



FTS Real Time System Project: Assessing Intrinsic Value using the Residual Income Valuation (RIV) Approach

Question: What is the intrinsic value of a stock using the RIV approach to valuation?

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I. Motivating Question:

The relationship between intrinsic or fair value and market prices is controversial. The efficient markets hypothesis asserts that market prices generally provide an unbiased and the best estimate of fair values because they immediately self correct when they deviate too far away from predicted equilibrium values. Behavioral finance argues that cognitive biases and other imperfections can prevent prices from self correcting. This debate has spilled over into Congressional hearings on Capitol Hill after the financial crisis of 2008. Bailout bill debates in Congress late September 2008 resulted in sections providing the SEC with the power of suspending fair value accounting.

The SEC would have the authority to "suspend, by rule, regulation, or order, the application of Statement Number 157 of the Financial Accounting Standards Board for any issuer...if the Commission determines that is necessary or appropriate in the public interest and is consistent with the protection of investors," Section 132 of the bill.

However, Hewitt the chief accountant at the SEC until January 2009 refused to suspend FAS 157 but instead worked to improve the standards by developing additional guidance and other tools for determining fair value. Similarly, the ex Federal Reserve Chairman, Alan Greenspan came under fire on Capitol Hill in October 2008 when he admitted that he had placed too much faith in efficient markets which led him to overlook important fundamentals when implementing regulatory policies.

In this project we address the issue of assessing the intrinsic or fair value of a stock using a residual earnings model applied to companies that we expect are going concerns. You are required to adopt the role of an analyst/investor whose problem it is to assess whether the stocks you are working with are under, over or appropriately priced in the market place. By understanding how the accounting numbers can be used to assess value for stocks where active markets exist provide relevant insights for dealing with cases where no active market exists as required by current accounting standards.

II. Derivation of the Dividend and Residual Income Valuation Models

If stock markets are efficient then the intrinsic value equals the spot stock price. The spot stock price can in turn be expressed as the present value of next period's expected dividend plus the end of period stock price discounted by the cost of equity capital.

$$\text{Intrinsic Value} = P_0 = (d_1 + P_1)/(1 + k_e) \quad 1)$$

where d_1 is next period's dividend, P_1 is the end of period price and k_e is the stock's cost of equity capital.

By recursively re-applying the definition of P for P_1, P_2 etc., yields the fundamental relationship that the intrinsic value of a stock equals the present value of future dividends discounted at the stock's cost of equity capital.

$$P_0 = d_1/(1+k_e) + d_2/(1+k_e)^2 + d_3/(1+k_e)^3 + \dots \quad 2)$$

Equivalently equation 1) can be rewritten by invoking the clean surplus relationship that underlies the change in the fundamental accounting identity $(A - L) = OE$. Clean surplus accounting captures the idea that all changes in shareholder equity, $(OE_1 - OE_0)$, not involving shareholders such as dividends, Treasury stock or new issues) pass through the income statement. This is the case for the accounting concept of “Comprehensive Income” as opposed to “Net Income” primarily because of foreign currency translation adjustments, derivative accounting and certain pension liability adjustments. Further if we divide the accounting identity by shares outstanding then this is the Book Value (BV) per share.

Under clean surplus accounting $d_1 = CI_1 - (BV_1 - BV_0)$, where CI_1 is comprehensive income for the next period, BV_1 is end of period book value per share and 0 denotes the present.

We can then re-write equation 1) invoking the clean surplus relationship above as:

$$\begin{aligned} \text{Intrinsic Value } (P_0) &= (CI_1 - (BV_1 - BV_0) + P_1)/(1 + k_e) \\ &= (BV_0 + CI_1)/(1+k_e) + (P_1 - BV_1)/(1+k_e) \end{aligned} \quad 3)$$

Observe that $BV_0/(1 + k_e)$ can be equivalently expressed by adding and subtracting BV_0 as $BV_0/(1+k_e) + BV_0 - BV_0$ and then re-arranging to yield:

$$BV_0 + BV_0/(1+k_e) - BV_0 \Rightarrow BV_0 + (BV_0 - (1+k_e)BV_0)/(1+k_e) = BV_0 - k_e BV_0/(1+k_e)$$

Substituting back into 2) yields:

$$P_0 = BV_0 + (CI_1 - k_e BV_0)/(1+k_e) + (P_1 - BV_1)/(1+k_e) \quad 4)$$

Again by substituting for P_1 and re-arranging you can then establish the equivalent form that is a function of P_2 and so on. That is, if the form holds for P_n then it can be shown to also hold for P_{n+1} and as a result, the general form then follows from mathematical induction as the present value of current book value and the present value of all future residual incomes.

$$P_0 = BV_0 + \text{Residual Income}_1/(1 + k_e) + \text{Residual income}_2/(1+k_e)^2 + \dots \quad 5)$$

That is the above expression starts with the spot book value per share and *adjusts* the present value of all future *residual income*. Residual income is a concept of how book value of owners equity grows over time under clean surplus accounting taking into account the opportunity cost of capital which is the rate of return that investors expect from the beginning period book value per share. As a result, the RIV valuation model as depicted in 5) is equivalent to the dividend model and provides a conceptually coherent framework that ties together clean surplus accounting, book values and income as described above.

Finally, observe that the equality above to the spot stock price is under the assumption that markets are ex ante efficient. If this assumption fails to hold then the RHS can be different from the LHS and the intrinsic value can be assessed by working directly with the RHS.

Summary: RIV Approach to Estimating Intrinsic Value

Intrinsic value = Book value per share + Present value of Residual Earnings discounted back at the stock's cost of equity capital (i.e., investors' required rate of return from investing in stocks).

III. Assessing the Intrinsic Value of a Firm: Key Concepts

Concept 1 (Book Value per Share): The firm's investment and dividend decisions determine the book value per share. The book value per share represents the shareholders' investment in the firm. Book value per share is simply value of the owners equity divided by the net shares (i.e., shares issued less Treasury stock) outstanding.

Concept 2 (Future Residual Earnings Stream): This concept is designed to capture the value added to book value per share that results from assessing the firm's investment and financing decisions. Residual Earnings at time t is defined as *Comprehensive Earnings* at time t – Investors' Required Rate of Return (= Cost of Equity Capital) * Beginning period book value.

Note: Residual Earnings is based upon the clean surplus accounting using "Comprehensive Income" which attempts to measure the total of all operating and financial events that have changed the shareholders' equity over the period.

To project residual earnings into the future the second important input for this concept is assessed growth behavior of the book value per share. This allows residual income to be projected out over time by growing at the assessed growth rates. Under these projections if residual earnings are expected to be positive over time then intrinsic value will exceed book value and vice versa.

Concept 3 (Cost of Capital): The discount rate used to compute the present value of future residual earnings per share is the stock's cost of equity capital. The firm's financing decision provides one driver of this discount rate in addition to capital market constraints. Combined the cost of equity capital equals the return required by investors in the capital markets.

