

Cash Flows

1

Outline

1. Five Steps of Project Valuation
2. What Are Cash Flows?
3. Basic Rules
 - I. Investments, Recoveries, Revenues & Costs
 - II. Sunk Costs and Opportunity Costs
 - III. Depreciation
 - IV. Book Gains and Book Losses
 - V. Net Working Capital

2

1. Five Steps of Project Valuation

- Step 1: Determine the project horizon.
 - The project is over if there are no more cash flows. For example, if a plant produces for five years and is sold in year six, the project lasts six years, not five.
 - If a project has an infinite life, we choose a time T (e.g., year 10) and estimate the cash flows between now and time T on a year-by-year basis (or, if applicable, as an annuity). All cash flows after time T are included in the project's "terminal value", which is typically the present value of a perpetuity or growing perpetuity at time T.

3

- Step 2: Estimate the project's cash flows.
- Step 3: Find the right opportunity cost of capital.
- Step 4: Compute the NPV by discounting the cash flows at the opportunity cost of capital.
- Step 5: Perform a sensitivity analysis.
 - Question your assumptions underlying the cash flows.
 - Use a range of different discount rates.

4

2. What Are Cash Flows?

1. If cash flows are uncertain, use expected cash flows.
 - Do not use the most likely cash flow.
 - Do not use a conservative estimate (e.g., the lowest cash flow).
2. Use only incremental cash flows, i.e., those that occur on the margin because you invest in the project.
 - Estimate all marginal changes that occur because the project is undertaken relative to the “base case” in which it is not undertaken.
 - Include all externalities on other parts of the firm.

5

3. Use only after-tax cash flows. Tax payments go to the IRS, not to investors.
4. Use only non-financial (or “unlevered”) cash flows assuming the firm is all-equity financed.
 - Do not include interest payments.

6

3. Basic Rules

I. Investments and Recoveries

- Investments are non-taxable capital expenditures. We typically assume they occur at the beginning of a period.
- Recoveries include the sale of equipment, machines, etc. The (expected) sales value is called "salvage value". The salvage value is not taxable unless it entails a book gain or book loss (see page 13).

7

II. Sunk Costs and Opportunity Costs

- Sunk costs are expenditures that have already been incurred. They are irreversible and must not be included in the cash flows.
- Opportunity costs are forgone cash flows that are lost if the project is undertaken. For example, if a firm already owns the land on which it builds a plant, the forgone (after-tax) rental income or revenue from (not) selling the land (whichever is higher) constitutes an opportunity cost.
- Another example of opportunity cost is when you "cannibalize" profits from other parts of your business. Ask yourself what cash flows you would lose relative to the "base case" in which you don't undertake the project.

8

III. Depreciation

- Depreciation itself is not a cash flow but the tax savings due to the tax deductibility of depreciation are ("tax shield").
- Use the depreciation schedule for tax reporting, not the one for financial reporting. The current rules for tax depreciation were set by the Tax Reform Act of 1986, which established the Modified Accelerated Cost Recovery System (MACRS).

9

- Two methods to account for depreciation:
 - Method 1: Compute the after-tax value of EBIT (revenues minus costs minus depreciation) and add back the depreciation.
 - Method 2: Compute the after-tax value of EBITDA (revenues minus costs) and add the depreciation tax shield ($= T \times \text{depreciation}$, where T = corporate tax rate).
- The two methods lead to the same outcome.
- Example: Revenues = 100, costs = 60, depreciation = 20, $T = 35\%$.

