



# Measuring wealth

*The widely admired Edwards-Bell-Ohlson valuation model provides a simple but powerful way to compute the fundamental values of publicly traded stocks*

BY CHARLES M.C. LEE

FOR YEARS, INVESTORS AND CORPORATE managers have been seeking a timely and reliable measurement of shareholders' wealth. With such a measure, investors could spot over- or underpriced stocks, lenders could gauge the security of their loans and managers could monitor the profitability of their factories, divisions and firms. Labor contract negotiations, executive compensation plans, corporate investment strategies and the efficiency of capital markets would also benefit.

The Edwards-Bell-Ohlson (EBO) valuation model may be such a measure. It has certainly created a stir in academic circles (see suggested readings). The late professor Victor Bernard, when he was the American Accounting Association's director of research, predicted the EBO model would have sweeping effects on future research. In recognition of his role in developing the model, Columbia University professor James Ohlson received the AAA's Notable Contribution to Accounting Literature Award in 1995. Currently, University of British Columbia distinguished professor Gerald Feltham is working closely with Ohlson on several extensions of the model.

EBO provides accountants and money managers with a simple but powerful way to compute the fundamental values of publicly traded stocks. It also allows investors with little or no expertise in financial analysis to quickly estimate a firm's fundamental value. Moreover, since recent studies suggest capital markets may not fully understand

the value implications of this theory, individuals who do understand EBO may be able to profit from that knowledge.<sup>1</sup>

The development of the EBO model parallels that of economic value added (EVA), popularized by Bennett Stewart in *Quest for Value*.<sup>2</sup> Both EVA and EBO rely on the idea of "residual income," defined as earnings in excess of an expected level of performance, tied to

performance of divisional managers. Major US corporations, such as AT&T, Coca-Cola and Quaker Oats, are said to have used EVA in this way.<sup>3</sup> The advantage of EVA over earnings alone is that EVA incorporates the cost of capital. When using traditional, profit-based performance measures, divisional managers tend to focus too much on the bottom line; but under an EVA-based system, they are accountable not only for the earnings they generate, but also for the amount of capital they employ. This aligns the incentives of lower-level managers with those of shareholders.<sup>4</sup>

Equation 1 shows a company or division can improve EVA (that is, create wealth) in three ways: by increasing earnings while using the same amount of capital; by reducing the amount of capital employed while generating the same earnings; or by decreasing the cost of capital. Thus, the single-period EVA focuses employees at all levels on creating investor wealth. Despite (or perhaps because of) its simplicity, EVA is a hot consulting commodity. Several firms besides Stern Stewart market the same idea under different trade names.

The first step in implementing EVA is to ask, "Whose EVA?" Stern Stewart computes EVA for all long-term investors, including shareholders and long-term debt holders. EBO, on the other hand, focuses only on equity investors.

In the Stern Stewart approach:

## THE EDWARDS-BELL-OHLSON MODEL SHOWS HOW SHAREHOLDERS' WEALTH IS RELATED TO THE NUMBERS ON INCOME STATEMENTS AND BALANCE SHEETS

capital employed. EVA for a given time period,  $t$ , can be written as:

$$EVA_t = \text{earnings}_t - r * \text{capital}_{t-1} \quad (1)$$

where  $\text{capital}_{t-1}$  is the asset base (net assets employed at the beginning of period  $t$ ),  $r$  is the cost of that capital, and  $\text{earnings}_t$  is the actual earnings on the capital. Equation 1 relates wealth creation to the amount of residual income generated. A company's or division's activities create wealth — that is, generate positive EVA — if actual earnings exceed the expected dollar return on the capital employed.

Consulting firm Stern Stewart advocates using EVA to evaluate the per-

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Earnings<sub>t</sub> = earnings before interest = EBI<sub>t</sub>  
 $r$  = weighted average cost of capital = WACC  
 Capital<sub>t-1</sub> = total assets<sub>t-1</sub> = TA<sub>t-1</sub>

Some texts refer to EBI as NOPLAT, net operating profits less associated taxes. The definition of the capital base may be negotiated by division managers and head office. Some companies, for instance, use an average of the TA at the beginning and end of the period.<sup>5</sup> Substitution of these definitions yields Equation 2a:

$$\begin{aligned} \text{EVA}_t &= \text{EBI}_t - \text{WACC} * \text{TA}_{t-1} \\ &= (\text{EBI}_t / \text{TA}_{t-1} - \text{WACC}) * \text{TA}_{t-1} \\ &= (\text{ROA}_t - \text{WACC}) * \text{TA}_{t-1} \end{aligned} \quad (2a)$$

where ROA is the company's return on assets. This equation shows a firm or division is creating wealth for its long-term investors only if its ROA exceeds the cost of capital (WACC). The amount of wealth created depends on the amount of capital employed (TA). Traditional measures of performance, such as EBI or ROA, are components of EVA and undue emphasis on either will not maximize investor wealth creation.