Next we will apply the above concepts to assess the intrinsic value of IBM.

IV. Concept 1 Estimating Book Value per Share

This implementation of the dividend model for intrinsic value starts by anchoring value at the book value per share. Book value per share is defined as the total assets divided by total net shares outstanding.

Intrinsic Value is then defined to equal book value plus a "premium." The premium captures the value added to book value from the investment decision.

Estimating Book Value per Share from a 10-K Statement Filed with the SEC

The book value per share can be computed from the Stockholder's Equity section of the balance sheet. The 2009 10-K statement provided the following information:

Consolidated Statement of Changes in Equity
INTERNATIONAL BUSINESS MACHINES CORPORATION AND SUBSIDIARY COMPANIES

(\$ in millions)

	Common Stock and Additional Paid-in Capital	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive Income/ (Loss)	Total IBM Stockholders' Equity*	Non- controlling Interests*	Total Equity*
2009							
Equity, January 1, 2009	\$ 39,129	\$ 70,353	\$ (74,171)	\$ (21,845)	\$ 13,465	\$ 119	\$ 13,584
Net income plus other comprehensive income/(loss):							
Net income		13,425			\$ 13,425		\$ 13,425
Other comprehensive income/(loss), net of tax:							
Net unrealized gains/(losses) on cash flow hedge derivatives (net of tax benefit of \$256)				(556)	(556)		(556)
Foreign currency translation adjustments (net of tax benefit of \$57)**				1,732	1,732		1,732
Retirement-related benefit plans:							
Prior service costs/(credits) (net of tax expense of \$146)				229	229		229
Net (losses)/gains (net of tax expense of \$439)				994	994		994
Curtailments and settlements (net of tax benefit of \$33)				(93)	(93)		(93)
Amortization of prior service (credits)/costs (net of tax benefit of \$55)				(107)	(107)		(107)
Amortization of net gains/(losses) (net of tax expense of \$402)				704	704		704
Net unrealized gains/(losses) on marketable securities (net of tax expense of \$71)				111	111		111
Total other comprehensive income/(loss)				3,015	3,015		3,015
Subtotal: net income plus other comprehensive income/(loss)					\$ 16,440		\$ 16,440
Cash dividends declared—common stock		(2,860)			(2,860)		(2,860)
Common stock issued under employee plans (30,034,808 shares)	3,011				3,011		3,011
Purchases (1,550,846 shares) and sales (6,408,265 shares) of treasury stock under employee plans—net		(19)	462		443		443
Other treasury shares purchased, not retired (68,650,727 shares)			(7,534)		(7,534)		(7,534)
Changes in other equity	(330)				(330)		(330)
Changes in noncontrolling interests						(1)	(1)
Equity, December 31, 2009	\$ 41,810	\$ 80,900	\$ (81,243)	\$ (18,830)	\$ 22,637	\$ 118	\$ 22,755

From the Income Statement the average number of shares outstanding respectively for: 2009, 2008 and 2007

Weighted-average number of common shares outstanding:			
Assuming dilution	1,341,352,754	1,387,797,198*	1,456,880,751*
Basic	1,327,157,410	1,369,367,069*	1,433,935,221*

Book Value per Share = Total Stockholders' Equity/(Shares issued – Treasury Stock) = 22.637/1.341 = \$16.881 equals the book value per share.

V. Concept 2 Future Residual Earnings

Residual income is dollar excess return over what is required by investors in terms of the cost of equity capital times book value of owners equity. As a result, it can be expressed as follows:

Residual Earnings_t Excess Return = (Return on Common Equity_t – Cost of equity capital) * Book value of common equity_{t-1}

In the above the Return on Common Equity_t (ROCE_t) is defined as Comprehensive Earnings_t/Book Value of Common Equity_{t-1}.

The two drivers of residual income are ROCE and Book Value plus to forecast residual income over time requires an assessment of growth behavior estimates.

IBM Example: The 10-K filings from IBM provide the source data as follows:

INTERNATIONAL BUSINESS MACHINES CORPORATION AND SUBSIDIARY COMPANIES

(\$ in millions)

For the year ended December 31:	2009	2008	2007
Cash flow from operating activities from continuing operations:			
Net income	\$ 13,425	\$ 12,334	\$ 10,418
(Income)/loss from discontinued operations	—	—	00
Adjustments to reconcile income from continuing operations to cash provided by operating activities:			
Depreciation	3,773	4,140	4,038
Amortization of intangibles	1,221	1,310	1,163
Stock-based compensation	558	659	713
Deferred taxes	1,773	1,900	740
Net gain on asset sales and other	(395)	(338)	(89)
Change in operating assets and liabilities, net of acquisitions/divestitures:			
Receivables (including financing receivables)	2,131	274	(1,408)
Retirement related	(2,465)	(1,773)	(228)
Inventories	263	(102)	182
Other assets/other liabilities	319	1,268	706
Accounts payable	170	(860)	(142)
Net cash provided by operating activities from continuing operations	20,773	18,812	16,094

Source 2009 10-K IBM SEC Filing

From the above the **Earnings per share** = $\$13.425/1.341 = \10.011 and as computed earlier in section IV the Book Value per Share equals \$16.881.

For Residual Income we are interested in Comprehensive income. This is defined as follows:

Comprehensive income = Net income + Other Comprehensive income

In the 10-K statements the last three years for "Other Comprehensive Income" is available in the Stockholders Equity Statement.

Conceptual Note:

In dirty surplus accounting some items are adjusted to the stockholder's equity as opposed to the income statement. The main three items are: foreign currency translation, pension liability and hedge accounting adjustments. As a result, these items can fluctuate from year to year and so we will take the average over the three years provided in the 10-K as a first pass for "Other Comprehensive Income."

The three years provided (2009, 2008 and 2007) respectively are:

Consolidated Statement of Changes in Equity
INTERNATIONAL BUSINESS MACHINES CORPORATION AND SUBSIDIARY COMPANIES

(\$ in millions)

