



Using a Spreadsheet to Value a Firm's Stock^{*}

In the ongoing search for bargains in the stock market, analysts and investors rely on models to estimate the intrinsic value of a firm's equity. By comparing the valuation suggested by their model to the actual value in the marketplace, they form opinions as to whether a given stock is under or over valued. Valuation models are also used by investment bankers as an aid to pricing initial public offerings, and to inform parties involved in assorted private transactions such as selling a business or division, dividing property among owners, and settling estates. In this note, we introduce a relatively simple but powerful model of equity (stock) valuation.¹

1. The basic idea behind valuation

As you will see in future courses (and in our valuation of debt in this course), valuation models in finance are typically based on discounted future cash flows or discounted future dividends. Keep in mind that, holding underlying assumptions constant, all valuation models should yield the same result. We prefer a model based on accounting data for valuing equity for the following reasons. Benchmarks for performance are almost always given in earnings per share (*EPS*) – not cash flows or dividends. Evidence from academic research suggests that earnings performance is generally more important to investors than cash flows or dividends. And, on the practical side, dividend payout policies tend to be stable for long periods making them less useful for tracking changes in value. Further, earnings generally receive far more attention from the business press, investors and analysts. Finally, analysts typically forecast earnings (rather than cash flows or dividends).² Thus, in the absence of a clearly superior approach, we emphasize a valuation model based on discounted future accounting earnings. We start with a highly simplified model that assumes earnings, cash flows and dividends are equivalent and that earnings continue at the same amount in perpetuity.³ Using this perpetuity model, the present value (PV) of a stream of future earnings is:

$$PV = \frac{NI}{r}$$

^{*} Prepared by Robert Bowen and Shiva Rajgopal of the University of Washington. Frank Hodge, Jane Kennedy and Terry Shevlin provided helpful comments. Revised: March 21, 2002.

¹ One can value a company's total assets or its owners' equity. We choose to value owners' equity as the resulting estimate can be compared to observed stock prices.

² An important exception is the Internet sector, especially before April 2000, where revenues and non-financial metrics such as 'hits' arguably received more attention from analysts than did earnings.

³ The British government has issued securities that look like this. They are called perpetuities and provide fixed payments into perpetuity, but the government is not required to repay the principal.

where:

NI = earnings assumed to continue in perpetuity

r = discount rate

Below we consider three simple applications of this so-called perpetuity valuation model.

Example 1: A savings account. Assume we put \$100 into a savings account that has an expected annual return of 5%. What is expected earnings for next year? Answer = \$5 (= 0.05 * \$100).

Now let's use our perpetuity valuation model to arrive at the *present value* of our savings account assuming it would continue to pay 5% interest. (Yes, we already know that the answer should be \$100.)

$$PV = \frac{\$5}{.05}$$

$$PV = \$100$$

Okay, our model 'worked' in that it yielded the known present value of our investment, \$100.

Example 2: Claude's Coffeehouse. Assume that Claude's Coffeehouse expects to earn \$120,000 next year. We will use our perpetuity valuation model to estimate the current market value of the company's stock. Assume a discount rate or 'cost of capital' of 10%. (Note that we are using market value and present value as synonyms.)

$$MV = \frac{\$120,000}{.10}$$

$$MV = \$1,200,000$$

Our model suggests that Claude's Coffeehouse is worth \$1.2 million.

Example 3: Robert Mondavi. According to the consensus analyst estimate provided by Yahoo.com (as of November 3, 2001), Mondavi [ticker symbol: Mond] is expected to earn \$2.41 per share in the next fiscal year. This time we will use our perpetuity valuation model to estimate the current market price of Mondavi's common stock. Assume a discount rate or 'cost of capital' of 7.88%. (Here, we express the present market value as the price per share, P.)

$$P = \frac{\$2.41}{.0788}$$

$$P = \$30.58$$

Our model suggests that Robert Mondavi shares are worth \$30.58. Mondavi's stock price in early November 2001 was \$33, so our model was close.