Under EBO, we define EVA as economic value added for equityholders, so we define the components of residual income as follows:

Earnings<sub>t</sub> = net income = NI<sub>t</sub>  
 $r$  = cost of equity capital ( $r_e$ )  
 Capital<sub>t-1</sub> = total shareholder's equity<sub>t-1</sub> = book value<sub>t-1</sub> = SE<sub>t-1</sub> = B<sub>t-1</sub>

Substituting these expressions yields Equation 2b:

$$\begin{aligned} \text{EVA}_t &= \text{NI}_t - r_e * \text{B}_{t-1} \\ &= (\text{NI}_t / \text{B}_{t-1} - r_e) * \text{B}_{t-1} \\ &= (\text{ROE}_t - r_e) * \text{B}_{t-1} \end{aligned} \quad (2b)$$

This equation shows a firm is creating wealth for its shareholders only if it earns a return on equity (ROE) in excess of the cost of equity capital ( $r_e$ ). Moreover, the amount of actual wealth created depends on the amount of equity capital employed.

EVA is a powerful valuation tool when it is extended to multiple periods. Since a firm derives value from both invested capital and future activities, we can write:<sup>6</sup>

$$\text{Firm value}_t = \text{capital}_t + \text{present value of all future EVAs} \quad (3)$$

Equation 3 may seem old hat to some readers, but it has attracted worldwide praise from the academic community because it is based directly on the accounting numbers we see on financial statements and holds for any accounting system that satisfies the clean surplus relation, that is:

$$\text{B}_t = \text{B}_{t-1} + \text{NI}_t - \text{D}_t$$

where  $\text{D}_t$  represents dividends at time  $t$ . The clean surplus relation, a normative accounting proposition that has been with us for more than half a century, says a firm's book value should be changed only by dividends or earnings.<sup>7</sup> Feltham and Ohlson show that by using the clean surplus relation,<sup>8</sup> high-school algebra, black coffee and a sharp pencil, one can get from a dividend-valuation equation based on the anticipated wealth distributed to the EVA equation based on the anticipated wealth created. And, although Feltham and Ohlson did not advocate it, many researchers and practitioners are using the model for valuing individual firms.

The first term on the right-hand side of Equation 3, capital invested at time  $t$ , comes from the balance sheet. The second term, the present value of future EVAs, comes from both the balance sheet and the income statement and can be viewed as the present value of expected residual earnings in the future.

In my research, I focused on the equityholders, expressing the variables on a per-share basis:

Capital<sub>t</sub> = B<sub>t</sub> = book value at time  $t$   
 Firm value<sub>t</sub> = "synthetic price" at time  $t$  = P<sub>t</sub>\*

I use the term "synthetic price" to denote a firm's intrinsic value per share, based on fundamental analysis. The observed market price may differ from the synthetic price because of a phenomenon called noise trading.<sup>9</sup> Under this notation, Equation 3 becomes Equation 4:

$$\begin{aligned} P_t^* &= \text{B}_t + \sum_{i=1}^{\infty} \text{EVA}_{t+i} \\ &= \text{B}_t + \frac{(\text{ROE}_{t+1} - r_e) * \text{B}_t}{1 + r_e} + \frac{(\text{ROE}_{t+2} - r_e) * \text{B}_{t+1}}{(1 + r_e)^2} \\ &\quad + \frac{(\text{ROE}_{t+3} - r_e) * \text{B}_{t+2}}{(1 + r_e)^3} + \frac{(\text{ROE}_{t+4} - r_e) * \text{B}_{t+3}}{(1 + r_e)^4} + \dots \end{aligned} \quad (4)$$

