

# Valuation - cash flow estimation

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## 1 Introduction

Discounted cash flow analysis conceptually simple: Generate an estimate (forecast) of future cash flows, and discount at an appropriate cost of capital.

While conceptually simple, in practice hard. In this lecture we discuss how generate an estimate of future cash flows.

General problem: Need to go from loose *plans* (corporate strategy/investment decisions) to specific *cash forecasts*.

Two generic situation

- Isolated investment.

Often need to start from scratch.

Either estimate cash flows directly, or estimate future accounting consequences.

- More structured, corporate (full company) valuations.

Start with the current state of the company (the company's accounts), translate the last few year's accounts to cash flow, assume a growth rate applied to e.g. corporate sales, and forecast forward cash flows.

In both settings: Specific skill: Go from accounting statements to cash flows.

## 2 Generating cash flows for an investment project

Let us look at how we evaluate the cash flows from a project, where we have the full information.

### Exercise 1.

In the spring of 2015, Jemison Electric was considering an investment in a new distribution center. Jamison's CFO anticipates additional earnings before interest and taxes (EBIT) of \$100,000 for the first year of operation

of the center, and, over the next five years, the firm estimates that this amount will grow at a rate of 5% per year. The distribution center will require an initial investment of \$400,000 that will be depreciated over a five-year period toward a zero salvage value using straight-line depreciation of \$80,000 per year. Jemison's CFO estimates that the distribution center will need operating net working capital equal to 20% of EBIT to support operation.

Assuming the firm faces a 30% tax rate, calculate the project's annual project free cash flows (FCFs) for each of the next five years where the salvage value of operating networking capital and fixed assets is assumed to equal their book values, respectively.

### Solution to Exercise 1.

Given:

Growth rate in EBIT for years 1-5: 5%

EBIT (year 1): \$100,000

CAPEX for year 0: \$400,000

Depreciable life of fixed assets: 5 years

Tax rate: 30%

New working capital for years 1-5: 20% of EBIT

	Year					
	0	1	2	3	4	5
EBIT		100,000	105,000	110,250	115,763	121,551
Taxes		(30,000)	(31,500)	(33,075)	(34,729)	(36,465)
NOPAT		70,000	73,500	77,175	81,034	85,085
Plus: Depreciation		80,000	80,000	80,000	80,000	80,000
Less: CAPEX	(400,000)	-	-	-	-	-
Less: Net working capital needs	(20,000)	(1,000)	(1,050)	(1,103)	(1,158)	24,310
Plus: Salvage value of the fixed assets in year 5						-
Firm Free Cash Flow (FFCF)	(420,000)	149,000	152,450	156,073	159,876	189,396
Net Fixed Assets (beginning of the year)	-	400,000	320,000	240,000	160,000	80,000
Plus: CAPEX	400,000	-	-	-	-	-
Less: Depreciation Expense for the Year	-	(80,000)	(80,000)	(80,000)	(80,000)	(80,000)
Net Fixed Assets (end of the year)	400,000	320,000	240,000	160,000	80,000	-

Note: At the end of year five the firm liquidates all its working capital investments

## 3 Discounted Cash Flow valuation of Companies

Reminder, how to implement the calculation of firm value:

- Value the cash flows of entire firm.
  - adjusting the cost of capital for the tax advantage of debt

WACC

$$\text{Value of firm} = \sum_{t=1}^{\infty} \frac{\text{Cflow firm}(FCF)}{(1 + WACC)^t}$$

- Value the firm in pieces
  - Value cash flows as if 100% equity financed
  - add effect of debt, other nonequity claims

Adjusted present value (APV)

$$\text{Value of firm} = \sum_{t=1}^{\infty} \frac{\text{Cflow firm}(FCF)}{(1 + r^*)^t} + \text{adjustments (tax, etc)}$$

- Value just the equity part, the value of the equity stake in a business.  
Flow to equity (FTE)

$$\text{Value of equity} = \sum_{t=1}^{\infty} \frac{\text{Cflow equity}(FCFE)}{(1 + k_e)^t}$$

Need to calculate either

- FCF (Free cash flow to the firm), or
- FCFE (Free cash flow to equity)

## 4 Free Cash Flow

Definition of *Free Cash Flow (FCF)*:

The amount of cash a company can distribute to all its security holders (debt holders, preferred equity holders, warrant holders, equity holders, etc.)