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Net income		13,425			\$ 13,425		\$ 13,425
Other comprehensive income/(loss), net of tax:							
Net unrealized gains/(losses) on cash flow hedge derivatives (net of tax benefit of \$256)				(556)	(556)		(556)
Foreign currency translation adjustments (net of tax benefit of \$57**)				1,732	1,732		1,732
Retirement-related benefit plans:							
Prior service costs/(credits) (net of tax expense of \$146)				229	229		229
Net (losses)/gains (net of tax expense of \$439)				994	994		994
Curtailments and settlements (net of tax benefit of \$33)				(93)	(93)		(93)
Amortization of prior service (credits)/costs (net of tax benefit of \$55)				(107)	(107)		(107)
Amortization of net gains/(losses) (net of tax expense of \$402)				704	704		704
Net unrealized gains/(losses) on marketable securities (net of tax expense of \$71)				111	111		111
Total other comprehensive income/(loss)				3,015	3,015		3,015
Subtotal: net income plus other comprehensive income/(loss)					\$ 16,440		\$ 16,440
Cash dividends declared—common stock		(2,860)					(2,860)
Common stock issued under employee plans (30,034,808 shares)	3,011				3,011		3,011
Purchases (1,550,846 shares) and sales (6,408,265 shares) of treasury stock under employee plans—net		(19)	462			443	443
Other treasury shares purchased, not retired (68,650,727 shares)			(7,534)		(7,534)		(7,534)
Changes in other equity	(330)				(330)		(330)
Changes in noncontrolling interests						(1)	(1)
Equity, December 31, 2009	\$ 41,810	\$ 80,900	\$ (81,243)	\$ (18,830)	\$ 22,637	\$ 118	\$ 22,755

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(\$ in millions)

	Common Stock and Additional Paid-in Capital	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive Income/ (Loss)	Total IBM Stockholders' Equity*	Non- controlling Interests*	Total Equity*
2008**							
Equity, January 1, 2008	\$ 35,188	\$ 60,640	\$ (63,945)	\$ (3,414)	\$ 28,470	\$ 145	\$ 28,615
Net income plus other comprehensive income/(loss):							
Net income		12,334			\$ 12,334		\$ 12,334
Other comprehensive income/(loss), net of tax:							
Net unrealized gains/(losses) on cash flow hedge derivatives (net of tax expense of \$79)				301	301		301
Foreign currency translation adjustments (net of tax benefit of \$153**)				(3,552)	(3,552)		(3,552)
Retirement-related benefit plans:							
Prior service (credits)/costs (net of tax benefit of \$86)				(136)	(136)		(136)
Net (losses)/gains (net of tax benefit of \$3,436)				(15,245)	(15,245)		(15,245)
Curtailments and settlements (net of tax expense of \$9)				16	16		16
Amortization of prior service (credits)/costs (net of tax benefit of \$73)				(132)	(132)		(132)
Amortization of net gains/(losses) (net of tax expense of \$358)				640	640		640
Net unrealized gains/(losses) on marketable securities (net of tax benefit of \$207)				(324)	(324)		(324)
Total other comprehensive income/(loss)				(18,431)	(18,431)		(18,431)
Subtotal: Net income plus other comprehensive income/(loss)					\$ (6,097)		\$ (6,097)
Cash dividends declared—common stock		(2,585)					(2,585)
Common stock issued under employee plans (39,374,439 shares)	3,919				3,919		3,919
Purchases (1,505,107 shares) and sales (5,882,800 shares) of treasury stock under employee plans—net		(36)	391			355	355
Other treasury shares purchased, not retired (89,890,347 shares)		54	(10,618)		(10,563)		(10,563)
Changes in other equity	(33)				(33)		(33)
Changes in noncontrolling interests						(26)	(26)
Equity, December 31, 2008	\$ 39,129	\$ 70,353	\$ (74,171)	\$ (21,845)	\$ 13,465	\$ 119	\$ 13,584

Consolidated Statement of Changes in Equity
INTERNATIONAL BUSINESS MACHINES CORPORATION AND SUBSIDIARY COMPANIES

(\$ in millions)

	Common Stock and Additional Paid-in Capital	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive Income/ (Loss)	Total IBM Stockholders' Equity*	Non- controlling Interests*	Total Equity*
2007**							
Equity, January 1, 2007	\$ 31,271	\$ 52,432	\$ (46,296)	\$ (8,901)	\$ 28,506	\$ 129	\$ 28,635
Cumulative effect of change in accounting Principle +		117			117		117
Net income plus other comprehensive Income (loss):							
Net income		10,418			\$ 10,418		\$ 10,418
Other comprehensive income/(loss), net of tax:							
Net unrealized gains/(losses) on cash flow hedge derivatives (net of tax benefit of \$32)				(123)	(123)		(123)
Foreign currency translation adjustments (net of tax benefit of \$553+)				726	726		726
Retirement-related benefit plans:							
Prior service costs/(credits) (net of tax expense of \$31)				44	44		44
Net gains/(losses) (net of tax expense of \$1,913)				3,611	3,611		3,611
Amortization of prior service costs/(credits) (net of tax benefit of \$50)				(85)	(85)		(85)
Amortization of net gains/(losses) (net of tax expense of \$654)				1,110	1,110		1,110
Amortization of transition assets (net of tax benefit of \$1)				(2)	(2)		(2)
Net unrealized gains/(losses) on marketable securities (net of tax expense of \$132)				206	206		206
Total other comprehensive income/(loss)				5487	5,487		5,487
Subtotal: net income plus other comprehensive income/(loss)				\$ 15,905	\$ 15,905		\$ 15,905
Cash dividends declared—common stock		(2,147)			(2,147)		(2,147)
Common stock issued under employee plans (49,137,038 shares)	4,332				4,332		4,332
Purchases (1,282,131 shares) and sales (9,282,055 shares) of treasury stock under employee plans—net		(179)	729		550		550
Other treasury shares purchased, not retired (178,383,436 shares)	(405)		(18,378)		(18,783)		(18,783)
Changes in other equity		(10)			(10)		(10)
Changes in noncontrolling interests						16	16
Equity, December 31, 2007	\$ 35,188	\$ 60,640	\$ (63,945)	\$ (3,414)	\$ 28,470	\$ 145	\$ 28,615

It is evident that the year to year fluctuations are large. As a result, by taking the average:

$$\text{Other Comprehensive Income} = (3015 + (18431) + 5487)/3 = (3309.67)$$

The Comprehensive income that we will apply for valuation purposes is:

$$\text{Comprehensive income} = \$13,425 + (\$3310) = \$10115 \text{ million}$$

Comprehensive Earnings per share = $\$10.115/1.341 = \7.543 and as computed earlier in section IV the Book Value per Share equals \$16.881.

Growth in Book Value per Share

To project residual earnings over time we further need to assess the growth behavior of the book value per share. This requires combining information about earnings growth rates as well as dividend policy as described next.

Estimating Growth in Book Value

From the clean surplus relationship in accounting we can express book value as:

$$BV_{t1} = CI_{t1} + BV_{t0} - d_{t1}$$

That is, Book Value can be forecast by forecasting Comprehensive Income and dividends.

