Forecasting Cashflows in Capital Budgeting

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Incremental Cashflows

- The objective of a manager is to maximize NPV of cash flows and is derived from the firm's objective to maximize firm value.

- Earnings flows do not translate into spendable resources though they will resemble cash flows in the long run.

- Furthermore, in determining whether to accept a project or not, we need to look at the extent to which it *adds* to the value of the firm.

- In other words, we need to look at "incremental" cash flows.
  - The devil is in the details of how one defines "incremental".

Incremental Earnings Forecast for HomeNet

- Consider the development of a wireless networking appliance, called HomeNet by Linksys.
- The firm forecasts annual sales of 100,000 units for 4 years at a price of $260, with production cost of $110 per unit.
- Other details are as given below (note assumed treatment of depreciation):

	Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)							
1 Sales		—	26,000	26,000	26,000	26,000	—
2 Cost of Goods Sold		—	(11,000)	(11,000)	(11,000)	(11,000)	—
3 **Gross Profit**		—	15,000	15,000	15,000	15,000	—
4 Selling, General, and Administrative		—	(2,800)	(2,800)	(2,800)	(2,800)	—
5 Research and Development		(15,000)	—	—	—	—	—
6 Depreciation		—	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT**		(15,000)	10,700	10,700	10,700	10,700	(1,500)
8 Income Tax at 40%		6,000	(4,280)	(4,280)	(4,280)	(4,280)	600
9 **Unlevered Net Income**		(9,000)	6,420	6,420	6,420	6,420	(900)

Project Details

- Unlevered Net Income is income from the project if it were financed entirely with equity (sometimes referred to as Net Operating Income). Hence, interest expense is <u>not</u> taken into account in cash flows. On the other hand, tax advantages of debt (interest deductibility) are also not considered.
  - Financing costs are instead generally considered in the cost of capital discount rate.
- SG&A expenses are estimated to be about $2.8m per year; however, these expenses are fixed and do not vary with the level of production.
  - Is this true in the real world?
- The project requires investment of $7.5m. in equipment to be depreciated straight line over its estimated life of 5 years. Even though the project life is 4 years, we'll assume that the equipment is not recoverable after 4 years and is depreciated over the entire 5 years. Else, after 4 years, the equipment would have been worth $7.5/5 = $1.5m book value.
- The project requires initial R&D expenditure of $15m.
- The tax rate is assumed to be 40% (considering both federal and state taxes).

Adjustments for Externalities

- Recall that we need incremental cash flows; hence, we need to adjust our figures for externalities.
- Externalities are indirect effects of the project that may increase or decrease the profits of other business activities of the firm. Here are some examples.
- If the introduction of the new product would lead to increased sales in other areas of the firm, that would be a positive externality. In HomeNet's case, we have the following negative externality.
- 25% of HomeNet's sales would come from customers who would otherwise have purchased an existing Linksys router, which sells for $100.
- Hence, the amount of cannibalization of revenue can be computed as 0.25(100,000)(100) = $2.5m. Net incremental sales are $26m. - $2.5m. or $23.5m.
- Cost of producing the existing router is $60. Hence total COGS will be lower by 0.25(100,000)(60) = $1.5m. Net incremental COGS is $11m. - $1.5m. = $9.5m.
- In terms of presentation, it's often better to show cannibalization or other externalities as a separate line item.

Opportunity Costs

- The lab will be housed in an existing facility, which would have been rented out for $200,000/yr. otherwise. Using it for HomeNet will thus entail an opportunity cost of an equal amount.
  - If you didn't know what the rental value was, what alternative approach could be used for this opportunity cost?
- Consequently, the SG&A is now $2.8m. + $0.2m. = $3m. per yr.
- Should there be other opportunity costs, for example, that are associated with SG&A?
- Opportunity costs usually result in estimated cost allocations and are often a source of contention between Finance and Operating people. In the long run, there are no fixed costs.

Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)						
1 Sales	–	23,500	23,500	23,500	23,500	–
2 Cost of Goods Sold	–	(9,500)	(9,500)	(9,500)	(9,500)	–
3 **Gross Profit**	–	14,000	14,000	14,000	14,000	–
4 Selling, General, and Administrative	–	(3,000)	(3,000)	(3,000)	(3,000)	–
5 Research and Development	(15,000)	–	–	–	–	–
6 Depreciation	–	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 EBIT	(15,000)	9,500	9,500	9,500	9,500	(1,500)
8 Income Tax at 40%	6,000	(3,800)	(3,800)	(3,800)	(3,800)	600
9 **Unlevered Net Income**	(9,000)	5,700	5,700	5,700	5,700	(900)

Change in Net Working Capital

- In order to generate the cash flows, the firm needs to lay out $7.5m in capital expenditures at the very outset, as we noted before.
- Furthermore, the firm needs to keep resources on hand to fund working capital.
- That is, the firm might need to provide credit to its customers. Of course, part of this can be offset from credit that the firm's suppliers provide.
- The firm might also need to keep cash on hand to meet unexpected needs.
- Furthermore, the firm may need to keep inventory on hand; i.e. firm may need to produce goods that will not be sold in the same period. This will involve a cash outflow that will show up as inventory.
- Remember that COGS only includes the cost of producing goods that are actually sold in the current period and does not reflect costs of goods that are in inventory.
- These cash requirements are computed by taking the change in Net Working Capital.

Change in Net Working Capital

- Suppose customers take 54.75 days to pay on average, then accounts receivable will consist of 54.75 days worth of sales (assuming that sales are spread evenly over the year). This works out to $(54.75/365)(23.5)$ or 15% of $23.5m. = $3.525m.

- Similarly, assuming that the firm takes about 54.75 days on average to pay its bills, payables each period are also expected to be 15% of COGS that period.

- If we were to assume zero cash requirements and just-in-time inventory practices (a bit unrealistically), we find that Net Working Capital works out to $2.1m.

- This requires an infusion of $2.1m which is required only at the end of yr. 1, while at the end of the project life, the $2100 would be recovered and then represents a positive cash flow. Our problem assumes that the $ 2.1m can be withdrawn only at the end of year 5, instead of when the project ends in year 4. The numbers in the table reflect this.

- In general, the yearly <u>change</u> in Net Working Capital (not presented in table) represents the cash flow effect.

Year	0	1	2	3	4	5
Net Working Capital Forecast ($000s)						
1 Cash Requirements	—	—	—	—	—	—
2 Inventory	—	—	—	—	—	—
3 Receivables (15% of Sales)	—	3,525	3,525	3,525	3,525	—
4 Payables (15% of COGS)	—	(1,425)	(1,425)	(1,425)	(1,425)	—
5 Net Working Capital	—	2,100	2,100	2,100	2,100	—

Noncash expenditures

- We also have to adjust Earnings for expenses that do not actually represent cash flows.
- Depreciation represents such an expense, and hence we add it back.
- That is, from a cash flow point of view, buying the equipment initially involves a cash outflow of $7.5m., followed by a cash inflow of whatever salvage value the equipment would have at the end. Thus, if the equipment could be sold for $1.5m after 4 years, there would be an inflow of $1.5 less applicable taxes at the end of 4 years. In our example, there is no final inflow.
- The assumed depreciation "expense" each period, therefore, has to be undone. In this sense, depreciation is a "fake" expenditure because it does not really reflect a cash outflow each period.
- However, there is a real cash flow implication of depreciation. This is because tax laws generally require payment of taxes only on EBIT (defined according to tax accounting rules). Depreciation is an expense that is deductible for tax purposes.
- Hence, depreciation reduces taxable income and taxes each period.
- We take this directly taken into account by computing (Unlevered) Net Income, which includes the tax benefit of depreciation and then adding back the entire depreciation amount to income to arrive at cash flow.
  - Which depreciation figures should one use: book or tax?
- Normal accounting convention includes depreciation in cost and expense categories and not as separate line item. One should be careful when estimating allocation ratios.
  - Full absorption vs. direct costing.

Earnings to Cash flows

Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)						
1 Sales	—	23,500	23,500	23,500	23,500	—
2 Cost of Goods Sold	—	(9,500)	(9,500)	(9,500)	(9,500)	—
3 **Gross Profit**	—	14,000	14,000	14,000	14,000	—
4 Selling, General, and Administrative	—	(3,000)	(3,000)	(3,000)	(3,000)	—
5 Research and Development	(15,000)	—	—	—	—	—
6 Depreciation	—	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT**	(15,000)	9,500	9,500	9,500	9,500	(1,500)
8 Income Tax at 40%	6,000	(3,800)	(3,800)	(3,800)	(3,800)	600
9 **Unlevered Net Income**	**(9,000)**	**5,700**	**5,700**	**5,700**	**5,700**	**(900)**
Free Cash Flow ($000s)						
10 Plus: Depreciation	—	1,500	1,500	1,500	1,500	1,500
11 Less: Capital Expenditures	(7,500)	—	—	—	—	—
12 Less: Increases in NWC	—	(2,100)	—	—	—	2,100
13 **Free Cash Flow**	**(16,500)**	**5,100**	**7,200**	**7,200**	**7,200**	**2,700**

General Formulae

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}}$$
$$+ \text{Depreciation} - \text{CapEx} - \Delta NWC$$

$$\Delta NWC_t = NWC_t - NWC_{t-1}$$

$$\text{Net Working Capital} = \text{Current Assets} - \text{Current Liabilities}$$
$$= \text{Cash} + \text{Inventory} + \text{Receivables} - \text{Payables}$$

- Keep in mind that the formulas given above for Unlevered Net Income, Current Assets and Current Liabilities are not complete – they only include the most common components.

Converting Cashflows to Present Value

- To compute HomeNet's NPV, we must discount its free cash flow at the appropriate cost of capital, i.e. the expected return that investors could earn on their best alternative investment with similar risk and maturity.

- Here we assume that this rate is 12%.

$$PV(FCF_t) = \frac{FCF_t}{(1 + r)^t} = FCF_t \times \underbrace{\frac{1}{(1 + r)^t}}_{t = \text{year discount factor}}$$

	Year	0	1	2	3	4	5
Net Present Value ($000s)							
1 Free Cash Flow		(16,500)	5,100	7,200	7,200	7,200	2,700
2 Project Cost of Capital	12%						
3 Discount Factor		1.000	0.893	0.797	0.712	0.636	0.567
4 PV of Free Cash Flow		(16,500)	4,554	5,740	5,125	4,576	1.532
5 NPV		5,027					

Other issues

- Any non-cash expenses, such as amortization, should be added back in computing cash flow from Net Income.
- If there is a salvage value, the tax implications should be taken into account – specifically, the payment of capital gains on the sale.
- If the project is expected to continue for a long time, the manager may forecast cash flows in a more detailed fashion for a shorter period and then assume that cash flows will grow at a forecasted rate from then on. This is because the manager is likely to have little information about the distant future.
- The tax rate used should be the marginal tax rate relevant for the company as a whole. Thus, if the company is making losses elsewhere, it may not pay taxes on the income from the project under consideration. On the other hand, if the company has income elsewhere, losses on the project in a particular year may result in tax savings.
  - What if you have multiple projects that exceed the tax loss carryforwards?
- More often than not in multinational companies, projects entail supply chains with income earned in different countries. One should either use an average global tax rate or decompose project income into each country where the income is earned and tax effect each country's income at its tax rate.
- Sunk costs can also be a source of controversy:
 - Should you consider sunk costs in pricing decisions?

Sensitivity Analysis

- It's important to do break-even analysis on the parameters – viz., at what level of the parameter will the project no longer be profitable?

- This can be done on a parameter-by-parameter basis, e.g. for cost of capital, units sold per year, sale price per unit, cost of goods sold per unit, etc.

- The likelihood of the break-even value not being achieved should then be evaluated to get a feel for the uncertainty and risk involved.

- Alternatively, the impact on NPV of best and worst case assumptions can be examined.

  - One can also rank the percentage change in NPV for a +/- 10% change in each parameter to determine which are the most sensitive parameters because more effort should be expended to estimate these more accurately.

NPV Under Best- and Worst-Case Parameter Assumptions

Green bars show the change in NPV under the best-case assumption for each parameter; red bars show the change under the worst-case assumption. Also shown are the break-even levels for each parameter. Under the initial assumptions, HomeNet's NPV is $5.0 million.
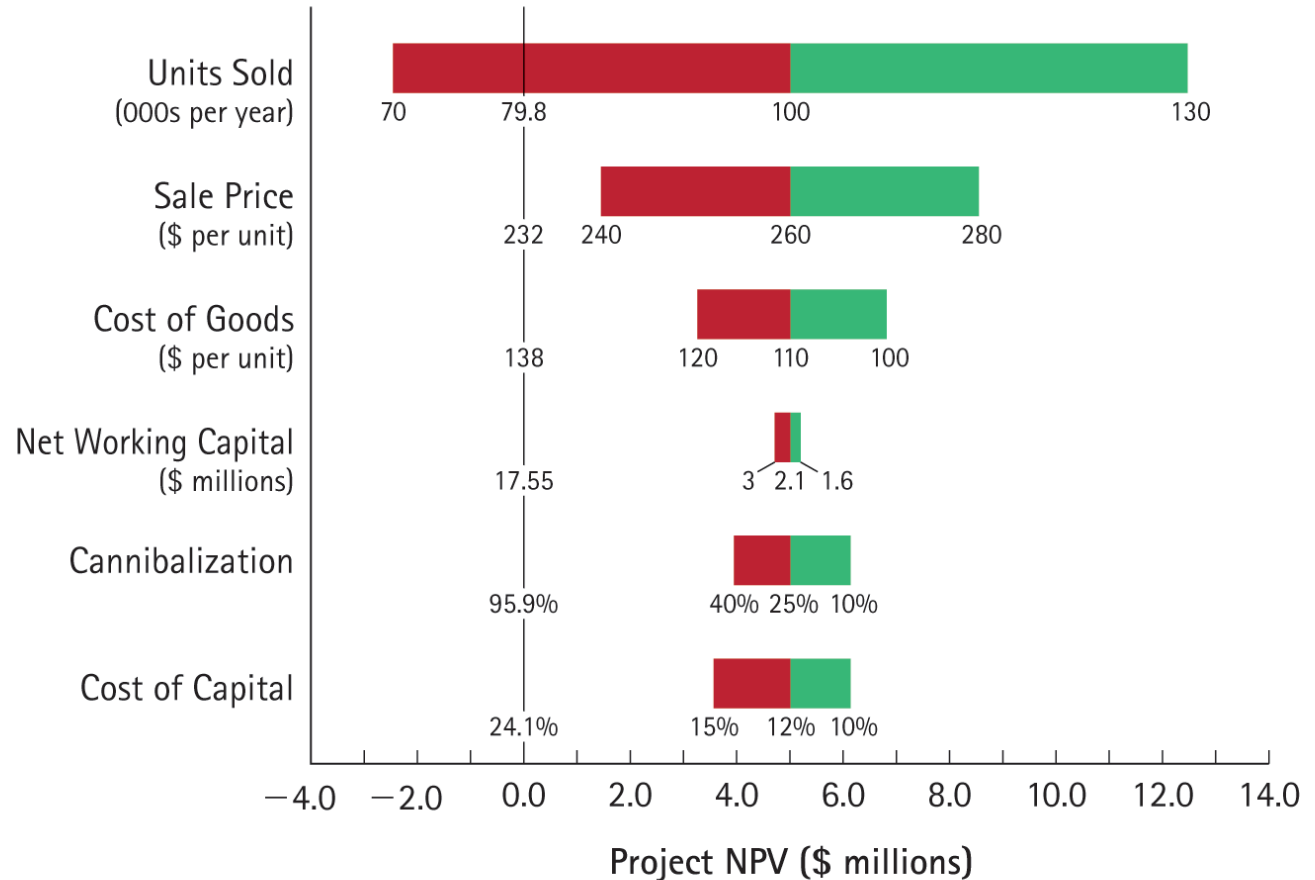
Scenario Analysis

- We may also want to change several parameter values simultaneously.
- For example, if we assume a higher sales price of $275, then it makes sense to assume a lower level of sales, rather than to keep the level of sales constant.
- The table below shows NPV values for three different combinations of price and sales.
- This can be done for other combinations of parameters, as well.
- An even more sophisticated approach is to use Monte Carlo simulation whereby probabilities are estimated for different outcomes of parameters and cash flows to generate a probability distribution of NPV.

Strategy	Sale Price ($/unit)	Expected Units Sold (thousands)	NPV ($ thousands)
Current strategy	260	100	5027
Price reduction	245	110	4582
Price increase	275	90	4937

Price-Volume Combinations with Same NPV

Another way of analyzing the data is to see what combinations of parameters will yield the same NPV.

The manager can use this information to decide on the optimal action, taking into account other strategic considerations that may not have been explicitly included in the analysis.