- To value a company, Find the cash flow the company is able to produce *consistently* over a long horizon.  
Cash flow that is generated by regular *operating activities*.

## 5 Computing Free Cash Flow (FCF)

At the company level, we have a “cookbook” for going from the accounts to the company FCF. The textbook uses the more simplified version in figure 1. There is a more detailed version in figure 2 with bit more broken down categories, which may be useful to make sure you cover these (easily overlooked) issues.

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**Figure 1** Computing Free Cash Flow (FCF) - basic

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	Sales (revenues)
Less	Costs of goods sold
	<b>Gross Profit</b>
Less	Operating expenses (including depreciation)
	<b>Earnings before Interest and Taxes</b>
Less	Taxes
	<b>Net Operating Profit after taxes (NOPAT)</b>
Plus	Depreciation
Less	Capital Expenditure (CAPEX) (Investments)
Less	Increase in Working Capital ( $\Delta NWC$ )
	<b>Free Cash Flow (FCF)</b>

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There is an alternative way of generating FCF from accounts that starts from the net income, called the *indirect* method. It is summarized in figure 3

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**Figure 2** Computing Free Cash Flow (FCF) - more detailed

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**Computing FCF (direct method)**

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	Sales (revenues)
-	Costs
+	Amortizations
=	<i>Earnings before interest, taxes, and amortization (EBITA)</i>
-	Taxes paid on EBITA
+	Increase in deferred taxes and taxes payable
=	<i>NOPLAT (Operating profit)</i>
+	Depreciation
-	Increase in operating working capital
-	Increase in other operating assets (net of operating liabilities)
-	Investments in property, plant, and equipment (capex)
-	Investment in goodwill
=	<i>Free Cash Flow (FCF)</i>

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**Figure 3** Reconciling FCF to Net Income (indirect method)

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	Net Income (Profits After Taxes)
+	Change in Taxes payable
+	After-tax financial expenses (e.g. interest)
-	After-tax financial income (e.g. interest)
=	<i>NOPLAT (Operating profit)</i>
+	Depreciation and other non-cash expenses
-	Increase in operating working capital
-	Increase in other operating assets (net of operating liabilities)
-	Investments in property, plant, and equipment (capex)
-	Investment in goodwill
=	<i>Free Cash Flow (FCF)</i>

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To illustrate the use of this cookbook, solve the following example.

**Exercise 2.**

2000	2001	
<i>Statement of Income</i>		
3,900	4,200	Sales
3,000	2,700	Operating expenses (excl. depreciations)
600	600	Depreciations
365	900	Interest expenses
200	200	Dividends
4,000	100	Capital expenditures
<i>Consolidated Balance Sheet</i>		
500	10,500	Cash and marketable securities
2,000	2,000	Debt (book value)
1,500	11,500	Common equity (book value)
100	140	Accounts receivables
60	60	Inventory
150	200	Accounts payable
45	0	Taxes payable

The tax rate is 35%, the amount of necessary cash as a percentage of sales is 1.0%.

1. Compute the Free Cash Flow for year 2001

**Solution to Exercise 2.**

The FCF for 2001 is 1,137.