Operational Details

Dividend Information is available from the Owners Equity part of the Balance Sheet:

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Purchases (1,550,846 shares) and sales (6,408,265 shares) of treasury stock under employee plans—net		(19)	462		443		443
Other treasury shares purchased, not retired (68,650,727 shares)			(7,534)		(7,534)		(7,534)
Changes in other equity	(330)				(330)		(330)
Changes in noncontrolling interests						(1)	(1)
Equity, December 31, 2009	\$ 41,810	\$ 80,900	\$ (81,243)	\$ (18,830)	\$ 22,637	\$ 118	\$ 22,755

Source 2009 10-K IBM SEC Filing

From the Income Statement:

Weighted-average number of common shares outstanding:			
Assuming dilution	1,341,352,754	1,387,797,198*	1,456,880,751*
Basic	1,327,157,410	1,369,367,069*	1,433,935,221*

Continuing the example using the 10-K filings then the dividend per share for IBM equals:

Dividend per Share = Dividends/(Shares issued – Treasury Stock) = 2,860/1341 = \$2.132 equals the dividend per share.

Dividend Payout Ratio (Relative to Comprehensive Earnings) = 2860/10115 = 0.283

Comprehensive Earnings per share = \$10,115/1341 = \$7.543

Dividend forecast information from analysts is available on the web. For example, Yahoo finance reports for IBM:

Dividends & Splits	
Forward Annual Dividend Rate ⁴ :	2.60
Forward Annual Dividend Yield ⁴ :	2.10%
Trailing Annual Dividend Yield ³ :	2.30
Trailing Annual Dividend Yield ³ :	1.90%
5 Year Average Dividend Yield ⁴ :	0.80%
Payout Ratio ⁴ :	21.00%
Dividend Date ³ :	Jun 9, 2010
Ex-Dividend Date ⁴ :	May 6, 2010
Last Split Factor (new per old) ² :	2:1
Last Split Date ³ :	May 27, 1999

The forward annual dividend is predicted to be \$2.60 per share.

Dividend Summary

Dividend per Share = Dividends/(Shares issued – Treasury Stock) = 2,860/1341 = \$2.132 equals the dividend per share.

What is the consensus 5-year growth forecast for IBM?

Here we will check two general sources from the web Yahoo Finance and MSN Money. These numbers are constantly revised over time in response to changes in the economy. For example, around April 2009 these numbers were:

Yahoo Finance

Yahoo Finance

Growth Est	IBM	Industry	Sector	S&P 500
Current Qtr.	11.20%	17.10%	63.10%	21.80%
Next Qtr.	13.80%	14.30%	33.00%	19.00%
This Year	12.60%	13.10%	39.30%	35.00%
Next Year	9.20%	13.00%	11.90%	17.80%
Past 5 Years (per annum)	19.50%	N/A	N/A	N/A
Next 5 Years (per annum)	10.86%	11.87%	11.96%	N/A
Price/Earnings (avg. for comparison categories)	11.11	13.93	13.57	13.23
PEG Ratio (avg. for comparison categories)	1.02	1.17	1.13	N/A

MSN Investor

Earnings Growth Rates	Last 5 Years	FY 2010	FY 2011	Next 5 Years	10 P/E
Company	+15.20%	+12.50%	+9.60%	+10.00%	11.10
Industry	-2.40%	+8.90%	+33.30%	+15.90%	16.10
S&P 500	-3.00%	+39.80%	+18.10%	NA	13.70

From the above the reported consensus forecasts for earnings are:

Current Year (FY2010): 12.6% and 12.5%

FY 2010: 9.2% and 9.6%

5-year projection: 10.86% and 10.00%

We will use the average of these estimates: 12.55%, 9.4% and 10.43% respectively as a first pass.

In a two stage growth model growth behavior is accurately forecast out for some period of time which is usually 5-years. Then a simplifying assumption is made that the income grows in perpetuity at some constant rate. This constant rate is referred to as the normal growth rate. The normal growth rate is constrained by economy wide growth as we cannot assume that a stock grows in perpetuity at a greater rate than this constraint. Otherwise, the stock (in the distant future) is implied to grow larger than the economy as a whole – a contradiction.

Normal Growth Example: We will use 4.5% for the stage 2 normal growth estimate as a conservative long term average growth rate for IBM. This number can be justified from long term macroeconomic data for the US economy.

First, refer to the following Government report. Long Term Growth in the US: In a 2005 Report to Congress on Long Term Growth for the US economy. The following quote was given:

<http://www.ftsmo.du.com/public/modules/ftsRT/projects/longtermgrowth.pdf>

“We also observe over the last 100-year span that the rates of economic growth across the then emerging industrial nations were fairly tightly clustered around this 2.0% pace. At the high end was Japan with an annual rate of growth averaging about 2.7%, while at the low end was Great Britain with an annual growth rate averaging 1.4%. The United States, which grew at a 1.8% average annual rate, was slightly below average.”

They also went on to observe:

“For the United States, the long-term growth of real GDP per capita over the last 125 years has revealed remarkable steadiness, advancing decade after decade with only modest and temporary variation from the observed 1.8% annual rate of increase.”

Inflation has been a fact of life for the U.S. economy. Inflation numbers suggest that inflation compounded from 1913 to 2008 resulted in a cumulative rate of 2071.23%¹ This, implies an annual constant compounded rate of approximately 3.24%.

Combining the above we can make a reasonable estimate for one plus the long term nominal growth in the US, to be around $1.018 \times 1.03 = 1.04854$. As a result, to be conservative we will use as an upper bound for economy wide growth for US stocks (i.e., the stage 2 growth rate) the rounded down number of 4.5%.

Current Summary of Key Inputs:

Book Value per Share = Total Stockholders' Equity/(Shares issued – Treasury Stock) = $22.637/1.341 = \$16.881$ equals the book value per share.

Dividend per Share = Dividends/(Shares issued – Treasury Stock) = $2,860/1341 = \$2.132$ equals the dividend per share.

Dividend Payout Ratio (Relative to Comprehensive Earnings) = $2860/10115 = 0.283$

Comprehensive Earnings per share 2009 = $\$10,115/1341 = \7.543

Comprehensive EPS FY 2010 $\$7.543 \times 1.1255 = \8.49

Comprehensive EPS FY 2011 $\$8.49 \times 1.094 = \9.288

5-Year Growth = 0.1043

Normal Growth = 0.045

Projected Dividend Per Share (Next Year) = $\$8.49 \times 0.283 = \2.403

Years in Stage 1 Growth: 5-years

We next turn our attention to the discount rate – that is assessing IBM's Cost of Equity Capital.

