Discounted Free Cash Flow Model

Equity Analysis FN 451: Part II Fundamental Analysis

Course lecturer: Sirinattha Techasiriwan

Topics to be Discussed:

I. Free Cash Flow to the Firm (FCFF) versus Free Cash Flow to Equity (FCFE) Approaches to Equity Valuation

II. Calculating FCFF and FCFE

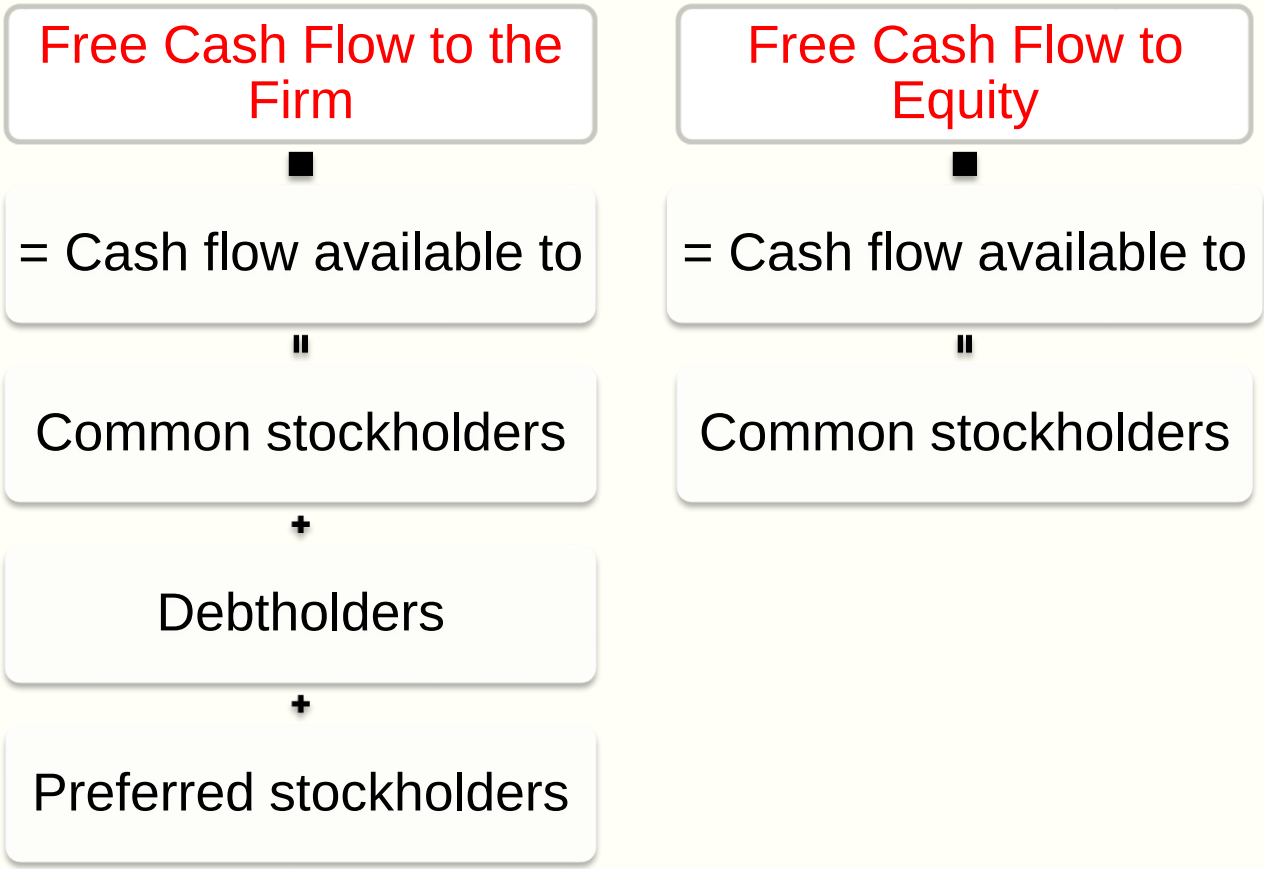
III. Single-Stage Free Cash Flow Models

IV. Simple Two-Stage FCF Models / The general version of FCF Models

V. Issues in Using the FCF Models

VI. Comparing FCFE and FCFF Model

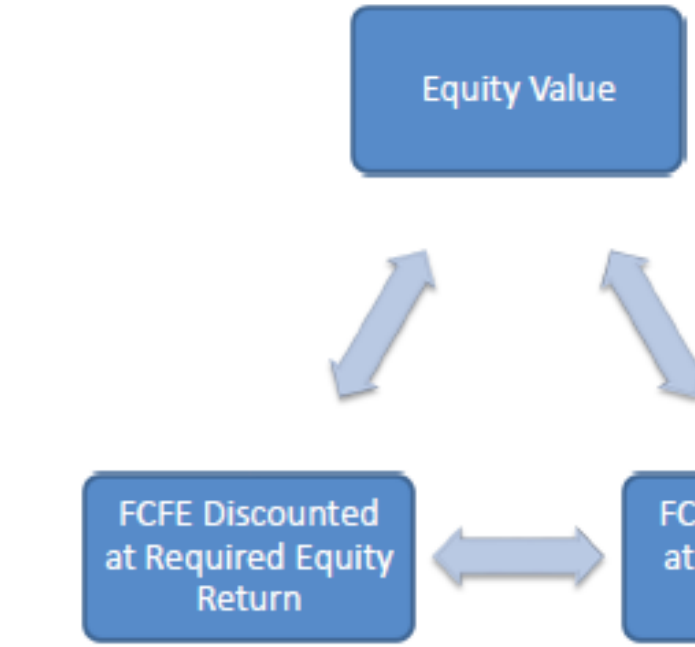
Free Cash Flow



Source: Equity Asset Valuation, 3nd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons

Sirinattha Techasiriwan
สิริณัฏฐา เตชะศิริวรรณ

FCFF vs. FCFE Approaches to Equity Valuation



$$\text{Equity value} = \sum_{t=1}^{\infty} \frac{\text{FCFE}_t}{(1+r)^t}$$

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

$$\text{Equity value} = \text{Firm value} - \text{Debt value}$$

I. Market value of interest-bearing debt

or II. (Adding the cash and marketable securities) and subtracting market value of the interest-bearing debts

Using Net Income, EBIT, EBITDA and Cash Flow from Operations (CFO) to Determine FCFF

Using Net Income to Determine FCFF