Income statement	2000	2001
Sales	3900	4200
Operating Expences(excl depr)	3000	2700
Depreciations	600	600
Interest expenses	365	900
Dividends	200	200
Capital expenditures	4000	100

Consolidated Balance sheet	2000	2001
Cash and marketable securities	500	10500
Debt(book value)	2000	2000
Common equity(book value)	1500	11500
Accounts receivables	100	140
Inventory	60	60
Accounts payable	150	200
Taxes payable	45	0

Direct method		
Earnings before Interest, taxes and amortizations (EBITA)	300	900
Taxes	105	315
Increase in deferred taxes		-45
NOPLAT	195	540
+Depreciation	600	600
-increase in operating working capital		-7
-increase in other operating assets		
-investment in property, plant, equipment (capex)		100
-investment in goodwill		
Free Cash Flow		1047
Indirect method		

Taxable income	0
Taxes	0
Change in taxes payable	-45
After-tax financial expences	585
NOPLAT	540
+Depreciation	600
-increase in operating working capital	-7
-increase in other operating assets	
-investment in property, plant, equipment (capex)	100
-investment in goodwill	
Free Cash Flow	1047
Note: Working Capital calculation	
	change
Necessary cash as a percentage of sales: 39 42	3
change in accounts receivable	40
change in accounts payable	50
sum	-7

## 6 Free Cash Flow to Equity (FCFE)

There is a corresponding “cookbook” for calculating the Free Cash Flow to Equity (FCFE)

### Free Cash Flow to Equity (FCFE)

<i>Sales (revenues)</i>
– Costs (excluding depreciation)
– Change in working capital
– Interest
– Provision for income taxes (from income statement)
= <i>Cash Flow from Operations</i>
– Investments in property, plant, and equipment (capital expenditures)
+ Proceeds from new debt and preferred equity issues
– Preferred dividends
– Debt repayments
= <i>Free Cash Flow to Equity (FCFE)</i>

### Exercise 3.

Diebold Incorporated manufactures, markets, and services automated teller machines in the United States. The following are selected numbers from the financial statements for 1992 and 1993 (in millions):

	1992	1993
Revenues	544.0	620.0
(Less) Operating Expenses	(465.1)	(528.5)
(Less) Depreciation	(12.5)	(14.0)
= Earnings before Interest and Taxes	66.4	77.5
(Less) Interest Expenses	(0.0)	(0.0)
(Less) Taxes	(25.3)	(29.5)
= Net Income	41.1	48.0
Working Capital	175.0	240.0

The firm had capital expenditures of \$15 million in 1992 and \$18 million in 1993. The working capital in 1991 was \$180 million.

1. Estimate the cash flows to equity in 1992 and 1993.
2. What would the cash flows to equity in 1993 have been if working capital had remained at the same percentage of revenue as it was in 1992?

### Solution to Exercise 3.

Show two alternative ways of doing the calculation. First follow the cookbook.

Free Cash Flow to Equity (FCFE)		
Sales (revenues)	544	620
- Costs (excluding depreciation)	465,1	528,5
- Change in working capital	-5	65
- Interest	-0	-0
- Provision for income taxes (from income statement)	25,3	29,5
cash flow from operations	58,6	-3
- Investments in property, plant, and equipment (capital expenditures)	15	18
+ Proceeds from new debt and preferred equity issues		
- Preferred dividends		
- Debt repayments		
Free Cash Flow to Equity (FCFE)	43,6	-21

Alternatively, start from the Net Income and adjust:

Net Income	41,1	48
+ Depreciation	12,5	14
- CAPEX	15	18
+Change WC	-5	65
	43,6	-21

For the second part, Working Capital as Proportion of Revenues in 1992:  $175/544 = 32.17\%$

Change in Revenues in 1993:  $620 - 544 = 76$

FCFE in 1993:  $48 + 14 - 18 - (175/544) \times (620 - 544) = 19.55$  million

## 7 Forecasting FCF

- The value of a company is the discounted value of future cash flows. Thus, FCF needs to be forecasted.
- Forecasts are made by forecasting sales or sales growth for a period of 5 to 15 years.
  - Proforma balance sheet and income statements for the first 5 years
  - Only main components of the FCFs for the remaining 5 to 10 years (or say 5–10 and then 10-15 with different growth rates).
- Other items are typically forecasted using the historical relationship to sales. Most important: Cost margins.
- Cash flows beyond the forecasting horizon is captured by the *Terminal Value*

## 8 Summarizing example

A final exercise

### Exercise 4.

Consider an investment opportunity available to Morgan Industries (Morgan), a hypothetical firm. The firm can make an investment in equipment to produce a new product line. The equipment will last for three years. At that time, Morgan can decide whether to continue, change, or end the product line. Thus the decision horizon is three years. The investment will be assumed to occur at the end of the current year, with sales beginning next year. The investment will be fully depreciated over the three years, even though Morgan believes the equipment will have some economic value (salvage value) at the end of the decision horizon. The specific assumed values for this investment are summarized in Table 1.