VI. Concept 3 Estimating the Cost of Equity Capital

The cost of equity capital for the firm as a whole is different from the cost of equity capital for the stock issued by the firm. The difference arises whenever a firm uses both debt and equity in their financing mix. For the firm as a whole as introduced in the beginning of this write-up the cost of capital is a weighted average cost of capital. The usual formulation is in terms of the after tax weighted average cost of capital.

$$WACC = \frac{D}{D + E} k_d(1 - \tau_c) + \frac{E}{D + E} k_e$$

¹ Source www.InflationData.com

Where τ_c is the effective corporate tax rate, k_d is the cost of debt capital and k_e is the cost of equity capital. The above equation works with the after tax cost of debt because interest expense is tax deductible whereas dividend payments are not. For the stock (k_e) the most widely used first pass estimate is provided from the Capital Asset Pricing Model (CAPM) estimate. This implies that k_e is a function of three major inputs:

- i. Risk free rate (Estimated from US Treasury bonds)
- ii. Beta (Measures how much volatility the stock contributes to the market as a whole)
- iii. Equity Premium (Excess return expected from stocks over the risk free rate)

i. First, you can get current estimates for the risk free rate from www.bloomberg.com:

U.S. Treasuries					
	COUPON	MATURITY DATE	CURRENT PRICE/YIELD	PRICE/YIELD CHANGE	TIME
3-MONTH	0.000	08/26/2010	0.15 / .15	-0.002 / -.002	11:00
6-MONTH	0.000	11/26/2010	0.21 / .21	-0.005 / -.005	11:28
12-MONTH	0.000	05/05/2011	0.31 / .31	-0.002 / -.002	11:00
2-YEAR	0.750	05/31/2012	99-30+ / .77	-0-00+ / .008	11:53
3-YEAR	1.375	05/15/2013	100-15 / 1.21	0-02 / -.022	11:46
5-YEAR	2.125	05/31/2015	100-08½ / 2.07	0-03½ / -.023	11:50
7-YEAR	2.750	05/31/2017	100-04½ / 2.73	0-04+ / -.022	11:50
10-YEAR	3.500	05/15/2020	101-28 / 3.28	0-02 / -.007	11:53
30-YEAR	4.375	05/15/2040	103-01+ / 4.19	0-05½ / -.010	11:53

We will assume a 30-year investor and set $R_f = 4.19\%$

- ii. We will work with popular web sites to get an estimate of Beta for IBM from. For example, MSN Money, Yahoo Investor and Google Finance all provide estimates. For the current example, beta for IBM was taken from the Google finance site:

International Business Machines Corp. (Public, NYSE:IBM) Watch this stock					
125.68	+0.42 (0.34%)	Range	124.35 - 126.88	Mkt cap	161.17B
Real-time: 11:58AM EDT	NYSE real-time data - Disclaimer	52 week	99.50 - 134.25	P/E	12.22
		Open	124.69	Div/yield	0.65/2.07
		Vol / Avg.	2.55M/9.01M	Inst. own	59%
		EPS	10.28		

Beta = 0.76

- iii. Again, like expected return the equity premium cannot be observed because it requires an estimate of the expected return from the market. So again this needs to be estimated. We do so from historical averages as discussed below.

The average real return from 1872 to 2000 in the US on the S&P500 index is 8.81% (Fama and French, JF April 2002). If we combine this with the estimate for long term inflation in the US (as discussed in the Normal Growth section above) which equals 3.24% then the long term average equity premium for the US is 5.57%. As a first pass we will use the estimate of 5.5% however we note that the equity premium fluctuates over time. For example, in the 1990's it was commonly speculated that the equity premium had declined and some estimates were as low as 3.5%. For example, interested readers are encouraged to read the speech by Allan Greenspan "Measuring Financial Risk in the 21st Century"

<http://www.federalreserve.gov/BOARDDOCS/SPEECHES/1999/19991014.htm>

Similarly, an interesting paper by Pablo Fernandez at the University of Navarra, has extensively surveyed textbooks and professors to provide international estimates of current equity premiums:

<http://ssrn.com/abstract=1344209>

This paper provides estimates for the Australia, Canada, Europe, UK and US.

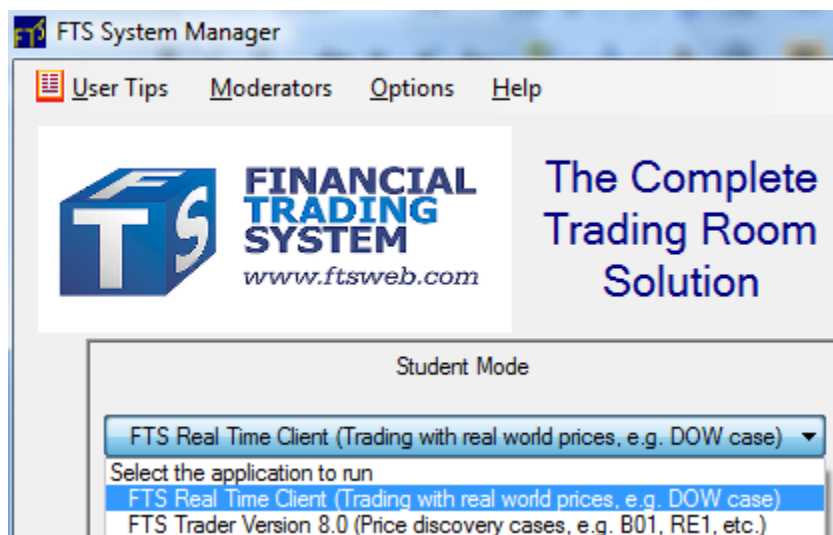
Cost of Equity Capital, using CAPM, for IBM

Collecting above together $k_e = r_f + \beta_i * (E(R_M) - r_f) = 0.0419 + 0.76 * 0.055 = 0.0837$

VII. Application Using the FTS System

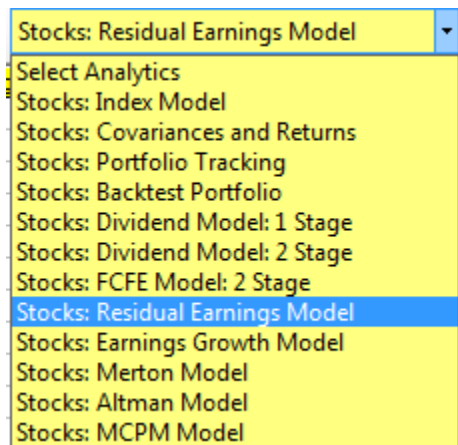
We will enter the values for IBM by gathering them together into a single location in the spreadsheet.

First launch the FTS Real Time Trader from the System Manager.



Once the FTS Real Time Client launches then select the trading exercise and enter your trading name, password and click on Login. If all is entered correctly it will connect to the market

In the FTS Real Time Client the bottom RHS of the screen lets you select the analytical support from what is available. In this exercise we are using “Stocks: Residual Earnings Model” so select this support from the yellow part of the screen below.



The bottom RHS will now appear as follows. It has the main inputs from the exercise to date as well as derived values from this model. The derived values will let you make additional inferences from the current market price.

