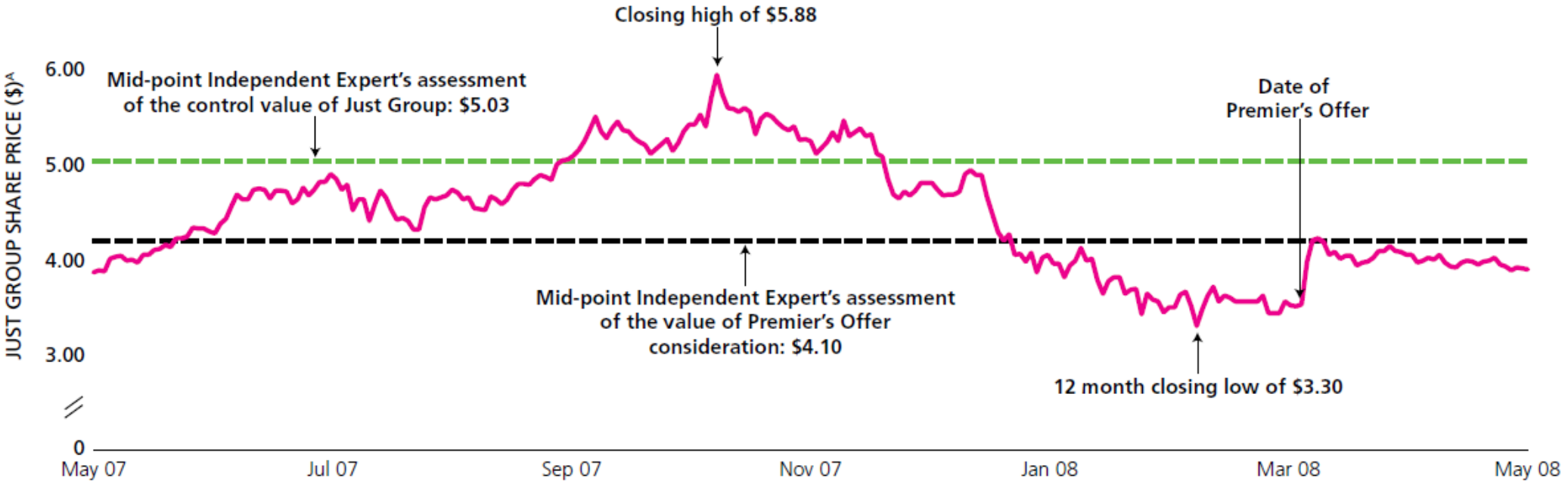
$$OE = Contributed\ equity + retained\ profits + reserves$$

$$= 14 + -8 + 51 = \$57m$$

Equity Value of Just Jeans Group - Takeover

In March 2008 Premier Investments (PMV) launched a hostile take-over bid for Just Jeans, offering a price of around $4.10 per share. Prior to the takeover bid the Just Jeans share price was trading at around $3.30.

In September 2008 PMV completed the takeover. They paid around $4.25 per share.



Source: IRESS

Projects with Different Lives

How do we choose between mutually exclusive projects when one ends before the other? For example, there are two machines that do the same job and the expensive machine lasts for longer than the cheap one. Which do you choose?

Wrong method 1: Choose the machine with the lowest present value of costs. Wrong because obviously the cheap machine will always appear better even though it lasts for less time.

Wrong method 2: Divide each machine's present value of costs by the number of years it lasts for. Wrong because it ignores the time value of money, it is an accounting way of thinking. It is spreading the present value of costs, which is an amount now, across years in the future which should actually be grown to account for the time value of money.

Equivalent Annual Cost (EAC)

Correct method: Find the present value of each machine's costs. Then calculate the Equivalent Annual Cost (EAC) using the annuity formula which spreads the costs into equal payments over the life of each machine, taking timing into account. Choose the machine with the lowest EAC.

This method implicitly assumes that whichever machine the firm chooses, it will keep buying identical machines to replace the previous one forever. This is known as 'constant chain of replacement'.

$$PV(annuity) = V_0 = \frac{C_1}{r}\left(1 - \frac{1}{(1+r)^T}\right)$$

$$V_0 = C_1 \times \frac{\left(1 - \frac{1}{(1+r)^T}\right)}{r}$$

$$V_0 = C_1 \times AnnuityFactor(r, T)$$

So V_0 will be the NPV of all future costs, C_1 will be the equivalent annual cost, and the annuity factor which depends on the effective discount rate per period r and the number of periods T.

$$\text{NPV(all costs)} = \text{EAC} \times \text{AnnuityFactor(r, T)}$$

$$\text{EAC} = \frac{\text{NPV(all costs)}}{\text{AnnuityFactor(r, T)}} = \frac{\text{V}_0}{\left(\frac{\left(1 - \frac{1}{(1+\text{r})^{\text{T}}}\right)}{\text{r}}\right)}$$

Calculation Example: EAC

Question: You estimate the following cash flows from buying, maintaining and selling two different old cars. Which one is the better choice if the discount rate is 10%? Ignore taxes and assume 'constant chain of replacement'.

	Cash Flows ($)	
Time	Toyota Camry	Holden Commodore
0	-1800	-3500
1	-500	-400
2	-500	-400
3	-500	-400
4	-500	-400
5	+50	-400
6		-400
7		+1500

Answer:

First find the total NPV of each car's costs:

$$V_{0,\text{toyota}} = -1800 - \frac{500}{0.1}\left(1 - \frac{1}{(1+0.1)^4}\right) + \frac{50}{(1+0.1)^5}$$

$$= -3{,}353.90$$

$$V_{0,\text{holden}} = -3500 - \frac{400}{0.1}\left(1 - \frac{1}{(1+0.1)^6}\right) + \frac{1500}{(1+0.1)^7}$$

$$= -4{,}472.40$$

Now find the equivalent annual costs.

For the Toyota:

$$-3{,}353.90 = \frac{C_{1,\text{toyota}}}{0.1}\left(1 - \frac{1}{(1+0.1)^5}\right)$$

$$C_{1,\text{toyota}} = -884.75$$

So 884.75 is the toyota's equivalent annual cost.

For the Holden:

$$-4{,}472.40 = \frac{C_{1,\text{holden}}}{0.1}\left(1 - \frac{1}{(1+0.1)^7}\right)$$

$$C_{1,\text{holden}} = -918.65$$

So 918.65 is the holden's equivalent annual cost.

Choose the Toyota since it has a lower equivalent annual cost.

Capital Budgeting / Project Valuation: Which Cash Flows to Include

The cash flows that should be included in a capital budgeting analysis are those that will occur **only** if the project is accepted. These cash flows are called **incremental cash flows**.

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

Project Valuation: Cash Flows to Add, Subtract and Ignore

- Sunk costs should be ignored.
  - unrecoverable costs incurred in the past.
  - for example, a marketing survey that has already been completed to gauge consumer interest in a proposed new product.
- Opportunity costs should be subtracted.
  - cost of next-best alternative forgone.
- Side effects
  - Positive side effects are benefits to other projects, should be added.

- Negative side effects are costs to other projects, should be subtracted

- Increases in net working capital should be subtracted.
- Financing costs should be ignored.
  - Interest and dividend payments
  - The required rate of return used to discount cash flows incorporates both the cost of equity and debt. Avoid double counting financing charges in the cash flows.
- Tax effects
  - Corporate tax on profits, taxed at a flat (constant) rate of 30% in Australia.
  - Must remember to include the effect of capital gains tax (CGT) when assets are sold for a capital gain or loss.

Calculation Example: Project Valuation

Question: A firm is considering the following project which will produce a new product line. Should it proceed with the project?

Project Data	
Project life	10 yrs
Initial investment in factory that lasts for 10 yrs	$10m
Depreciation of factory per year	$1m
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
Tax rate	30%
Discount rate	10%

Notes:

- The firm's inventories (current assets) are expected to grow by $0.1m per year due to the project, but the project will not affect the firm's other current assets and liabilities. Assume that the cost of the investment in inventories is incurred at the end of each year. At the end of the project, all inventory can be sold at cost.
- 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.

Formulas:

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

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

$$\Delta NWC = (CA_{now} - CL_{now}) - (CA_{before} - CL_{before})$$

$$CFFA = NI + Depr - CapEx - \Delta NWC + IntExp$$

$$NPV = PV(CFFA)$$

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 ($0.5\text{m} \times (1 - t_c)$) from yearly CFFA 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.

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

$$= (0.9m \times (10 - 6) - (1.5m + 0.5m) - 1m - 0) \times (1 - 0.3)$$

$$= \$0.42m$$

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

$$CFFA = NI + Depr - CapEx - \Delta NWC + IntExp$$

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

The increase in Net Working Capital (ΔNWC) will be \$0.1m at the end of every year due to the yearly increases in inventories. There is

no initial increase in NWC, but at the end of the project NWC will fall by \$0.9m (9yrs × \$0.1m/yr), which is a negative increase.

$$\text{CFFA}_{t=1,2,\ldots 9} = \text{NI} + \text{Depr} - \text{CapEx} - \Delta\text{NWC} + \text{IntExp}$$

$$= 0.42\text{m} + 1\text{m} - 0 - 0.1\text{m} + 0$$

$$= 1.32\text{m each year}$$

$$\text{CFFA}_{t=0} = \text{NI} + \text{Depr} - \text{CapEx} - \Delta\text{NWC} + \text{IntExp}$$

$$= 0 + 0 - 10\text{m} - 0 + 0$$

$$= -10\text{m}$$

$$\text{CFFA}_{t=10} = \text{NI} + \text{Depr} - \text{CapEx} - \Delta\text{NWC} + \text{IntExp}$$

$$= 0.42\text{m} + 1\text{m} - 0 - (-9 \times 0.1\text{m}) + 0$$

$$= 2.32\text{m}$$

$$\text{NPV} = \text{PV}(\text{CFFA}_{t=0}) + \text{PV}\left(\text{CFFA}_{t=1,2,\ldots 9}\right) + \text{PV}(\text{CFFA}_{t=10})$$

$$= \text{CFFA}_{t=0} + \text{CFFA}_{t=1,2,\ldots 10} \times \frac{1}{r}\left(1 - \frac{1}{(1+r)^T}\right) + \frac{\text{CFFA}_{t=10}}{(1+r)^T}$$

$$= -10\text{m} + 1.32\text{m} \times \frac{1}{0.1}\left(1 - \frac{1}{(1+0.1)^9}\right) + \frac{2.32\text{m}}{(1+0.1)^{10}}$$

$$= -10\text{m} + 7.6019\text{m} + 0.8945\text{m}$$

$$= -1.5036\text{m}$$

Since the NPV is negative, reject the project.