Table 1. Morgan's new product line investment summary.

Initial investment	180,000
Salvage value	20,000
Fixed annual cash operating expenses	55,000
Revenue in the first year	400,000
Cash variable expenses (% of revenue)	70%
Working capital needs (% of revenue)	10%
Growth rate of sales	15%
Tax rate	25%

1. Calculate the Free Cash Flow for this investment

**Solution to Exercise 4.**

The FCF is estimated below using two alternative methods

Table 2. Analysis of operating cash flow by parts.

	Year 0	Year 1	Year 2	Year 3	
<b>Annual Cash Flow After Tax</b>					
Cash revenues		400,000	460,000	529,000	
Cash variable expenses		280,000	322,000	370,300	
Cash fixed expenses		55,000	55,000	55,000	
Annual cash profit		65,000	83,000	103,700	
Tax on annual cash profit		16,250	20,750	25,925	
		48,750	62,250	77,775	A
<b>Investments Cash Flow</b>					
Investment	(180,000)				
Recovery of investment				15,000	
Change in NWC		(40,000)	(6,000)	(6,900)	
Recovery of NWC				52,900	
	(180,000)	(40,000)	(6,000)	61,000	B
Depreciation Tax Shield Depreciation		60,000	60,000	60,000	
Tax shield (depreciation × tax rate)		15,000	15,000	15,000	C
Cash flow [A + B + C]		23,750	71,250	153,775	
NWC		40,000	46,000	52,900	

Table 3. Salvage value schedule.

Salvage value	20,000
Book value	0
Gain or loss	20,000
Tax on gain or loss	5,000
Salvage value	20,000
Tax	5,000
Net cash flow from salvage value	15,000

Table 4. Free cash flow calculation.



	Year 0	Year 1	Year 2	Year 3	
Cash revenues		400,000	460,000	529,000	
Cash variable expenses		280,000	322,000	370,300	
Cash fixed expenses		55,000	55,000	55,000	
Depreciation		60,000	60,000	60,000	
EBIT		5,000	23,000	43,700	
Tax on EBIT		1,250	5,750	10,925	
NOPAT		3,750	17,250	32,775	A
plus: Depreciation		60,000	60,000	60,000	B
less: Capital expenditures	180,000				C
plus: Residual value				15,000	D
less: Change in NWC		40,000	6,000	6,900	E
plus: Recovery of NWC				52,900	F
Free cash flow $[A + B - C + D - E + F]$	(180,000)	23,750	71,250	153,775	

(This example is from an article by Marc Lipson).

The rest of this lecture note is background reading, that will not be discussed in class, but useful for understanding practicalities of valuation.

## 9 Computing FCF, comments on

### Sales and costs

- Sale or revenue is unit price times the number of units sold for the period that we are looking at.
- The costs for the same period is the sum of
  - Costs of goods sold (COGS)
  - Selling, general, and administrative expenses (SG&A)
  - Research and development
  - Depreciation and amortization

### Amortization

- Amortization is added back because it is a non-cash expense
- It is treated differently than depreciation because intangible assets does not depreciate:
  - Since intangibles does not depreciate, we do not subtract amortization when computing NOPLAT.
  - You could argue that goodwill impairment should be treated in the same way as depreciation (goodwill is impaired when a third party justifies a reduction in the value of the goodwill.)
- To the extent that amortization is tax deductible, it is part of the computation of tax on EBITA.