Dividing through by B<sub>t</sub>, we get Equation 5:

$$\begin{aligned} \frac{P_t^*}{\text{B}_t} &= 1 + \frac{(\text{ROE}_{t+1} - r_e) * \text{B}_t}{1 + r_e} * \frac{1}{\text{B}_t} + \frac{(\text{ROE}_{t+2} - r_e) * \text{B}_{t+1}}{(1 + r_e)^2} * \frac{1}{\text{B}_t} + \dots, \text{ or} \\ \frac{P_t^*}{\text{B}_t} &= 1 + \sum_{i=1}^{\infty} \frac{(\text{ROE}_{t+i} - r_e) * \text{B}_{t+i}}{(1 + r_e)^i} * \frac{1}{\text{B}_t} \end{aligned} \quad (5)$$

Equation 5 is the EBO valuation formula that appears in the accounting literature.<sup>10</sup> In this article, I assumed certainty to keep the notation simple. Under uncertainty, future EVAs are expressed as expectations conditional on information available at time  $t$  and the costs of capital are expected rates that can vary across firms and over time.

Equation 5 provides several interesting insights. The price-to-book ratio is expressed in terms of future abnormal ROEs and growth in book value. In a competitive equilibrium, a typical firm's ROE should be close to its cost of equity capital ( $\text{ROE} = r_e$ ), subject to accounting and risk factors that may affect the reported ROE. The formula shows these firms should trade at a P/B ratio close to 1. Moreover, firms that are expected to earn above-normal ROEs should trade at higher P/B ratios.

How does the EBO equation relate to traditional valuation models, such as the dividend discount model (DDM) and the discounted cash flow model (DCF)? As already mentioned, firm value computed using the EBO formula is mathematically identical to the present value of future dividends from a DDM. It is also equivalent to the present value of discounted cash flows from DCFs.<sup>11</sup> The EBO valuation method has several attractive properties, however, that make it more practical to use than traditional valuation methods. Dividends are a poor surrogate for the increment in firm value because they measure wealth distribution, not wealth creation. In fact, more than 25% of firms listed on the New York Stock Exchange do not pay any dividends at all. When firms do pay dividends, the amount is discretionary and often does not reflect current firm prospects. These practical constraints greatly limit the usefulness of DDM.

Valuation models based on discounted future earnings and cash flows also have

shortcomings. They typically ignore much of the information contained in the balance sheet, although Equation 3 shows that a firm derives its value from both existing assets and future wealth-creating activities. What if we used a conservative accounting policy, writing off all assets, so that the reported capital base was zero? Then we would find that firm value derived entirely from future EVAs. Suppose we also paid all our earnings each year as dividends. Then the beginning capital base for each future period would be zero; future EVAs would simply be the stream of future earnings and Equation 4 would collapse into an earnings (or equivalently, a cash flow) discount model.

This is the essence of the DCF approach. By ascribing all of a firm's value to its future earnings (cash flow) stream, DCF valuations ignore the value-relevant information in balance sheets. In effect, the DCF model pushes the portion of firm value in the balance sheet into future projections of cash flows (or earnings). This causes a much greater proportion of the firm value to appear in later periods of the forecast. As a result, DCF valuations tend to be plagued by significant practical problems associated with terminal value estimations. These terminal values are higher and more volatile than they need to be because a large portion of the projected cash flow pertains to the current capital base. The EBO method reduces this problem with terminal values by projecting only the value-relevant portion of future earning streams — that is, the future residual income.

Equation 4 suggests that if we can forecast future ROEs for a stock, we can estimate  $P_t^*$ , the firm's intrinsic value, or the present value of its future dividends, if we have four inputs: current book value per share ( $B_t$ ), the cost of equity capital ( $r_e$ ), ROE forecasts for T future periods, and an estimate of the dividend payout ratio (k).

The book value (or shareholders' equity) per share ( $B_t$ ) is readily obtained from balance sheets found in the annual report. Or, total shareholders' equity may be divided by the total number of shares outstanding, which should be the weighted-average number of shares outstanding as reported in the EPS cal-

culuation, typically found in the income statement.