$$FCFF = NI + NCC + Int(1 - \text{Tax rate}) - FCInv - WCInv$$

Net noncash charges (NCC) include depreciation, amortization, unrealized capital gains (losses), non-cash restructuring income (expenses), etc.

Using EBIT and EBITDA to Determine FCFF

$$FCFF = EBIT(1 - \text{Tax rate}) + Dep - FCInv - WCInv$$

$$FCFF = EBITDA(1 - \text{Tax rate}) + Dep(\text{Tax rate}) - FCInv - WCInv$$

FCInv = investments (change) in fixed assets, WCInv = investments (change) in working capital

Using Cash Flow from Operations (CFO) to Determine FCF

$$FCFF = CFO + Int(1 - \text{Tax rate}) - FCInv$$

CFO = Net Income + [Depreciation & Amortization +/- One-Time Adjustments] +/- Change in Working Capital

Source: Equity Asset Valuation, 3nd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons

Calculating FCFE from FCFF, Net Income, and CFO

FCFE from net income (NI) and FCFF:

FCFF = NI + NCC + Int(1-Tax rate) – FCInv – WCInv

FCFE = NI + NCC – FCInv – WCInv + Net borrowing

FCFE from CFO and FCFF:

FCFF = CFO + Int(1-Tax rate)- FCInv

FCFE = CFO – FCInv + Net borrowing

FCFE = FCFF – Int(1- Tax rate) + Net borrowing

CFO = Net Income + Depreciation & Amortization +/- One-Time Adjustments +/- Change in Working Capital