### Tax on EBITA

- Provision for income taxes (from income statement)
- + Tax shield on interest (Interest expense times marginal tax rate)
- Tax on interest income (Interest income times marginal tax rate)
- + Tax on non-operating income
- = *Tax on EBITA*

- Notice that we ignore the tax savings created by interest payments when computing the Free Cash Flow.
- These tax savings will later be reflected as a reduction in the cost of capital used to discount the Free Cash Flows.

### Deferred taxes and taxes payable

- Deferred taxes is computed as the difference between deferred tax liabilities and deferred tax assets.
  - *Example:* Straight line depreciation in the financial statements and accelerated depreciation for tax purposes.  
Early on in an asset's life, the actual tax paid is less than it appears in the provision for income tax. This creates a tax liability.
  - Until the government is paid, shareholders require a return on these funds. Thus,
    - \* Add increase in deferred taxes (relative to provision for income taxes) when computing NO-PLAT.

- Taxes payable are taxes for the current period that is not yet paid. An increase in taxes payable is added back.

### NOPLAT

- Net Operating Profit Less Adjusted Taxes (NOPLAT)
  - A measure of after-tax operating profits when all taxes are converted to a cash basis and the interest tax shield is ignored.

### Depreciation

- Depreciation is added back when computing FCF since it is a non-cash expense.
- It is not added back when computing NOPLAT since it does represent wear and tear on the assets used in the operations. This is consistent with using net Property, Plant, and Equipment (i.e., the book value of PP&E) in the definition of Invested Operating Capital.

### Operating working capital

Operating working capital is defined as: *Operating current assets* less *Non-interest bearing current liabilities*.

- *Operating current assets*: Accounts receivables, Inventories, and “necessary” cash.
- *Non-interest bearing current liabilities*: Accounts payable, and other accrued expenses.
- *Change in working capital* =
  - + Change in Accounts receivables
  - + Change in Inventories
  - + Change in necessary cash
  - Change in Accounts payable

### Other operating assets

- Other operating assets is computed net of non-interest bearing liabilities.
- Include deferred expenses

### Capital expenditures

- Capital expenditures or investments in property, plant, and equipment
  - Includes expenditures on new fixed assets and replacement fixed assets
  - Should not include *extraordinary* sales of capital (remember, we are trying to identify the cash flow that will be maintained in the future).
- Capital expenditures are necessary to generate future cash flows.
- Should therefore be subtracted from revenues to get Free Cash Flow.

### Investment in goodwill

- Goodwill is the difference between then book value of the assets of an acquired company and the purchase price of that company.
- From one fiscal year-end to another, the book value of goodwill changes as follows:  $GW_{t-1} - A_t + I_t = GW_t$ , where  $GW_{t-1}$  is the book value of goodwill at the beginning of period  $t$ ,  $A_t$  is goodwill amortization,  $I_t$  is investment in goodwill, and  $GW_t$  is the book value of goodwill at the end of period  $t$

- Thus, investment in goodwill can be computed as follows:  $GW_t + A_t - GW_{t-1}$ .
- It is common to compute FCF both with and without investment in goodwill. If acquisitions are not part of the company's growth strategy, it may better to drop investment in goodwill.

### Other issues

- Retirement related liabilities: For unfunded or underfunded plans, treat the liability as interest-bearing debt:
  - Add estimated interests expenses to EBITA
  - Adjust taxes for the tax shield
- Operating leases
  - Operating leases should be capitalized and put on the balance sheet as debt (i.e., a source of financing).
- Minority Interest
  - Treat the balance sheet item as quasi equity
  - Treat earnings attributable to minority interests as a financing cost (as an interest expense, adjust taxes on EBIT accordingly)

## 9.1 Distribution of the FCF

### Distribution of the FCF

- Free Cash Flow (this is what you start with)
  - Regular payments
    - Interest (to bondholders and other lenders)
    - Preferred dividend (to holders of preferred stock)
    - Dividend (to holders of common stock)
    - etc.
  - Capital market transactions
    - Debt retirement
    - Share repurchases
  - + New financing: bank debt, bond issues, equity issues
  - + Exercise of warrants
    - etc.
- = Change in cash and cash equivalents (this is what you end up with)

## 10 Issues in going from accounts to cashflows

What do we want for valuation purposes?

