

Topic II. Initial Public Offerings

(2) IPO Valuation

Discounted Cash Flow Method

1. Introduction
2. General Methodology
3. Two-stage FCFE Model
4. Two-stage FCFE Model: Example

1. Introduction

- (1) Definition
- (2) Pros & Cons
- (3) Application



1. Introduction

(1) Definition

- Discounted Cash Flow (DCF) method uses future free cash flow (FCF) projections and discounts them (most often using the weighted average cost of capital) to arrive at a present value.
 - Cash flow: FCF
 - Discount rate: WACC



1. Introduction

(2) Pros & Cons

- Advantages
 - DCF model is based upon fundamentals and is less exposed to market moods
 - DCF model forces us to think about the underlying characteristics of the firm and understand its business.



1. Introduction

(2) Pros & Cons

- Disadvantages
 - More inputs and information are required than other methods
 - The inputs and information can be manipulated.
 - DCF is based on strong assumptions.

1. Introduction

(3) Application

- DCF method works best when
 - For firms,
 - The cash flows are currently positive and can be estimated with reliability.
 - A proxy for risk that can be used to obtain discount rates is available.
 - For investors who have a long time horizon



2. General Methodology

- (1) Free Cash Flow to Firm (FCFF)
- (2) Formula
- (3) Variables

2. General Methodology

(1) Free Cash Flow to Firm (FCFF)

- Cash flow available to the firm's suppliers of capital after all operating expenses have been paid and necessary investments in working capital and fixed capital have been made.
- It is the incremental effect of an investment project on a firm's available cash.

2. General Methodology

(2) Formula

- Value of firm
 - The present value of future FCFF discounted at the weighted average cost of capital

$$\text{Firm Value} = \sum_{t=1}^{\infty} \frac{\text{FCFF}_t}{(1 + \text{WACC})^t}$$

2. General Methodology

(2) Formula

- Value of equity:

$$V_{equity} = V_{firm} - V_{debt} + V_{cash}$$

- Debt: market value
- Cash: cash or cash equivalent (marketable securities, non-current investments in stocks and bond, etc.)

2. General Methodology

(2) Formula

- Share price

$$P = \frac{V_{equity}}{\text{Shares Outstanding}}$$

2. General Methodology

(3) Variables

- Free Cash Flow (FCF)

$$\text{FCF} = \text{EBIT} \times (1 - \tau) + \text{Depreciation} - \text{Capital Expenditure} - \Delta \text{NWC}$$

- ▣ τ : tax rate
- ▣ ΔNWC : change in net working capital

$$\begin{aligned} \text{NWC} &= \text{Current Assets} - \text{Current Liabilities} \\ &= (\text{Cash} + \text{Inventory} + \text{Receivables}) - \text{Payables} \end{aligned}$$

$$\Delta \text{NWC}_t = \text{NWC}_t - \text{NWC}_{t-1}$$

2. General Methodology

(3) Variables

- Weighted Average Cost of Capital (WACC)
 - The required rate of return that investors should demand for a cash flow stream like that generated by the firm.
 - The cost of capital is often considered the opportunity cost of the suppliers of capital.

2. General Methodology

(3) Variables

- Weighted Average Cost of Capital (WACC)

- Formula

$$WACC = \frac{E}{E + D} \cdot r_E + \frac{D}{E + D} \cdot r_D (1 - \tau)$$

Where, E = market value of equity

r_E = equity cost of capital

D = market value of debt (net of cash)

r_D = debt cost of capital

τ = corporate tax rate



3. Two-stage FCFE Model

(1) Assumption

(2) Formula

(3) Cost of Equity



3. Two-stage FCFE Model

(1) Assumption

- The growth rate is constant (or given) in stage one, and then it drops to the long-run sustainable rate in stage two.
 - Stage 1: fast growth
 - Stage 2: growing perpetuity



3. Two-stage FCFE Model

(2) Formula

- We calculate the free cash flows available to equity holders (Free Cash Flow to Equity) after taking into account all payments to and from debt holders
 - o Free Cash Flow to Equity (FCFE): It is the free cash flow that remains **after adjusting for interest payments, debt issuance and debt repayments.**
 - o The FCFEs are then discounted using the equity cost of capital (r_E).