Example: Calculating FCFF

Calculating FCFF from Net Income

$$NI = (EBITDA - Dep - Int)(1 - Tax\ rate)$$

$$NI = (\$1000 - \$400 - \$150)(1 - 0.30) = \$315$$

$$FCFF = NI + NCC + Int(1 - Tax\ rate) - FCInv - WCInv$$

$$FCFF = \$315 + \$400 + \$150(1 - 0.30) - \$500 - \$50 = \$270$$

EBITDA	$1,000
Depreciation expense	$400
Interest expense	$150
Tax rate	30
Purchases of fixed assets	$500
Change in working capital	$50
Net borrowing	$80
Common dividends	$200

Calculating FCFF from EBIT and EBITDA

$$EBIT = EBITDA - Dep = \$1000 - \$400 = \$600$$

$$FCFF = EBIT(1 - Tax\ rate) + Dep - FCInv - WCInv$$
$$FCFF = \$600(1 - 0.30) + \$400 - \$500 - \$50 = \$270$$

$$FCFF = EBITDA(1 - Tax\ rate) + Dep(Tax\ rate) - FCInv - WCInv$$
$$FCFF = \$1000(1 - 0.30) + \$400(0.30) - \$500 - \$50 = \$270$$

Calculating FCFF from CFO

$$CFO = NI + Dep - WCinv$$
$$CFO = \$315 + \$400 - \$50 = \$665$$

$$FCFF = CFO + Int(1 - Tax\ rate) - FCInv$$
$$FCFF = \$665 + \$150(1 - 0.30) - \$500 = \$270$$

Example: Calculating FCFE

Calculating FCFE from FCFF

$$FCFE = FCFF - Int(1 - Tax\ rate) + Net\ borrowing$$
$$FCFE = \$270 - \$150(1 - 0.30) + \$80 = \$245$$

Calculating FCFE from NI

$$FCFE = NI + NCC - FCInv - WCInv + Net\ borrowing$$
$$FCFE = \$315 + \$400 - \$500 - \$50 + \$80 = \$245$$

Calculating FCFE from CFO

$$FCFE = CFO - FCInv + Net\ borrowing$$
$$FCFE = \$665 - \$500 + \$80 = \$245$$

EBITDA	$1,000
Depreciation expense	$400
Interest expense	$150
Tax rate	30
Purchases of fixed assets	$500
Change in working capital	$50
Net borrowing	$80
Common dividends	$200

Single-Stage Free Cash Flow Models

$$\text{Firm value} = \frac{\text{FCFF}_1}{\text{WACC} - g}$$

$$\text{Equity value} = \text{Firm value} - \text{Debt value}$$

g = Stable growth rate in the FCFF forever = Stable growth rate$_{FCFF}$

*****g_n must be less than WACC*****

$$\text{Equity value} = \frac{\text{FCFE}_1}{r - g}$$

g = Stable growth rate in the FCFE forever = Stable growth rate$_{FCFF}$

*****g_n must be less than r*****

Stable growth rate$_{NOPAT}$ = Reinvestment rate$_0$ x Return on reinvestment$_s$

Source: Equity Asset Valuation, 3nd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons

Simple Two-Stage FCF Models

$$\text{Firm value} = \sum_{t=1}^{n} \frac{\text{FCFF}_t}{(1+\text{WACC})^t} + \frac{\text{FCFF}_{n+1}}{(\text{WACC}-g)} \frac{1}{(1+\text{WACC})^n}$$

$$\text{Equity value} = \sum_{t=1}^{n} \frac{\text{FCFE}_t}{(1+r)^t} + \frac{\text{FCFE}_{n+1}}{(r-g)} \frac{1}{(1+r)^n}$$

Source: Equity Asset Valuation, 3nd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons

Sirinattha Techasiriwan
สิรินัฏฐา เตชะศิริวรรณ

IV Example: Simple Two-Stage FCFE Model (cont.)