Philosophical: Accounting numbers in balance problematic. What we would like is something like shown in figure 4. However, not really what we get from accounts. Accounting numbers influenced by the historical cost of getting the asset. Accountants argue they want to estimate the replacement cost of a set of assets, and the accounting profession has moved in that direction with the emphasis on market value evaluation, but accounts are still influenced by historical costs.

The accounting balance is not what we want for valuation purposes. Instead, the value of the assets are their ability to generate future cashflows, either

- in the future running of the firm

**Figure 4** Balance (market values)

Assets		Liabilities	
Existing investments Generate cash flows today include long-lived (fixed) and short-lived (wc) assets	<b>Assets in Place</b>	<b>Debt</b>	Fixed claim on cash flows little or no role in management Fixed Maturity tax deductible
Expected value that will created by future investments	<b>Growth Assets</b>	<b>Equity</b>	Residual claim on cash flows Significant role in management Perpetual lives

- or (worst case) price hat can be had for assets by selling them in the market (liquidation value)

Therefore, the prime source of information from accounts are measures of earnings, because they can be used to estimate cashflows.

Problems:

1. Earnings are not the same as cashflows, even if earnings are measured correctly.
2. Accounting measures of earnings are easily manipulated, confound the problems of going from earnings to cash flows

Example: Throughout the 90's, Microsoft beat analysts earnings expectations 39 out of 40 quarters.

Look for

- (a) one-time components
- (b) subsidiaries
- (c) working capital increasing more than revenues (selling on credit to boost revenues)
- (d) large swings from one year to the other.

From earnings to cashflow:

Look for: Cashflows after taxes, before debt payments, after reinvestment needs

Issues:

#### **Effective tax rate**

- tax regulation - starting point - statutory rate
- tax loss carryforwards
- international operations
- tax subsidies

#### **Working capital**

Accounting view: The difference

- current assets
- current liabilities

Back out for valuation purposes: cash, marketable securities, interest bearing debt

Forecasting working capital: When is it necessary to go into detail? ask: are there changes to the firms planned operations that is likely to affect working capital.

Related to working capital: The use of supplier credit as a source of capital. This is treated as non-interest bearing debt. In practice it is not, there are substantial savings (cash discounts) missed by using supplier credit. The cost of supplier credit is the losses on non-used cash discounts, which are similar to interest...

## 11 General: Lessons from analysing investment projects

Now that you have looked at the mechanics of generating cash flows, it is useful to get some perspective by going back to the roots: What you learned in introductory finance about evaluation of investment projects.

(Re)read these, and think about the implications for FCF.

### Only cash flow is relevant

1. Cash flow is the difference between dollars received and dollars paid out. Do not confuse cash flow with accounting profits.
2. Always estimate cash flows on an after-tax basis.
3. Make sure cash flow is credited at the time it actually occurs, not before. Example: Credit sales.

### Estimate Cash flows on an incremental basis.

1. Do not confuse average with incremental profit. Past performance may have nothing to do with future investment opportunities.
2. Include all incidental effects. Example: Compliments and substitutes.
3. Do not forget to include any additional investment in working capital that is required.
4. Forget about sunk costs. Only future cash flows are relevant. Example: unrecoverable research and development costs.
5. Include opportunity costs. The cost of a resource may be relevant even though no cash changes hands. Example: Land used to build a new office building.
6. Beware of allocated overhead costs. You should include only the *additional* expenses that will result from the project.

### Be consistent in your treatment of inflation.

If the discount rate is stated in *nominal* terms, then consistency requires that cash flows be estimated in *nominal* terms, taking account of trends in selling price, labour and material costs etc. Of course, there is nothing wrong with discounting *real* cash flows with a *real* discount rate. The two methods, if done appropriately, should produce the same NPV.

## 12 Readings

The material in this lecture is covered in (Titman and Martin, 2016, Chapter 2)

## References

Sheridan Titman and John D Martin. *Valuation. The art and science of corporate investment decisions*. Pearson, third edition, 2016.