Name	Mkt Price	PV Abnormal Earnings	PV Continuing Value	Intrinsic Value	Premium over Book
INTERNATIONAL BUSINESS MACHINE	124.85	38.14	206.34	272.22	244.4
INTEL CORP	21.40	2.19	8.97	19.08	11.1
JOHNSON & JOHNSON	59.05	17.56	101.64	120.41	119.0

In particular the following fields are available:

- RE_BV (Book Value)
- RE_D (Current Dividend)
- RE_D1 (Next year’s dividend)
- RE_EPS (Current EPS)
- RE_EPS1 (Next year’s EPS)
- RE_EPS2 (Following year’s EPS)
- RE_Y1 (Number of years in Stage 1)
- RE_G1 (Stage 1 growth --- e.g., 5-year Stage 1 growth)
- RE_G2 (Stage 2 (i.e., Normal) Growth)
- RE_Ke1 (Cost of Equity Capital Stage 1)
- RE_Ke2 (Cost of Equity Capital Stage 2)
- RE_PR (Payout Ratio)

In addition the derived fields are:

Market Price – Current spot stock price

PV Stage 1 Earnings --- PV of residual earnings for Stage 1

PV Continuing Value – PV of residual earnings for Stage 2

Intrinsic Value (sum of Current Book Value + PV Stage 1 Earnings + PV Continuing Value)

Premium over Book --- Value of future residual earnings stream

Over/Under --- market price relative to intrinsic value

Current Summary of Key Inputs:

Book Value per Share = Total Stockholders' Equity/(Shares issued – Treasury Stock) = 22.637/1.341 = \$16.881 equals the book value per share.

Dividend per Share = Dividends/(Shares issued – Treasury Stock) = 2,860/1341 = \$2.132 equals the dividend per share.

Dividend Payout Ratio (Relative to Comprehensive Earnings) = 2860/10115 = 0.283

Comprehensive Earnings per share 2009 = \$10,115/1341 = \$7.543

Comprehensive EPS FY 2010 \$7.543*1.1255 = \$8.49

Comprehensive EPS FY 2011 \$8.49*1.094 = \$9.288

5-Year Growth = 0.1043

Normal Growth = 0.045

Projected Dividend Per Share (2010) = \$8.49*0.283 = \$2.403

Years in Stage 1: 5-years

Cost of Equity Capital for both Stages 1 and 2 = 0.0837

The remaining fields are derived fields.

Working with the FTS Real Time Client

You are encouraged to override the base set of inputs with your own inputs. These can be entered as follows.

Entering Personal Estimates into the Analytical Support

First, in the FTS Real Time Trader click on Menu item Parameters,

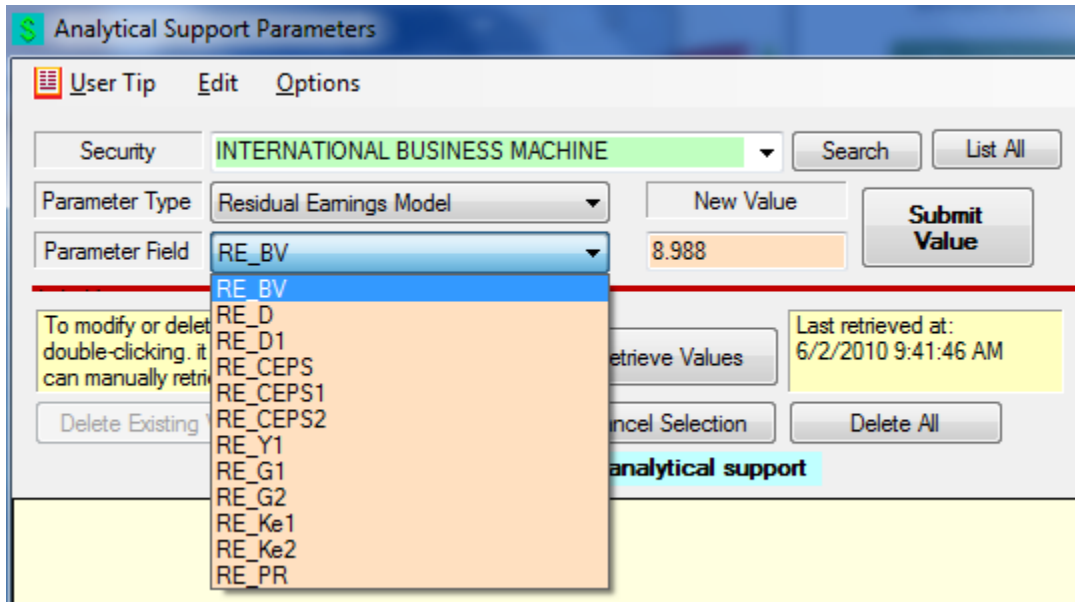
The values can be entered either manually or as a group from Excel. Once entered they are automatically stored on the FTS Server until you choose to delete or override with different inputs.

Tip: The Parameter menu item lets you store your current working set so that if you have multiple parameter sets you should keep other sets in your personal Excel workbook.

Entering Personal Values to Override FTS Default Values

Step 1: Click on List All above and then select IBM as the security from the dropdown

Step 2: Select the Residual Earnings Model



Step 3: For Parameter Field you can select all inputs depicted above and enter your personal override values. Your screen will appear as follows:

Finally be careful to Check the Checkbox “Use these values in my analytical support”

The main trading screen now appears as follows:

Name	Mkt Price	PV Abnormal Earnings	PV Continuing Value	Intrinsic Value	Premium over Book	Over/Under	Book Value	CEPS 1	CEPS 2	Years 1	Abnormal Growth	Normal Growth	Ke 1
INTERNATIONAL BUSINESS MACHINE	124.41	30.72	157.77	205.37	188.49	-80.96	16.88	8.49	9.29	5	0.1043	0.0450	0.0837
INTEL CORP	21.22	2.19	8.97	19.08	11.16	2.14	7.92	0.73	1.48	5	0.1250	0.0350	0.0989
JOHNSON & JOHNSON	68.90	17.56	101.64	130.41	119.21	-71.51	11.20	4.58	4.93	5	0.1030	0.0350	0.0714

Interestingly our first pass estimate is consistent with the first pass estimate in the FCFE project description.