3. Two-stage FCFE Model

(2) Formula

$$V_E = \sum_{t=1}^n \frac{\overset{\text{PV(Stage 1)}}{\downarrow} FCFE_t}{(1+r_{E1})^t} + \frac{\overset{\text{PV(Stage 2)}}{\downarrow} FCFE_{n+1}}{(r_{E2} - g) \times (1+r_{E1})^n}$$

$FCFE$ = free cash flow to equity

d : debt ratio (for FCFE calculation)

r_{E1} : cost of equity in Stage 1.

r_{E2} : cost of equity in Stage 2.

g : growth rate in Stage 2.

3. Two-stage FCFE Model

(2) Formula

- FCFE
 - o General formula

$$FCFE = \text{earnings} + \text{Depreciation} - \Delta\text{NWC} - \text{Cap.Exp.} + \Delta\text{Debt}$$

- o Assuming a fixed debt ratio, then,

$$FCFE = \text{earnings} + (\text{Depreciation} - \Delta\text{NWC} - \text{Cap.Exp.}) \times (1 - d)$$

$$d : \text{debt ratio, } \frac{\text{Total debt}}{\text{Total Assets}}$$



3. Two-stage FCFE Model

(3) Cost of Equity

- The expected cost of equity (CAPM)

$$E(r_E) = r_F + \beta_i(r_M - r_F)$$

r_F : risk - free interest rate

r_M : market portfolio return

β_i : company i 's beta



3. Two-stage FCFE Model

(3) Cost of Equity

- Market portfolio
 - A portfolio of all assets in the economy.
 - In practice, a broad stock market index, such as the S&P Composite, is used to **represent** the market.
- Risk-free interest rate
 - U.S. T-bills (short-term) is normally perceived as a good proxy for the risk free rate.
 - <https://www.treasury.gov/resource-center/data-chart-center/Pages/index.aspx>



3. Two-stage FCFE Model

(3) Cost of Equity

- Beta (β)
 - It is the sensitivity of a stock's return to the return on the market portfolio.

$$\beta_i = \frac{Cov(r_i, r_M)}{Var(r_M)}$$



3. Two-stage FCFE Model

(3) Cost of Equity

- Beta (β)
 - Estimate β using historical data
 - If you believe that the operations of the firm are **fundamentally different** from the operations of the rest of the industry, you should use the firm's β .
 - EXCEL: COVAR, VAR, SLOPE, & regression
 - Estimate β using industry's β
 - If you believe that the operations of the firm are **similar** to the operations of the rest of the industry, you should use the industry β .



3. Two-stage FCFE Model

(3) Cost of Equity

- Beta (β)
 - Determinants of β
 - Cyclicity of revenues: highly cyclical stocks have higher β .
 - Operating leverage: β increases as the fixed costs rise.
 - Financial leverage: β increases as firm's fixed costs of financing rise. The relationship between the unlevered and levered betas of equity is:

$$\frac{\beta^U}{E} = \frac{\beta^L}{[E + (1 - \tau)D]} \Rightarrow \beta^L = \left[\frac{E + (1 - \tau)D}{E} \right] \beta^U$$



4. Two-stage FCFE Model: Example

- (1) Background Information
- (2) Stage 1: High Growth Period
- (3) Stage 2: Stable Growth Period
- (4) Present Value



4. Two-stage FCFE Model: Example

(1) Background Information

- Current period ($t = 0$)
 - Earnings per share = \$1.95
 - Capital Expenditures per share = \$0.40
 - Depreciation per share = \$0.32
 - Revenues per share = \$7.45



4. Two-stage FCFE Model: Example

(1) Background Information

- Stage 1: High growth period (set $T = 5$)
 - Return on equity = 21.74%
 - Retention ratio = 100%
 - Risk-free interest (r_F) = 6%
 - Market risk premium ($r_M - r_F$) = 5.5%
 - Beta (β_I) = 1.3
 - NWC: 20% of revenues
 - Debt ratio: 9.55%; it is expected to remain unchanged.
 - Capital expenditures and depreciation are assumed to grow at the same rate as earnings.