Next, we introduce our general model for a firm's market value of equity (a.k.a. 'market cap'). This model allows for growth in earnings and introduces the concept of 'normal' versus 'abnormal' earnings. The market value of a firm's equity at time t (MVE_t) is:⁴

$$MVE_t = BVE_t + \sum_{\tau=1}^{\tau=\infty} \frac{NI_{t+\tau} - r_e \cdot BVE_{t+\tau-1}}{(1+r_e)^\tau} \quad (1)$$

where:

BVE_t = the book value of equity at time t

NI_t = forecasted earning for time $t+1$ and beyond

r_e = the cost of equity capital assumed constant over time

While this model may look daunting, it is really quite intuitive. Below we discuss how the model is built, the inputs needed to make it work and where you can find the data on the Internet to build your own model.

2. Building the model – the theory

At the most simple level, when a firm earns a 'normal' economic return on the shareholders' investment (r_e), the firm's total market capitalization (MVE_t) should be approximately equal to its accounting book value of equity (BVE_t), i.e., $MVE_t = BVE_t$. Book value of equity is the amount contributed by the owners over time, plus the cumulative amount earned by the company, less any dividend payouts to the owners.

However, professional managers are hired to do better than earn normal returns – their goal is to build (some would say maximize) shareholder value. If they are successful, the company earns more on shareholders' capital than the capital costs. The stock market is forward looking and when success is expected, MVE_t exceeds BVE_t . To model the size of this market-to-book premium, we evaluate each future period and compare the expected earnings (NI_{t+1}) to the minimum earnings required by investors to meet the cost of equity capital ($r_e * BVE_t$). This period-by-period difference ($NI_{t+1} - r_e * BVE_t$) is often called 'abnormal' earnings.⁵ If a company's prospects are poor, forecasts of future earnings may be less than the required cost of equity capital. In this case, shareholder value is being destroyed and abnormal earnings are negative. Either way, the value of owners' equity is a function of the magnitude of abnormal earnings. In mathematical terms, our model looks like:

$$MVE_t = BVE_t + (NI_{t+1} - r_e \cdot BVE_t) + (NI_{t+2} - r_e \cdot BVE_{t+1}) + \dots$$

⁴ Alternatively, the price per share (P) can be modeled as a function of the book value of equity per share ($BVPS$)

and earnings per share (EPS) as follows: $P_t = BVPS_t + \sum_{\tau=1}^{\tau=\infty} \frac{EPS_{t+\tau} - r_e \cdot BVPS_{t+\tau-1}}{(1+r_e)^\tau}$

This per share version of the model is described in appendix 1. We will use it to estimate the value of a real world companies because most analyst data is provided on a per share basis.

⁵ It is also referred to as residual income. Stern Stewart, a large international consulting firm, has introduced and trademarked its custom version of residual earnings called economic value added or EVA[®]. See www.sternstewart.com for details.

However, we cannot simply add these future values to the current book value of equity. We need to consider the time value of money and discount each future flow back to its present value, yielding the somewhat more complicated looking model:

$$MVE_t = BVE_t + \frac{(NI_{t+1} - r_e \cdot BVE_t)}{(1 + r_e)^1} + \frac{(NI_{t+2} - r_e \cdot BVE_{t+1})}{(1 + r_e)^2} + \dots$$

Finally, we use the shorthand of the summation sign to group all of the abnormal earnings terms together – replicating model (1) above.

$$MVE_t = BVE_t + \sum_{\tau=1}^{\tau=\infty} \frac{NI_{t+\tau} - r_e \cdot BVE_{t+\tau-1}}{(1 + r_e)^\tau} \quad (1)$$

The first term on the right-hand side, the book value of equity, is known and publicly available. The second summation term represents forecasted data, the present value of future abnormal earnings. All of the model's complexity is in estimating this term.

We now turn our attention to each of the inputs to the valuation model.