Understanding How Intrinsic Value is Calculated

Step 1: Check that you have checked Use these Values in my Analytical support

Delete Existing Value		Modify Existing Value		Cancel Selection		Delete All	
<input checked="" type="checkbox"/> Use these values in my analytical support							
Trader	RealName	Date	Time	Security	Field	Value	
jo0xdjia	jo0xDJIA	6/2/2010	9:45:44 AM	INTERNATIONAL BUSINESS MACHINE	RE_BV	16.881	
jo0xdjia	jo0xDJIA	6/2/2010	9:46:09 AM	INTERNATIONAL BUSINESS MACHINE	RE_D	2.132	
jo0xdjia	jo0xDJIA	6/2/2010	9:46:38 AM	INTERNATIONAL BUSINESS MACHINE	RE_D1	2.403	
jo0xdjia	jo0xDJIA	6/2/2010	9:47:11 AM	INTERNATIONAL BUSINESS MACHINE	RE_CEPS	7.543	
jo0xdjia	jo0xDJIA	6/2/2010	9:47:36 AM	INTERNATIONAL BUSINESS MACHINE	RE_CEPS1	8.49	
jo0xdjia	jo0xDJIA	6/2/2010	9:48:08 AM	INTERNATIONAL BUSINESS MACHINE	RE_CEPS2	9.288	
jo0xdjia	jo0xDJIA	6/2/2010	9:48:26 AM	INTERNATIONAL BUSINESS MACHINE	RE_Y1	5	
jo0xdjia	jo0xDJIA	6/2/2010	9:49:00 AM	INTERNATIONAL BUSINESS MACHINE	RE_G1	0.1043	
jo0xdjia	jo0xDJIA	6/2/2010	9:49:11 AM	INTERNATIONAL BUSINESS MACHINE	RE_G2	0.045	
jo0xdjia	jo0xDJIA	6/2/2010	9:50:14 AM	INTERNATIONAL BUSINESS MACHINE	RE_Ke1	0.0837	
jo0xdjia	jo0xDJIA	6/2/2010	9:50:19 AM	INTERNATIONAL BUSINESS MACHINE	RE_Ke2	0.0837	
jo0xdjia	jo0xDJIA	6/2/2010	9:50:54 AM	INTERNATIONAL BUSINESS MACHINE	RE_PR	0.283	

Step 2:

Edit	US Dollar	Stocks: Residual Earnings Model				UserTip
Name	Mkt Price	PV Abnormal Earnings	PV Continuing Value	Intrinsic Value	Premium over Book	
HEWLETT-PACKARD CO	46.05	17.05	61.76	83.01	78.8	
INTERNATIONAL BUSINESS MACHINE	125.28	30.72	157.77	205.37	188.4	
INTEL CORP	20.95	2.19	8.97	19.08	11.1	

Give focus back to the Residual Earnings Model and double click on the stock Name “**International Business Machine**” this brings up the following screen:

Analytic details						
File Edit Options						
Residual Earnings Model		1	2	3	4	5
DPS		2.4030	2.6285	2.9027	3.2054	3.5397
CEPS		8.4900	9.2880	10.2567	11.3265	12.5079
Discount Rate (Ke)		0.0837	0.0837	0.0837	0.0837	0.0837
Book Value		22.9680	29.6275	36.9816	45.1027	54.0708
Residual Earnings		7.0771	7.3656	7.7769	8.2312	8.7328
PV Residual Earnings(€)		6.5305	6.2718	6.1105	5.9679	5.8426
PV of Residual Earnings	30.7233					
Continuing Value	235.8075					
Long Term Ke	0.0837					
PV of Continuing Value	157.7656					
Intrinsic Value	205.3699					

The above screen provides a breakdown of the valuation model:

First in this current example time 0 = 2009 but the intrinsic value of IBM is the PV of future residual earnings not the current. We used 2009 numbers to base our forecasts from. As a result:

1 = 2010, 2 = 2011, 3 = 2012, 4 = 2013, 5 = 2014

Interpretation of the rows above:

DPS = Dividend per Share. For 2010 $2.4030 = 8.49 * 0.283 = 2010$ projected residual earnings times the dividend payout ratio

CEPS = Comprehensive Income per share for each year, 2010, 2011, 2012 In the above screen the CEPS for 2009 = 7.543. Recall the assumed growth behavior was as follows:

Year 1: 2010 = $7.543 * 1.1255$

Year 2: 2011 = $8.49 * 1.094$

Year 3: 2012 = $9.288 * 1.1043$

Note: The above convention is consistent with typical textbook presentations where the 5-year growth forecast is applied over years 3-5. However, a variation that you can use is to compute the implied growth forecasts for years 3-5 from the 1-year, 2-year and 5-year forecasts. This is computed as follows:

Computing Implied forecast for years 3-5:

Recall for 2010 IBM's growth was forecast to be 0.125, for 2011 this is 0.094 and for the next 5-years 0.1043. As a result, the annual growth forecasts for 2012, 2013, 2014 is implied from the above three numbers. That is, $1.125 * 1.094 * ? * ? * ? = 1.1043$. Solving for ? yields 0.1007.

If you prefer to use this internally consistent number then change the Stage 1 growth phase number to 0.1007 (see below for RE_G1:

Use these values in my analytical support

Trader	RealName	Date	Time	Security	Field	Value
jo0xdjia	jo0xDJIA	6/2/2010	9:45:44 AM	INTERNATIONAL BUSINESS MACHINE	RE_BV	16.881
jo0xdjia	jo0xDJIA	6/2/2010	9:46:09 AM	INTERNATIONAL BUSINESS MACHINE	RE_D	2.132
jo0xdjia	jo0xDJIA	6/2/2010	9:46:38 AM	INTERNATIONAL BUSINESS MACHINE	RE_D1	2.403
jo0xdjia	jo0xDJIA	6/2/2010	9:47:11 AM	INTERNATIONAL BUSINESS MACHINE	RE_CEPS	7.543
jo0xdjia	jo0xDJIA	6/2/2010	9:47:36 AM	INTERNATIONAL BUSINESS MACHINE	RE_CEPS1	8.49
jo0xdjia	jo0xDJIA	6/2/2010	9:48:08 AM	INTERNATIONAL BUSINESS MACHINE	RE_CEPS2	9.288
jo0xdjia	jo0xDJIA	6/2/2010	9:48:26 AM	INTERNATIONAL BUSINESS MACHINE	RE_Y1	5
jo0xdjia	jo0xDJIA	6/2/2010	9:49:00 AM	INTERNATIONAL BUSINESS MACHINE	RE_G1	0.1007
jo0xdjia	jo0xDJIA	6/2/2010	9:49:11 AM	INTERNATIONAL BUSINESS MACHINE	RE_G2	0.045
jo0xdjia	jo0xDJIA	6/2/2010	9:50:14 AM	INTERNATIONAL BUSINESS MACHINE	RE_Ke1	0.0837
jo0xdjia	jo0xDJIA	6/2/2010	9:50:19 AM	INTERNATIONAL BUSINESS MACHINE	RE_Ke2	0.0837
jo0xdjia	jo0xDJIA	6/2/2010	9:50:54 AM	INTERNATIONAL BUSINESS MACHINE	RE_PR	0.283

Now double click on IBM in the analytical support for Residual Income Valuation again to bring up the support working:

Analytic details

File Edit Options

Residual Earnings Model		1	2	3	4	5
DPS		2.4030	2.6285	2.8932	3.1845	3.5052
CEPS		8.4900	9.2880	10.2233	11.2528	12.3859
Discount Rate (Ke)		0.0837	0.0837	0.0837	0.0837	0.0837
Book Value		22.9680	29.6275	36.9576	45.0259	53.9066
Residual Earnings		7.0771	7.3656	7.7435	8.1594	8.6173
PV Residual Earnings(t)		6.5305	6.2718	6.0843	5.9159	5.7653
PV of Residual Earnings	30.5678					
Continuing Value	232.6888					
Long Term Ke	0.0837					
PV of Continuing Value	155.6790					
Intrinsic Value	203.1278					

The above is a refinement that uses an internally consistent set of Growth Forecasts. This can be contrasted with the initial set of numbers (see below which reveals intrinsic value initial estimate = \$205 versus \$203). Such a refinement makes a small difference to the projected intrinsic value but one that is usually within measurement error ranges which may explain why many ignore doing this type of refinement and just work directly with the 5-year growth forecast left unadjusted.