	Year				
	1	2	3	4	5
Percentage sales growth	20%	20%	20%	5%	5%
Sales per share	$12.000	$14.400	$17.280	$18.144	$19.051
EPS	$1.200	$1.440	$1.728	$1.814	$1.905
FCInv per share	$0.800	$0.960	$1.152	$0.346	$0.363
WCInv per share	$0.500	$0.600	$0.720	$0.216	$0.227
Debt financing per share	$0.390	$0.468	$0.562	$0.168	$0.177
FCFE per share	$0.290	$0.348	$0.418	$1.421	$1.492
Growth in FCFE		20.0%	20.0%	240.3%	5.0%

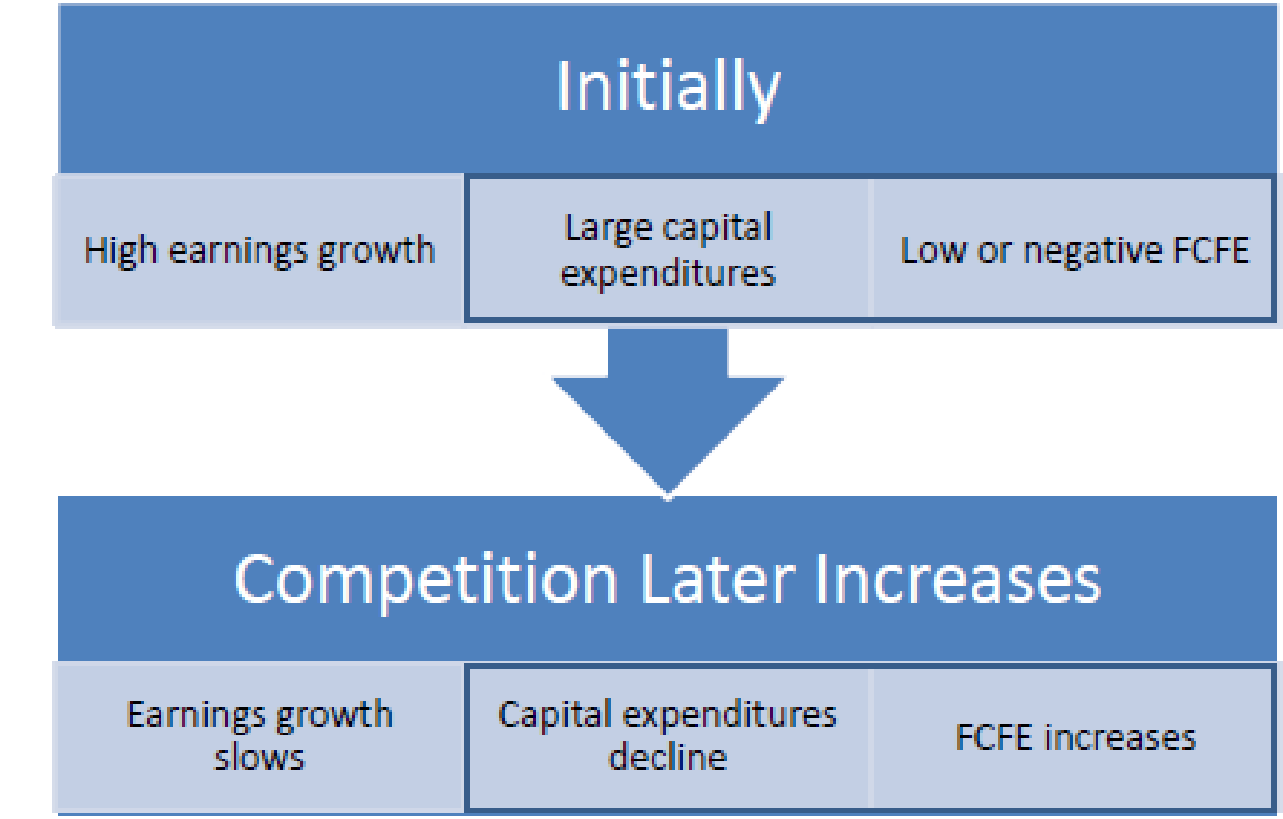
$$\text{Equity value} = \sum_{t=1}^{n} \frac{\text{FCFE}_t}{(1+r)^t} + \frac{\text{FCFE}_{n+1}}{(r-g)} \frac{1}{(1+r)^n}$$

$$\text{Equity value} = \frac{\$0.29}{(1.12)^1} + \frac{\$0.348}{(1.12)^2} + \frac{\$0.418}{(1.12)^3} + \frac{\$1.421}{(0.12 - 0.05)} \frac{1}{(1.12)^3}$$

$$\text{Equity value} = \$0.2589 + \$0.2774 + \$0.2975 + \$14.4491 = \$15.28$$

Source: Equity Asset Valuation, 3nd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons

Issues in Using the FCF Models: Declining Growth



Causes that can Result in FCFF to be Inflated or Deflated

Beware of the causes that can result in FCFF to be inflated or deflated:

- If the inputs for reinvestment are **not a function of expected growth** the free cash flow to the firm can be **inflated (or deflated)** by reducing (increasing) **capital expenditures relative to depreciation**.
- Even if industry averages are used to compute the reinvestment, it is always prudent to estimate **what return on capital is imputed in that reinvestment** (obtained by dividing the growth rate in perpetuity by the reinvestment rate).
- **A negative change in working capital creates a cash inflow.** As a result it can significantly elevated a fair value if we assume it in perpetuity.

Source: Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd Edition, Damodaran, A., 2012, John Wiley & Sons.

Comparing DDM and FCFE Model

- One way to describe a free cash flow to equity model is that it represents a model where we discount **potential dividends** rather than **actual dividends**.
- When we replace the dividends with FCFE to value equity, w**e are implicitly assuming that the FCFE will be paid out to stockholders.** There are two

Source: Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd Edition, Damodaran, A., 2012, John Wiley & Sons.

Comparing FCFE and FCFF Model

- The value of equity, can be extracted from the value of the firm by subtracting the market value of outstanding debt.

Equity value = Firm value – Market value of debt

FCFE = FCFF – Interest expense(1 – Tax rate)
+ (New debt issued – Debt repayments)

- The value for equity obtained from the **firm valuation** and **equity valuation** approaches will be **the same** if you make **consistent assumptions about financial leverage.** However, getting them to converge in practice is much more difficult.

Source: Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd Edition, Damodaran, A., 2012, John Wiley & Sons.

Summary: FCFF vs. FCFE

FCFF vs. FCFE

- FCFF = Cash flow available to all firm capital providers
- FCFE = Cash flow available to common equity holders
- FCFF is preferred when FCFE is negative or when capital structure is unstable

Equity Valuation with FCFF and FCFE

- Discount FCFF with WACC
- Discount FCFE with required return on equity
- Equity value = PV(FCFF) – Debt value or PV(FCFE)

Source: Equity Asset Valuation, 3nd edition, Jerald E. Pinto, Elaine Henry, Thomas R. Robinson, John D. Stove, John Wiley & Sons

Sirinattha Techasiriwan
สิรินัฏฐา เตชะศิริวรรณ

DDM, FCFF or FCFE Model?

The dividend discount model (DDM) works best for firms that maintain a policy of **paying out residual cash flows** (i.e., cash flows left over after debt payments and reinvestment needs have been met) **as dividends**. Hence, we may misvalue **firms that consistently fail to return what they can afford to their stockholders**.

Why Firms May Pay Out Less than Available

- Desire for stability
- Future investment needs
- Tax factors
- Managerial self-interest
- Signaling **prerogative**
  - Firms often use dividends as signals of future prospects, with **increases in dividends** being viewed as **positive signals** and **decreases** as **negative signals**.

Free Cash Flow to Firm (FCFF) Model is best suited for firms that either have **very high or very low leverage** or are **in the process of changing their leverage (i.e. unstable capital structure)** or have **negative FCFE**.

- The calculation of **FCFE** is much more difficult in these cases because of the **volatility induced by debt payments** (or new issues), and the **value of equity**, which can a small slice of the total value of the firm for **highly levered firms**, is **more sensitive to assumptions about growth and risk.**

Free Cash Flow to Equity (FCFE) Model is best suited for **firms in stable leverage.**

Assignments:

Damodaran, A., 2012, Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd Edition

- Read chapter 14 – Free Cash Flow to Equity Discount Model (pages 351 – 352, 356 – 363, 372-374)
- Read chapter 15 – Firm Valuation (pages 380 – 386, 396-397)

Group Project