3. Implementation – defining inputs required for the model

From model (1), it appears that we only need to know four items to estimate current stock price: current and future book value of equity (BVE_t and $BVE_{t+\tau}$), future earnings ($NI_{t+\tau}$) and return on equity (r_e), which we assume remains constant over time. Unfortunately, it is not quite that simple. We are dealing with an uncertain future and we need to make some strong assumptions and rely on expert analysts to help us in our valuation. In this section, we define the four main inputs to the valuation model and revisit why they are included.

Current data: this is the first term on the right-hand side of model (1)

1. *Current book value of equity (BVE_t).* Book value of equity is our starting point. It is the only *known* item in our model – the remainder are *forecasts*. If a firm only earns a 'normal' return on its equity, investors should only be willing to pay for its book value of equity. In this case, the firm's market cap should (approximately) equal its book value of equity.

Future data: the second term on the right-hand side of model (1) estimates the future value of abnormal earnings. The inputs are:

2. *Forecasts of earnings (NI).* The essence of our forward-looking model relies on professional analyst forecasts of future earnings.⁶ Analysts typically forecast NI only out a few years, but fortunately, analysts also forecast a long-term growth rate in earnings. We use this long-term growth rate (*LTG*) to estimate NI approximately 5-10 years into the

⁶ In practice, analysts generally forecast earnings per share (EPS). As indicated in note 3 above, our model can be written in per share terms. We will practice using both versions.

future.⁷ We generally use the average or consensus forecast obtainable from many sources (including the Internet as described below). Of course, you can easily modify analyst estimates – especially if you have superior information.

3. *Future book value of equity ($BVE_{t+\tau}$)*. Future book value of equity is needed to create our benchmark for a ‘normal’ expected return. If a firm can earn more than the normal rate of return on the shareholders’ investment, then investors should be willing to pay more than the book value of the firm’s equity. In this situation, managers are taking actions that add value for shareholders. In contrast, when the firm is earning less than its cost of equity capital, managers are taking actions that destroy value and the shareholders’ investment should be less than the book value of the firm’s equity. Since both earnings and dividends affect how much capital is retained in the company, we must adjust the prior period’s book value of equity by adding this period’s earnings and subtracting this period’s dividends (*DIV*), if any.
4. *Cost of equity capital (r_e)*. Estimating the cost of equity capital is a major (and difficult) topic in finance. For our purposes, we will either take the rate as given and assume it remains constant over time, or use the model described in footnote 8 to calculate the cost of a firm’s equity capital.⁸

4. Getting more practical – a numerical example

In order to introduce some additional practical issues, consider the following situation.

Example 4: Claude’s Coffeehouse

Assume it is 1/1/01 and Claude Lamar is considering selling his 5-store chain of coffee shops (“Claude’s Coffeehouse”) to Starbucks. Claude wants to estimate the intrinsic value of his firm in order to respond to Starbucks’ offer of \$1 million (or \$10.00 per share) for all of the 100,000 outstanding shares.

Below is a list of the key inputs to the discounted earnings-based valuation model discussed above. Because Claude is not used to thinking in per share amounts, we provide absolute dollar amounts and the number of shares outstanding.

- Book value of equity = \$800,000.
- Earnings forecast for 2001 = \$120,000. Forecasted earnings are expected to grow at a rate of 11% for 9 more years through 2010.
- Abnormal earnings in year 10 (2010) continue in perpetuity.
- Claude’s does not pay dividends and none are forecasted.
- Cost of equity capital is estimated to be 10%.
- Number of shares outstanding = 100,000.

⁷ Some variants of the model assume that company-specific long-term earnings growth reverts to the industry mean after a finite period. When this is the case, the firm’s ROE is often predicted to gradually revert to the industry average. This is sometimes referred to as a ‘fade’ model.

⁸ We could model the cost of equity capital as a function of the current risk free rates (R_f), the riskiness of the firm’s stock (BETA), and the normal premium for accepting risk (approximately 6%). The relation is $r_e = R_f + \text{BETA} * \text{Risk Premium}$. This relation will be discussed in your finance course.