Analytic details						
File Edit Options						
Residual Earnings Model		1	2	3	4	5
DPS		2.4030	2.6285	2.9027	3.2054	3.5397
CEPS		8.4900	9.2880	10.2567	11.3265	12.5079
Discount Rate (Ke)		0.0837	0.0837	0.0837	0.0837	0.0837
Book Value		22.9680	29.6275	36.9816	45.1027	54.0708
Residual Earnings		7.0771	7.3656	7.7769	8.2312	8.7328
PV Residual Earnings(t)		6.5305	6.2718	6.1105	5.9679	5.8426
PV of Residual Earnings	30.7233					
Continuing Value	235.8075					
Long Term Ke	0.0837					
PV of Continuing Value	157.7656					
Intrinsic Value	205.3699					

Calculating Book Value of Owners Equity Per Share over Time

Recall from the clean surplus relationship in accounting we can express the dynamic behavior of book value of owners equity over time as:

$$BV_{t1} = CI_{t1} + BV_{t0} - d_{t1}$$

That is, Book Value can be forecast by forecasting Comprehensive Income and dividends.

First, book value of equity for 2009 (time = 0) was: \$16.881 per share. We can compute the time 1 book value per share as:

$$BV_{2010} = 8.49 + 16.881 - 2.403 = 22.968$$

Similarly,

$$BV_{2011} = 9.288 + 22.968 - 2.6285 = 29.6275 \text{ and so on.}$$

Growth Rate in Book Value

$$2010: 22.968/16.881 \Rightarrow 36.06\%$$

$$2011: 29.6275/22.968 \Rightarrow 28.99\%$$

$$2012: 36.9816/29.6275 \Rightarrow 24.82\%$$

$$2013: 45.1027/36.9816 \Rightarrow 21.96\%$$

$$2014: 54.0708/45.1027 \Rightarrow 19.88\%$$

Calculating Residual Income Per Share Over Time

First recall Residual Earnings is computed as:

Residual Income = Comprehensive Income_t - Book Value of Equity_{t-1} * Cost of Equity Capital

From the above numbers it can be verified that:

$$\text{Residual Income}_{2010} = 7.0771 = 8.49 - 16.881 * 0.0837$$

$$\text{Residual Income}_{2011} = 7.3656 = 9.288 - 22.968 * 0.0837$$

Calculating Return on Common Equity (ROCE) Over Time

The return on common equity is defined as Comprehensive Income to Common Equity at time t divided by the Book value of Equity at time t-1.

$$\text{ROCE}_{2010} = 8.49/16.881 = 0.5029$$

$$\text{ROCE}_{2011} = 9.288/22.9683 = 0.4043$$

Interpreting Residual Income

The above permits an alternative view of Residual Earnings which highlights the understanding of residual earnings. Residual income is dollar excess return over what is required by investors in terms of the cost of equity capital times book value of owners equity.

Residual Earnings_t = (Return on Common Equity_t – Cost of equity capital) * Book value of common equity_{t-1}

$$\text{Residual Income}_{2010} = (0.5029 - 0.0837) * 16.881 = 7.0771$$

$$\text{Residual Income}_{2011} = (0.4043 - 0.0837) * 22.968 = 7.3656$$

Calculating the Present Value of Residual Earnings over the Stage 1 Growth Phase

The cost of equity capital equals the investors' required rate of return. In turn this equals the discount rate for computing the present value of the residual earnings over the Stage 1 growth phase. You can verify the above as follows:

$$\text{Present Value Stage 1 phase Residual Income} = 30.7233 = 7.0771/(1.0837) + 7.3656/(1.0837^2) + 7.7769/(1.0837^3) + 8.2312/(1.0837^4) + 8.7328/(1.0837^5)$$

Calculating the Present Value of Going Concern

At the end of the Stage 1 growth phase we make the simplifying assumption that the firm is a going concern. As such it's residual income will continue to grow at it's estimated normal growth rate in perpetuity.

Recall from above that in 2014 the residual income is projected to be \$8.7328. To compute the continuing value of the firm we use Gordon's constant growth model:

Continuing Value of the Stock at the beginning of 2015 = $(\$8.7328 * 1.045) / (0.0837 - 0.045) = \235.8075

Finally, we need to discount this back to the present:

$$PV = \$235.8075 / (1.0837^5) = \$157.7656$$

Calculating the Intrinsic Value of the Stock

Intrinsic Value for IBM = Book Value₂₀₀₉ + PV of Stage 1 Phase Residual Income + PV of Going Concern

$$\text{Intrinsic Value for IBM} = 16.881 + 30.7233 + 157.7656 = \$205.36$$

Calculating Price Ratios

Suppose the current price is 125.28 and as calculated earlier the ROCE = 50.29:

$$\text{Price/Book Ratio} = 125.28 / 16.881 = 7.42$$

$$\text{Price/E(Book Ratio)} = 125.28 / 22.968 = 5.45$$

$$\text{Price/CEPS Ratio} = 125.28 / 7.543 = 16.61$$

$$\text{Price/E(CEPS) Ratio} = 125.28 / 8.49 = 14.76$$

$$(\text{Price/E(CEPS)}) / \text{Stage 1 Growth} = 14.76 / 10.43 = 1.41$$

Sensitivity Analysis

By how much do we need change the value of key inputs to make IBM's assessed value more consistent with the market price?

Your goal is to understand the underlying economics of the company you are valuing in terms of how from the firm side the three major decisions impact upon your assessments as well as how economy wide constraints impact upon your analysis. This will provide important insights into whether we assess the current market price to be reasonable or not. By attempting to answer the above question provides rich insight into how IBM is being valued by the market as well as which inputs of our "first pass" analysis may be optimistic. This will also provide useful experience for assessing the relative importance of the various inputs into this intrinsic value exercise. For the current exercise sensitivity analysis on Comprehensive Income is clearly a primary target for additional analysis.

For the Residual Income Model the initial inputs to examine are the cost of equity capital and the growth behavior assumptions for IBM. Furthermore, by inspecting implied growth rates for Book Value of Owners Equity may imply taking a close look at Comprehensive Earnings projections.

VIII. Conclusions

The above analysis is clearly a first pass analysis and one that you can modify using the current best of estimates you can get your hands on. After working through the IBM example you should then focus

attention on the stock that you are working with. You can also create live links to Excel for your personal parameter support to create even more powerful trading support systems if desired.