

# Estimation of Free Cash Flow

Bernt Arne Ødegaard

University of Stavanger

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# Introduction

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

While conceptually simple, in practice hard.

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

# Introduction

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.

# Generating cash flows for an investment project

Evaluate the cash flows from a project.

## Titman and Martin, Problem 2-3, Calculating Project FCF

In the spring of 2015, Johnson Electric was considering an investment in a new distribution center. Jemison'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 towards 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 operations.

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 network capital and fixed assets is assumed to equal their book values, respectively.

## Solution

### 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

## Solution, ctd

### Free Cash Flow (thousands)

	Year					
	0	1	2	3	4	5
EBIT		\$100	\$105	\$110.250	\$115.763	\$121.551
Taxes		(30)	(31.5)	(33.075)	(34,729)	(36.465)
NOPAT		\$70	\$73.5	\$77.175	\$81.034	\$85.085
Depreciation		80	80	80	80	80
CAPEX	(400)	-	-	-	-	-
Working capital	(20)	(1)	(1.05)	(1.103)	(1.158)	24.310
Salvage value				-		
FCF	\$(420)	\$149	\$152.45	\$156.073	\$159.876	\$189.396

## Solution, ctd

### Fixed Assets (thousands)

	Year					
	0	1	2	3	4	5
Net Fixed Assets (start of year)	-	\$400	\$320	\$240	\$160	\$80
Plus: CAPEX	400	-	-	-	-	-
Less: Depreciation Expense	-	(80)	(80)	(80)	(80)	(80)
Net Fixed Assets (end of year)	\$400	\$320	\$240	\$160	\$80	\$-



# 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

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

## Discounted Cash Flow valuation of Companies, ctd

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

Adjusted present value (APV)

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

## Discounted Cash Flow valuation of Companies, ctd

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

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

## Discounted Cash Flow valuation of Companies, ctd

Need to calculate either

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

# 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*.

## 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:

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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## Calculating FCF (direct method)

There is a more detailed version with bit more broken down categories, which may be useful to make sure you cover these (easily overlooked) issues.

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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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## Reconciling FCF to Net Income (indirect method)

There is an alternative way of generating FCF from accounts that starts from the net income, called the *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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## Exercise - FCF estimation

2000	2001	
<hr/> <i>Statement of Income</i> <hr/>		
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
<hr/> <i>Consolidated Balance Sheet</i> <hr/>		
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

## Exercise - FCF estimation

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

## Exercise - FCF estimation, solution

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

## Exercise - FCF estimation, solution

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

## Exercise - FCF estimation, solution

### 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

## Exercise - FCF estimation, solution

### 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

## Exercise - FCF estimation, solution

### 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

(My calculation is shown in the spreadsheet `fcf_example`)

## Calculating FCFE

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

### **Free Cash Flow to Equity (FCFE)**

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*Sales (revenues)*

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



## Diebold

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.

## Diebold, solution

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

	1992	1993
Sales (revenues)	544	620
- Costs (excl depr.)	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
- CAPEX	15	18
+ new debt		
- Debt repayments		
Free Cash Flow to Equity (FCFE)	43,6	-21

## Diebold, solution, ctd

Alternatively, start from the Net Income and adjust:

	1992	1993
Net Income	41,1	48
+ Depreciation	12,5	14
- CAPEX	15	18
+Change WC	-5	65
FCFE	43,6	-21

## 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*

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

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	
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
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		60,000	60,000	60,000	
Tax shield (depreciation $\times$ 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	

## Solution

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



## Solution

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).