10

- Method 1:

	<u>No Depreciation</u>	<u>Depreciation</u>
Revenue	100	100
- Costs	60	60
- Depreciation	0	20
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EBIT	40	20
- Taxes	14	7
<hr/>	<hr/>	<hr/>
(1-T) × EBIT	26	13
+ Depreciation	0	20
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Cash Flow	26	33

11

- Method 2:

	<u>No Depreciation</u>	<u>Depreciation</u>
Revenue	100	100
- Costs	60	60
<hr/>	<hr/>	<hr/>
EBITDA	40	40
- Taxes	14	14
<hr/>	<hr/>	<hr/>
(1-T) × EBITDA	26	26
+ Depreciation Tax Shield	0	7
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Cash Flow	26	33

12

IV. Book Gains and Book Losses

- The book value of an asset (plant, machine, etc.) is equal to the initial investment cost minus the cumulative depreciation. For example, if you buy a machine for \$600 and IRS rules prescribe straight-line depreciation over three years, the book value in one, two and three years from now is 400, 200 and zero, respectively.
- If you sell an asset and the book value equals the sales price, there are no tax consequences. If you sell an asset and the sales price is above the book value, the difference constitutes a taxable book gain. Finally, if you sell an asset and the sales price is below the book value, the difference constitutes a book loss, which gives rise to a tax credit.

13

- Suppose you sell an asset at price P and the book value of the asset is B . The corporate tax rate is T .
 - $P = B$: cash flow is P .
 - $P > B$ (book gain): cash flow from sale is P minus taxes on book gain of $T \times (P - B)$. (Note: taxes accrue at end of year, while the sale itself may or may not be at end of year.)
 - $P < B$ (book loss): cash flow from sale is P plus tax credit on book loss equal to $T \times (B - P)$. (Note: tax credit accrues at end of year, while the sale itself may or may not be at end of year.)

14

- Example 1: The Pierpont Company is thinking of building a plant to make trumpets. The plant and equipment costs \$1 million. It lasts for five years and has no salvage value at the end of that time. The costs of running the plant are expected to be \$100,000 per year. The revenues from selling the trumpets are expected to be \$375,000 per year. All cash flows occur at the end of a year. IRS rules prescribe straight-line depreciation for the plant and equipment over five years. The firm faces a corporate tax rate of 35%. The opportunity cost of capital for this type of project is 10%. The projected income statement for the project is as follows:

15

• Revenues	\$375,000/year
Operating costs	<u>-\$100,000/year</u>
EBITDA	\$275,000/year
Depreciation	<u>-\$200,000/year</u>
EBIT	\$75,000/year
Taxes	<u>-\$26,250/year</u>
Net income	\$48,750/year

Should the Pierpont Company build the plant?

16

- Method 1:

17

- Method 2:

18

- Example 2: Over the last five years, the Billagong Company has spent \$25 million developing a new product called bings. It is considering whether to build a plant in California that will manufacture the bings. The current date is 1/1/01. The cost of the plant is \$10 million to be paid now. It will take one year to build the plant. The plant will start producing on 1/1/02 and the first revenues and costs will be received and paid on 12/31/02. The plant is expected to produce for three years. It will produce 3 million bings a year. IRS rules prescribe straight-line depreciation for the plant over four years as soon as the plant starts producing. The plant will be sold on 12/31/04 for \$2 million. The company can sell each bing for \$5 and the raw materials will cost \$2 per bing. These numbers remain constant over the three years in which bings are produced.

Over, please.

19

- Total labor costs for the first year of production will be \$1.5 million and these costs are expected to grow at a rate of 4% per year. The land the plant will be built on could be rented out for \$0.5 million a year. The firm already owns some of the machines it will use for producing the bings. These machines cost \$1 million ten years ago. The \$10 million cost of the plant does not include the cost of these machines. The machines are fully depreciated and could be sold now for \$0.5 million. However, the machines have no salvage value if they are used for producing the bings. The company has a corporate tax rate of 35% and profitable ongoing operations. The opportunity cost of capital for this kind of project is 10%.

Should the Billagong Company build the plant?

20

- Cash-flow table:

21

- Cash-flow table (continued):

22

- Assume that everything is as before, except that IRS rules prescribe straight-line depreciation for the plant over **three** years (instead of four) as soon as the plant starts producing. Is the company better off under this new or under the original depreciation schedule?