4. Two-stage FCFE Model: Example

(1) Background Information

- Stage 2: Stable growth period ($t > 5$)
 - Expected growth rate (g_2) = 6%
 - Risk-free interest (r_F) = 6%
 - Market risk premium ($r_M - r_F$) = 5.5%
 - Beta (β_2) = 1.1
 - NWC: 20% of revenues
 - Capital expenditures and depreciation are assumed to grow at 6% a year.

4. Two-stage FCFE Model: Example

(2) Stage 1: High Growth Period

- $FCFE_i$

$$FCFE = \text{Earnings} + (\text{Depreciation} - \text{Capital Expenditure} - \Delta NWC) \times (1 - d)$$

d : debt ratio

Earnings, Depreciation, Capital Expenditure, ΔNWC : we need the growth rate

- Cost of equity

$$E(r_E) = r_F + \beta_i(r_M - r_F)$$



4. Two-stage FCFE Model: Example

(3) Stage 2: Stable Growth Stage

- Step 1: discount to $T = 5$ using growing perpetuity

$$V_T = \frac{FCFE_{T+1}}{r_{E2} - g_2}$$

- Step 2: discount to $t = 0$ for present value

$$V_0 = \frac{V_T}{(1 + r_{E1})^T}$$



4. Two-stage FCFE Model: Example

(4) Present Value

1 Year	0	1	2	3	4	5	6
2 Net income	\$1.95	\$2.37	\$2.89	\$3.52	\$4.28	\$5.21	\$5.53
3 Capital Exp	\$0.40	\$0.49	\$0.59	\$0.72	\$0.88	\$1.07	\$1.13
4 Depreciation	\$0.32	\$0.39	\$0.47	\$0.58	\$0.70	\$0.86	\$0.91
5 Revenue	\$7.45	\$9.07	\$11.04	\$13.44	\$16.36	\$19.92	\$21.12
6 % NWC to Revenue	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
7 NWC = 5 * 6	\$1.49	\$1.81	\$2.21	\$2.69	\$3.27	\$3.98	\$4.22
8 $\Delta(\text{NWC}) = 7(t) - 7(t-1)$		\$0.32	\$0.39	\$0.48	\$0.58	\$0.71	\$0.24
9 ROE	21.74%						
10 Retention ratio	100.00%						
11 $g = 9 * 10$	21.74%	21.74%	21.74%	21.74%	21.74%	21.74%	6%
12 beta (β)	1.3						1.1
13 $r_{(M)} - r_{(F)}$	5.50%						5.50%
14 $r_{(F)}$	6.00%						6.00%
15 Cost of Equity = 14 + 12 * 13	13.15%	13.15%	13.15%	13.15%	13.15%	13.15%	12.05%
16 Debt ratio (d)	9.55%	9.55%	9.55%	9.55%	9.55%	9.55%	9.55%
17 FCFE = 2 - (3 - 4 + 8) * (1 - 16)		\$1.99	\$2.43	\$2.95	\$3.60	\$4.38	\$5.11
18 PV(FCFF)		\$1.76	\$1.89	\$2.04	\$2.19	\$2.36	\$45.50
19 Total							\$55.75



Review

- Discounted Cash Flow (DCF) Method
 - General information
 - General methodology: FCFF
 - FCFF (firm)
 - Discount rate: WACC (firm)
 - $V_E = \dots\dots$
 - $P_E = \dots\dots$

Review

- Two-stage FCFE Model
 - Two stages
 - Formula (for V_E)
 - Discount rate: r_E
 - Beta, β
 - Note:
 - FCFF => firm value => equity value (WACC)
 - FCFE => equity value (r_E)