Required:

Use the data above and models (1) and (1a) to estimate the value of equity for Claude's Coffeehouse. Compare your estimate to Starbucks's offer. What would you recommend? (Exhibit 1 can be used to estimate the market value of equity and Exhibit 2 can be used to estimate the price per share.)

5. How to find the inputs to our valuation model on the Internet

Now that we've covered a simple example, let's proceed to the real world. Almost all (if not all) of the inputs for the valuation model can be found on Yahoo-Finance at <http://finance.yahoo.com/>.

Example 5: Robert Mondavi:

Below is an example applied to the Robert Mondavi Corporation as of November 3, 2001 – follow the steps and you will (hopefully) locate the data you need. Exhibit 3 provides the initial data in an Excel worksheet – double click on the spreadsheet and it should open. In this real world example, we will use the *per share* version of model (1) described in appendix 1 because analysts generally forecast per share amounts.

Required:

Using model (1a) and the data you find on the Internet (as described below), estimate the current stock price for Robert Mondavi. Compare your estimate to Mondavi's actual stock price. Why might your estimate be different than the actual stock price? (Again, Exhibit 3 contains an Excel template that uses a 5-year forecast horizon.)

Finding the Company on Yahoo Finance. Enter the company ticker symbol ("Mond") on the <http://finance.yahoo.com/> home page. Information on Mondavi should appear on screen. We will access data from two additional sources under '**More Info**' shown below: 1) 'Profile' to get data on Book Value per share, Dividends per share and Beta, and 2) 'Research' to obtain data on analysts' earnings forecasts.

Symbol	Last Trade	Change	Volume	More Info	Trade
MOND	12:43PM	31.81 -0.44 -1.36%	9,700	Chart , News , Profile , Reports Research , Insider , Options , Msgs	Choose Brokerage
View accounts from over 200 financial institutions! Yahoo! Online Account Access					

[Add to My Portfolio](#) - [Set Alert](#)

[Non-Tables Version](#) - [Download Spreadsheet](#)

Finding the Data – Profile: Statistics at a Glance

- Click on 'Profile' in the '**More Info**' box.
- Next, scroll to the bottom of the page to 'Statistics at a Glance.' There you will find under 'Per-Share Data' that Book Value per share (BVPS) = \$24.38.
- You will also find 'Annual Dividends' per share = none. Mondavi doesn't pay dividends.

- Next, we estimate the cost of equity capital using the formula in footnote 7. One component is BETA, which you can find on the left hand side of ‘Statistics at a Glance.’ BETA = 0.98. Now we need to find the risk free rate, which we will assume is the 3-month U.S. Treasury Bill rate available at <http://www.bloomberg.com/markets/C13.html>. This rate is currently approximately 2%. Finally, we need an estimate of the Risk Premium. For now, use 6%. Using these inputs, our estimate of the cost of equity capital = 2% + (0.98 * 6%) = 7.88%.

Finding the Data – Research: First Call Estimates (of future earnings)⁹

- Next, we need to locate forecasts of future earnings. Scroll back to the top of the page and click on ‘Research’ in the list that looks like this:
More Info: [Quote](#) | [Chart](#) | [News](#) | [Profile](#) | **Research** | [SEC](#) | [Msgs](#) | [Insider](#) | [Options](#) | [Financials](#)
- On the left-hand side of the new window, you will find First Call earnings estimates for this year and next year (2001 and 2002) under ‘Earnings Per Share:’
 - Mondavi’s mean (average) earnings per share (EPS) forecast for the year ended June 2002, i.e., ‘this year’ = \$2.41
 - Mondavi’s mean (average) earnings per share (EPS) forecast for the year ended June 2003, i.e., ‘next year’ = \$2.76
- Finally, scroll down to near the bottom of the page to the section titled ‘Earnings Growth.’ There you will find
 - The forecasted long-term growth in EPS for the ‘next 5 years’ = 16.50%.

6. Using the spreadsheet to estimate the stock price for Mondavi

We can now insert the above data into our spreadsheet template and use this template to estimate Mondavi’s price per share. Again, a template is included in Exhibit 3 below. The template uses a 5-year forecast horizon and contains the initial data for Mondavi as of Nov. 3, 2001.

7. Comparing our estimate to Mondavi’s actual price

For publicly traded companies such as the Robert Mondavi Corporation, we can compare our estimate to the actual stock price (or market cap). Differences between the actual market price and our estimate can be attributed to:

- Our model’s assumptions differing from the consensus assumptions implicit in the market price.
- Our model not including the effects of hard-to-measure intangibles that are important to the market, e.g., quality of management, flexibility to move into new fields, human capital, etc.
- The market irrationally setting prices.

⁹ If you look around the Yahoo Finance site, you may find other earnings forecasts that are somewhat different from these. For now, use the First Call data.

Appendix 1

A “per share” version of our earnings-based valuation model

Because most analyst data is provided on a *per share* basis, e.g., analysts forecast earning per share (EPS), we can restate model (1) on a per share basis. The general model for a firm’s market price *per share* at time t (P_t) is:

$$P_t = BVPS_t + \sum_{\tau=1}^{\tau=\infty} \frac{EPS_{t+\tau} - r_e \cdot BVPS_{t+\tau-1}}{(1+r_e)^\tau} \quad (1a)$$

where:

$BVPS_t$ = the book value of equity *per share* at time t

EPS_t = forecasted earning *per share* for time $t+1$ and beyond

r_e = the cost of equity capital assumed constant over time

Again, at the most simple level, when a firm earns a ‘normal’ economic return on the shareholders’ investment (r_e), the price per share of stock (P_t) should be approximately equal to its accounting book value of equity per share ($BVPS_t$), i.e., $P_t = BVPS_t$. Book value of equity per share is the amount contributed by the owners (per share over time), plus the cumulative amount earned by the company (per share), less any dividend payouts (per share) to the owners.

However, professional managers are hired to do better than earn the normal return – their goal is to build (some would say maximize) shareholder value. If they are successful, the company earns more on shareholders’ capital than the capital costs. The stock market is forward looking and, when success is expected, P_t exceeds $BVPS_t$. To model the size of this market-to-book premium, we evaluate each future period and compare the expected earnings (EPS_{t+i}) to the minimum earnings required by investors to return the cost of equity capital ($r_e * BVPS_t$). This period-by-period difference between the earnings forecast and the minimum required return ($EPS_{t+i} - r_e * BVPS_t$) is often called ‘abnormal’ or ‘residual’ earnings. If a company’s prospects are poor, forecasts of future earnings may be even less than the required cost of equity capital. In this case, shareholder value is being destroyed and abnormal earnings are negative. Either way, the value of owners’ equity is a function of the magnitude of abnormal earnings. In mathematical terms, our model looks like:

$$P_t = BVPS_t + (EPS_{t+1} - r_e \cdot BVPS_t) + (EPS_{t+2} - r_e \cdot BVPS_{t+1}) + \dots$$

However, we cannot simply add these future values to the current book value of equity. We need to consider the time value of money and discount each future flow back to its’ present value, yielding the somewhat more complicated looking model:

$$P_t = BVPS_t + \frac{(EPS_{t+1} - r_e \cdot BVPS_t)}{(1+r_e)^1} + \frac{(EPS_{t+2} - r_e \cdot BVPS_{t+1})}{(1+r_e)^2} + \dots$$

Finally, we use the shorthand of the summation sign to group all of the abnormal earnings terms together – thus replicating model (1a) above.

Exhibit 1: Spreadsheet template for Claude's Coffeehouse, estimating the market value of equity**Valuation of Claude's Coffee**

(market cap version)

<u>year</u>	<u>Beginning Book Value</u>	<u>"Normal" Earnings</u>	<u>Forecasted Earnings</u>	<u>"Abnormal" Earnings</u>	<u>Dividends</u>	<u>PV factor</u>	<u>10 yr. Horizon PV of Abnormal Earnings</u>	<u>5 yr. Horizon PV of Abnormal Earnings</u>
2001	\$ 800,000	\$ 80,000	\$ 120,000	\$ 40,000	\$ -	0.909	\$ 36,364	\$ 36,364
2002						0.826	\$ -	\$ -
2003						0.751	\$ -	\$ -
2004						0.683	\$ -	\$ -
2005						0.621	\$ -	\$ -
2006						0.564	\$ -	\$ -
2007						0.513	\$ -	\$ -
2008						0.467	\$ -	\$ -
2009						0.424	\$ -	\$ -
2010						0.386	\$ -	\$ -
Cumulative present value of abnormal earnings -- 2001-2009 (2004 for 5-year horizon)							\$ 36,364	\$ 36,364
Continuing value of terminal year abnormal earnings -- 2010 (or 2005) and beyond							\$ -	\$ -
Beginning book value of equity							\$ 800,000	\$ 800,000
Estimated value of equity							\$ 836,364	\$ 836,364

Assumptions include:

- a. earnings growth rate 11%
- b. firm's cost of equity capital 10%

Exhibit 2: Spreadsheet template for Claude's Coffeehouse, estimating the market price per share**Valuation of Claude's Coffee**

(per share version)

<u>year</u>	<u>Beginning Book Value</u>	<u>"Normal" Earnings</u>	<u>Forecasted Earnings</u>	<u>"Abnormal" Earnings</u>	<u>Dividends</u>	<u>PV factor</u>	<u>10 yr. Horizon PV of Abnormal Earnings</u>	<u>5 yr. Horizon PV of Abnormal Earnings</u>
2001	\$ 8.00	\$ 0.80	\$ 1.20	\$ 0.40	\$ -	0.909	\$ 0.36	\$ 0.36
2002						0.826	\$ -	\$ -
2003						0.751	\$ -	\$ -
2004						0.683	\$ -	\$ -
2005						0.621	\$ -	\$ -
2006						0.564	\$ -	\$ -
2007						0.513	\$ -	\$ -
2008						0.467	\$ -	\$ -
2009						0.424	\$ -	\$ -
2010						0.386	\$ -	\$ -
Cumulative present value of abnormal earnings -- 2001-2009 (2004 for 5-year horizon)							\$ 0.36	\$ 0.36
Continuing value of terminal year abnormal earnings -- 2010 (or 2005) and beyond							\$ -	\$ -
Beginning book value of equity per share							\$ 8.00	\$ 8.00
Estimated price per share							\$ 8.36	\$ 8.36

Assumptions include:

- a. earnings growth rate 11%
- b. firm's cost of equity capital 10%

Exhibit 3: Spreadsheet template for the Robert Mondavi Corporation, estimating the market price per share

(per share version -- 5 year horizon)

<u>year</u>	<u>Beginning</u> <u>BV/share</u>	<u>"Normal"</u> <u>Earnings</u>	<u>Forecasted</u> <u>Earnings</u>	<u>"Abnormal"</u> <u>Earnings</u>	<u>Dividends</u>	<u>PV factor</u>	<u>5 yr. Horizon</u> <u>PV of Abnormal</u> <u>Earnings</u>
2001	\$ 24.38	\$ 1.92	\$ 2.41	\$ 0.49	\$ -	0.927	\$ 0.45
2002	\$ 26.79					0.859	\$ -
2003						0.796	\$ -
2004						0.738	\$ -
2005						0.684	\$ -
Cumulative present value of abnormal earnings -- 2001-2004							\$ 0.45
Continuing value of terminal year abnormal earnings -- 2005 and beyond							\$ -
Beginning book value of equity per share							\$ 24.38
Estimated price per share							\$ 24.83
Current price (as of 11/2/01)							\$ 32.30

Assumptions include:

- a. Mondavi's cost of equity capital (from below) 7.88%
- b. Mondavi's long term growth rate in earnings 16.50%

Estimate of the cost of equity capital:

Rf	2.00%	http://www.bloomberg.com/markets/C13.html
BETA	0.98	http://biz.yahoo.com/p/d/dell.html
Risk prem	6.00%	an estimate
est. cost of equity capital	7.88%	