23

24

- Example 3: The projected income statement for the Madison Company for the next five years is as follows:

Revenues	100,000/year
Operating costs	<u>-50,000/year</u>
EBITDA	50,000/year
Depreciation	<u>-30,000/year</u>
EBIT	20,000/year
Taxes	<u>-8,000/year</u>
Net income	12,000/year

25

- In an attempt to improve this projected performance, the firm is considering replacing one of its machines. The replacement is not expected to affect revenues but operating costs would be reduced by 10%. The old machine was purchased three years ago for \$42,000 and could now be sold for \$25,000. It was estimated to have an eight-year economic life at the end of which it has an expected salvage value of \$2,000. The new machine costs \$30,000. It has a five-year economic life and no salvage value. IRS rules prescribe straight-line depreciation over seven years for the old machine and five years for the new machine. The opportunity cost of capital is 16%.

Should the Madison Company purchase the new machine?

26

- Cash flows associated with sale of old machine:

27

28

- Cash flows associated with purchase of new machine:

29

- Cash-flow table:

30

- Cash-flow table (continued):

- NPV:

31

V. Net Working Capital

- Net Working Capital (NWC) is the difference between short-term assets and short-term liabilities. Essentially, NWC is a short-term investment that must be (temporarily) financed until the investment is recovered.
- The principal short-term assets are accounts receivable (customers' unpaid bills) and inventories. The principal short-term liabilities are accounts payable (bills the firm has not paid yet).

32

- Short-term debt is not included in NWC as we only consider non-financial (i.e., unlevered) cash flows.
- Importantly, NWC is not a “flow” but a “level”. By implication, NWC itself is not a cash flow while changes in NWC are. Increases in NWC are cash outflows and decreases in NWC are cash inflows.
- NWC is fully recovered at the project’s end. Recovery means that NWC decreases from X to zero, resulting in a cash inflow of X at the project’s end.

33

- Including changes in NWC in the cash flows is a way to correct for the fact that the dates at which accounting revenues and costs are booked do typically not coincide with the dates at which the underlying cash flows occur.
- Example 4: You’re in the business of buying widgets from a local producer and selling them over the Internet. You buy \$100 worth of widgets in February and you pay for them immediately. In March you sell the widgets for \$150 but your customer doesn’t pay for them until April. In your income statement this shows up as a profit (revenues minus COGS) of \$50 in March, whereas the actual cash flows occur in February (outflow of \$100) and April (inflow of \$150), respectively.

34

		February	March	April
Balance Sheet (Levels)	Inventory			
	Accounts Receivable			
Income Statement (Flows)	Revenues			
	Costs of goods sold (COGS)			
Cash Flow Statement	NWC (level)			
	Δ NWC			
	Cash flows			

35

- Example 5: The Olympics Corporation is considering whether to build a new bakery to make cherry pies. The current date is 1/1/03. The new bakery will be built over two years and will be ready to start production on 1/1/05 and will cease production on 12/31/06. The investment for the bakery requires an outlay of \$2.5 million to be paid today. IRS rules prescribe that this expenditure is depreciated using straight-line depreciation over the two years the bakery is producing. The total salvage value of the plant and equipment on 12/31/06 is expected to be \$1 million. The land the bakery will be built on could be rented out for \$0.2 million per year for the four years while the bakery is being built and is in production. The bakery will produce 1.2 million cherry pies a year.

Over, please.

36

- The cherry pies can be sold at \$7 per pie. Raw material costs are \$1.20 per pie and total labor costs are \$0.42 million per year. These revenues and costs are expected to be the same for the two years the bakery is producing. The working capital required on 12/31/04 to allow inventories to be financed during the first year of production is \$0.3 million. Working capital needs for the second year will be 10% higher. When the bakery ceases production all the working capital will be recovered. The firm has a corporate tax rate of 35% and other profitable ongoing operations. All cash flows occur at the end of a year. The opportunity cost of capital is 12%.
Should the Olympics Corporation build the bakery?

37

- Cash-flow table:

38

- Cash-flow table (continued):

- NPV: