

Equity Analysis and Valuation

VI. Free Cash Flow to Firm Discount Model

VII. Free Cash Flow to Equity Discount Model

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

Course instructor: Sirinattha Techasiriwan



Key Learning Outcome:

Free Cash Flow to Firm Discount Model

- I. Free Cash Flow to Firm (FCFF)
- II. Firm Valuation: Valuing a Firm with a FCFF Model
 1. FCFF Model for a Stable Growth Firm
 2. The General Version of FCFF Model
 3. Benefits and Pitfalls (of DDM and) FCFF Model

Key Learning Outcome (cont.):

Free Cash Flow to Equity Discount Model

IV. Free Cash Flow to Equity (FCFE)

V. Equity Valuation: FCFE Valuation Models

1. Constant Growth FCFE Model
2. Two-Stage FCFE Model

Comparing DDM, FCFE and FCFF Discount Model

V. FCFE Valuation Versus DDM Valuation

Free Cash Flow to Firm Discount Model

Free Cash Flow to Firm (FCFF)

- The free cash flow to the firm (FCFF) is the sum of the cash flows to **all claim holders (capital contributors) in the firm**, including **common stockholders, bondholders, and preferred stockholders**.

$$\text{FCFF} = \text{EBIT}(1 - \text{Tax rate}) + \text{Depreciation} \\ - \text{Capital expenditure} - \Delta \text{ Working capital}$$

$$\text{FCFF} = \text{Net Income} + \text{Non Cash Charges} + [(\text{Interest} * (1 - \text{tax rate}))] \\ - \text{Capital expenditure} - \Delta \text{ Working capital}$$

- **Capital expenditure (CAPEX)** and change in **working capital** are the necessary reinvestments to generate growth in future cash flows.
- Since this cash flow is **prior to debt payments**, it is often referred to as an **unlevered cash flow**.
- **In a strict sense**, **cash and marketable securities** are not considered as parts of **operating assets** and a **firm value** is viewed as the **value of the firm's operating assets**. As a result, **the value of the firm does not include the value of cash and marketable securities**.
- And since cash and marketable securities are netting out of firm value, **interest income from the cash and marketable securities is not counted as part of the EBIT**.



II-1 FCFF Model for a Stable Growth Firm

- A firm with free cash flows to the firm growing at a stable growth rate can be valued using the following equation:

$$\text{Value of firm or Enterprise Value (EV)} = \frac{\text{FCFF}_1}{(\text{WACC} - g_n)}$$

where

FCFF_1 = Expected FCFF next year

WACC = Weighted average cost of capital

g_n = Growth rate in the FCFF forever

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

- Adding the cash and marketable securities and subtracting market value of the debt yields a value for the equity**



II-1 FCFF Model for a Stable Growth Firm: the Cost of Capital

- The **cost of capital (WACC)** should also be reflective of a stable growth firm. In particular, the **beta** should be close to 1 - the rule of thumb that the beta should be **between 0.8 and 1.2**.
- The **capital structure**: While **stable growth firms tend to use more debt, this is not a prerequisite for the model**, since debt policy is subject to managerial discretion.



FCFF Model for a Stable Growth Firm: the Stable Growth Rate (g_n)

- The **growth rate** used in the model has to be **less than the WACC**.
- The growth rate used in the model **has to be less than or equal to the growth rate in the economy**—nominal growth, if the cost of capital is in nominal terms, or real growth, if the cost of capital is a real cost of capital.
- The characteristics of the firm have to be consistent with **assumptions of stable growth**. In particular, the **reinvestment rate** used to estimate free cash flows to the firm should be consistent with the **stable growth rate** (**$g = \text{reinvestment rate} \times \text{rate of return on the investment}$**).



Stable growth rate = Reinvestment rate x Return on Capital



II-1 FCFF Model for a Stable Growth Firm: the Reinvestment Rate

$$\text{Reinvestment rate}_0 = \frac{(\text{CAPEX} - \text{Depreciation}) + \text{Change in WC}}{\text{EBIT} (1-t)_0}$$

Refer to our
previous lesson:

Equity reinvested in business = Capital expenditures – Depreciation +
Change in working capital
– (New debt issued – Debt repaid)

Equity reinvestment rate = Equity reinvested/Net income₀

Expected growth in net income = Equity reinvestment rate ×
Return on equity



FCFF Model for a Stable Growth Firm: the Reinvestment Rate (cont.)

- If reinvestment is estimated from net capital expenditures and change in working capital:
 - The **net capital expenditures** should be similar to those other firms in the industry (perhaps by setting the ratio of **capital expenditures to depreciation** at industry averages).
 - The **change in working capital** should generally **not be negative**.

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.



II-1 Example: Valuing a Firm with the Stable Growth FCFF Model—Telesp (Brazil)

- Telesp provides local telecommunication services to the Brazilian state of Sao Paulo. In 2010, the company had operating income (EBIT) of 3,544 million BR and faced an effective tax rate of 30%. In 2010, the firm reported capital expenditures of 1,659 million BR and depreciation of 1,914 million BR and an increase in working capital of 1,119 million BR. Calculate reinvestment rate, return in capital and the expected growth rate.

- Its reinvestment in 2010 can be computed as follows:

$$\text{Reinvestment rate} = \frac{\text{CAPEX} - \text{Depreciation} + \text{Change in WC}}{\text{EBIT} (1-t)} = \frac{(1,659 - 1,914 + 1,119)}{3,544 (1-0.3)} = 34.8\%$$

- The return on capital generated by the company in 2010 was computed as follow:

$$\text{EBIT}_{2010} (1-t) / \text{BV equity}_{2009} + \text{BD debt}_{2009} - \text{Cash}_{2009} = 15.68\%$$

- The expected growth rate that emerges from these inputs is:

$$\text{Expected growth rate} = 34.82\% \times 15.68\% = 5.46\%$$



II-1 Example: Valuing a Firm with the Stable Growth FCFF Model—Telesp (Brazil) (cont.)

- The **risk-free rate** in BR in May 2011 was **7%**. In conjunction with a **beta of 0.8** and an **equity risk premium for Brazil of 8%** (composed of a mature market premium of 5% and an additional country risk premium of 3% for Brazil), **this yields a cost of equity of 13.40%**. Incorporating a **pretax cost of debt of 9.50%** and a **debt ratio of 20%** (based on current market values for equity and debt), **a cost of capital is 12.05%**:

$$\text{Debt-to-capital ratio} = \frac{\text{Debt}}{\text{Debt} + \text{Market value of equity}} = \frac{5,519}{5,519 + 21,982} = 20.0\%$$

$$\text{Cost of capital} = 13.40\%(80\%) + 9.50\%(1 - .30)(20\%) = \mathbf{12.05\%}$$

Find the fair value of equity. The firm's market capitalization in May 2011 was **21,982** million BR Is the company's equity mispriced?

- The value for the **operating assets** can then be estimated as follows:

$$\begin{aligned} \text{FCFF in 2010} &= \text{EBIT} (1 - t) + \text{Depreciation} - \text{Capital expenditures} - \text{Change in noncash WC} \\ &= 3,544(1 - .30) + 1,914 - 1,659 - 1,119 = \mathbf{1,617} \text{ million BR} \end{aligned}$$

$$\text{Value of operating assets} = \text{FCFF}_1 / (\text{WACC} - g_n) = 1,617 * (1.0546) / (.1205 - .0546) = \mathbf{25,901\#}$$

Adding the **cash and marketable securities (1,557 million BR)** and subtracting the **debt (5,519 million BR)** at the end of 2010 yields a value for the equity:

$$\begin{aligned} \text{Value of equity} &= \text{Value of operating assets} + \text{Cash} - \text{Debt} \\ &= 25,901 + 1,557 - 5,519 = \mathbf{21,939} \text{ million BR} \end{aligned}$$

- The firm's market capitalization in May 2011 was **21,982** million BR, making it **fairly priced**.

II-2 General Version of the FCFF Model

- The value of the firm (**firm value, enterprise value (EV)**) in the most general case, can be written as the present value of expected free cash flows to the firm:

$$EV = \sum_{i=1}^n \frac{FCFF_i}{(1+WACC)^i} + \frac{TV}{(1+WACC)^n}$$
$$TV = \frac{FCFF_{n+1}}{(WACC - g)} = \frac{FCFF_n \times (1+g)}{(WACC - g)}$$

where

EV = Enterprise value

FCFF_i = Free cash flow to firm in year i

WACC = Weighted average cost of capital

g = stable growth rate

- Adding the cash and marketable securities and subtracting market value of the debt yields a value for the equity



II-2 Example: General Version of the FCFF Model (OISHI)

In the excel file

(Assignment: OISHI)



II-3 Benefits and Pitfalls (of DDM and) FCFF Model

- **The dividend discount model (DDM)** is easy to understand but the model 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**.

- **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**).
 - 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 Discount Model



IV Free Cash Flow to Equity (FCFE)

- **Free cash flows to equity (FCFE)** are cash flows **left over after meeting all financial obligations**, including debt payments, and after covering capital expenditure and working capital needs. **FCFE** a simple measure how much cash is available to be paid out to stockholders after meeting reinvestment needs.

$$\text{FCFE} = \text{FCFF} - [\text{Int} \times (1 - \text{tax rate})] + \text{Net Borrowing}$$

- **Free Cash Flow to Equity (FCFE) Model** is best suited for **firms in stable leverage**, while **FCFF** is preferred when **FCFE is negative or when capital structure is unstable**.
 - In cases where the leverage is expected to change significantly over time, FCFF is a significant time saver, since estimating new debt issues and debt repayments when leverage is changing can become increasingly messy the further into the future you go.
 - The firm valuation approach does, however, require information about debt ratios and interest rates to estimate the weighted average cost of capital.

V Equity Valuation: FCFE Valuation Models

- As a result, when discounting FCFE, it is safest to **separate the existing cash balance from the operating assets** of the firm, to **value the equity in the operating assets** and then **add on the existing cash balance**.
- Consequently, the **return on equity can also have to be modified** to reflect the fact that the conventional measure of the return includes **interest income from cash and marketable securities in the numerator** and the **book value of equity also includes the value of the cash and marketable securities**.
- In the FCFE model, there is no excess cash left in the firm and the **return on equity should measure the return on noncash investments**. You could construct a modified version of the return on equity that measures this:

$$\text{Noncash ROE} = (\text{Net income} - \text{After-tax income from cash and marketable securities}) / (\text{BV of equity} - \text{Cash and marketable securities})$$



Constant Growth FCFE Model

- The constant growth FCFE model is designed to value firms that are growing at a stable growth rate and are hence in steady state. The value of equity, under the constant growth model, is as follow:

$$\text{Value} = \frac{\text{FCFE}_1}{(k_e - g_n)}$$

where

Value = Value of stock today

FCFE_1 = Expected FCFE next year

k_e = Cost of equity of the firm

g_n = Growth rate in the FCFE forever

- The **sustainable growth rate (g) cannot exceed the cost of equity (k)**. If g exceeds k, the value per share becomes negative.
- The stable growth rate (g) can be estimated base on **the sustainable growth rate formula**.



Constant Growth FCFE Model: The Stable Growth Rate (g_n)

- With a sustainable growth rate formula:
Expected growth rate = Retention ratio x Return on Equity
- To estimate the sustainable growth rate of FCFE, we replace the retention ratio with the equity reinvestment rate and replace the return on equity with the noncash ROE.

Expected growth rate_{FCFE} = Equity reinvestment rate x Noncash ROE

**Equity reinvestment = (Capital expenditures – Depreciation)
– (Change in noncash working capital)
+ (New debt issued – Debt repayments)**

Equity reinvestment rate = Equity reinvestment / Net income



Example: Stable Growth FCFE Model - Volkswagen

Volkswagen is a mature German automobile company. The firm is assumed to be in stable growth, and the following inputs were used to value it in May 2011:

- The net income, not including the interest income from cash, for the company in 2010 was **5,279 million euros**, and we will use this as the base year income.

- The **expected growth in net income over time** is assumed to be **3%** and the **noncash return on equity** that Volkswagen is expected to deliver is **10%**.

➔ **Stable equity reinvestment rate = $g/ROE = 3\%/10\% = 30\%$**

- The firm did report **capital expenditures of 11,462 million euros**, **depreciation of 10,089 million euros**, and an **increase in noncash working capital of 423 million euros** in 2010. ➔ **The reinvestment rate using those inputs was 20.41%:**

$$\text{Reinvestment rate in 2010} = (11,462 - 10,089 + 423) / 5,279 = 20.41\%$$

We could have used this reinvestment rate in the valuation, but with an expected growth rate in perpetuity of **2.04%** ($20.41\% \times 10\% = 2.04\%$).

Text book P360



V-1

Example: Stable Growth FCFE Model – Volkswagen (cont.)

- Volkswagen's cost of equity is estimated using a beta of 1.20, reflecting the average beta across European auto companies, a euro risk-free rate of 3.2%, and an equity risk premium of 5%:

$$\text{Cost of equity} = 3.2\% + 1.2(5\%) = 9.2\%$$

- With the inputs, we can estimate the overall value of equity:

$$\begin{aligned} \text{Value of equity} &= \text{Expected net income next year} (1 - \text{Equity Reinvestment Rate}) / \\ &\quad (\text{Cost of equity} - \text{Expected growth rate}) \\ &= [5,279 * 1.03 (1-.3)] / (.092 - .03) = 61,392 \# \end{aligned}$$

- Note that this is the **value of the equity in the non-cash operating assets**, since we took out the income from cash from our base FCFE. **Adding the cash balance of 18,670 million euros yields an overall value of equity of 80,062 million euros**, significantly higher than the market capitalization of 53,560 million euros in May 2011.

Text book P360



Two-Stage FCFE Model

- The value of any stock is the present value of the FCFE per year for the extraordinary growth period plus the present value of the terminal price at the end of the period.

Equity value = PV of FCFE + PV of terminal price

$$\text{Equity value} = \sum_{t=1}^n \frac{\text{FCFE}_t}{(1+k_{e,hg})^t} + \frac{\text{FCFE}_{n+1}}{(k_{e,st} - g)} \frac{1}{(1+k_{e,hg})^n}$$

where

FCFE = Expected FCFE

k_e = Cost of equity in high growth (hg) and stable growth (st) periods

g = Growth rate in the FCFE forever



Example: Two-Stage FCFE Model

Text book P 363

(self study)

Sirinatta Techasiriwan
สิรินัทธนา เศษศิริวรรณ

Comparing DDM and FCFE



Differences between DDM and FCFE Model

	<i>Dividend Discount Model</i>	<i>FCFE Model</i>
Implicit Assumption	Only dividends are paid. Remaining portion of earnings are invested back into the firm, some in operating assets and some in cash & marketable securities.	The FCFE is paid out to stockholders. The remaining earnings are invested only in operating assets.
Expected Growth	Measures growth in income from both operating and cash assets. In terms of fundamentals, it is the product of the retention ratio and the return on equity	Measures growth only in income from operating assets. In terms of fundamentals, it is the product of the equity reinvestment rate and the non-cash return on equity.
Dealing with cash and marketable securities	The income from cash and marketable securities is built into earnings and ultimately into dividends. Therefore, cash and marketable securities do not need to be added in	You have two choices: <ol style="list-style-type: none"> 1. Build in income from cash and marketable securities into projections of income and estimate the value of equity. 2. Ignore income from cash and marketable securities, and add their value to equity value in model



Assignments:

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

- Read chapter 15 – Firm Valuation: Cost of Capital and Adjusted Present Value Approaches (pages 380 – 386, 396-397), chapter 14 – Free Cash Flow to Equity Discount Model (pages 351 – 352, 356 – 363, 372-374)
- **OISHI valuation: FCFF Model, FCFE Model**
- **End of chapter 14 exercises (questions 1, 2, 3)***
- **End of chapter 15 exercises (questions 1, 2, 5)***