For publicly traded firms, the capital asset pricing model (CAPM) can be used to estimate a firm's cost of equity capital ( $r_e$ ). Under the CAPM, a firm's beta ( $\beta$ ) captures all the relevant risk, and an estimate of the cost of equity is:

$$r_e = r_f + \beta * [E(R_m) - r_f]$$

where  $r_f$  is the risk-free rate,  $\beta$  is the firm's beta and  $E(R_m)$  is the long-term expected return on the market — about 13% in the United States. Recent studies cast some doubt on the ability of  $\beta$  to explain cross-sectional returns.<sup>12</sup> But the CAPM still provides a good starting point for estimating the cost of equity for a public firm. (Private firms might be compared to publicly traded firms of similar industry and size.)

### SUGGESTED READINGS

Since EBO is a new area, many of these selections have not yet appeared in journals:

- "Accounting-based valuation methods, determinants of market-to-book ratios, and implications for financial statement analysis," working paper by Victor L. Bernard (who coined the term "Edwards-Bell-Ohlson"), University of Michigan, June 1993.

- "A synthesis of security valuation theory and the role of dividends, cash flows, and earnings," by James A. Ohlson, *Contemporary Accounting Research*, 1990, Vol. 6, pp. 648-676.

- "Earnings, book values, and dividends in security valuation," by James A. Ohlson, *Contemporary Accounting Research*, Spring 1995.

- "Valuation and clean surplus accounting for operating and financial activities," by Gerald Feltham and James A. Ohlson, *Contemporary Accounting Research*, Spring 1995.

Recent applications of EBO include:

- "P/E, P/B and the present value of future dividends," by Patricia Fairfield, *Financial Analysts Journal*, July-August 1994, pp. 23-31.

- "Financial statement analysis and the evaluation of market-to-book ratios," working paper by Jane A. Ou and Stephen H. Penman, Santa Clara University and the University of California at Berkeley, May 1994.

What if a firm increases its leverage? The short answer is that it should have little effect. While increasing debt increases the ROE and the cost of equity capital ( $r_e$ ), Nobel laureates Merton Miller and Franco Modigliani argue that financing activities such as paying dividends or increasing leverage do not affect firm value.<sup>13</sup> In practice, however, if a firm is underleveraged, increasing debt may improve firm value for tax reasons.

The dividend payout ratio (k) is the percentage of net income paid out as dividends each year. This variable is used along with the clean surplus relation (CSR) to derive future book values. The CSR can be written as:

$$\begin{aligned} B_{t+1} &= B_t + NI_{t+1} - D_{t+1} \\ &= B_t + (1 - k) * NI_{t+1} \\ &= B_t * (1 + (1 - k) * ROE_{t+1}) \end{aligned}$$

- "A comparison of dividend, cash flow, and earnings approaches to equity valuation," working paper by Stephen H. Penman and Theodore Sougiannis, University of California at Berkeley and University of Illinois at Urban-Champaign, October 1994.

- "Is the US stock market myopic?" working paper by Jeffrey Abarbanell and Victor Bernard, University of Michigan, January 1995.

- "Accounting valuation, market expectation, and the book-to-market effect," working paper by Richard Frankel and Charles M.C. Lee, University of Michigan, June 1995.

- "The Feltham-Ohlson framework: implications for empiricists," by Victor L. Bernard, *Contemporary Accounting Research*, Spring 1995.

Earlier treatments can be found in:

- "Annual survey of economic theory: the theory of depreciation," by G. Preinreich, *Econometrica*, 1938, Vol. 6, pp. 219-241.

- *The Theory and Measurement of Business Income*, by E. Edwards and P. Bell, Berkeley, University of California Press, 1961.

- "Some formal connections between economic values and yields and accounting numbers," by Kenneth Peasnell, *Journal of Business Finance and Accounting*, October 1982, pp. 361-381.

Dividing both sides by  $B_t$ , we get:

$$B_{t+1}/B_t = 1 + (1-k)*ROE_{t+1}$$

Analogously, all future book values can be expressed as functions of  $B_t$ ,  $k$ , and future ROEs. For example, we can write:

$$B_{t+2}/B_t = (B_{t+2}/B_{t+1}) * (B_{t+1}/B_t) = [1 + (1-k)*ROE_{t+2}] * [1 + (1-k)*ROE_{t+1}]$$

Under CSR,  $k$  must incorporate all changes in book value other than net income. Therefore,  $k$  is best regarded as reflecting the "net dividends paid"; that is, dividends paid net of any new capital contributions. Firms that raise new equity will increase their book value independent of net income. The effect of new equity is to reduce  $k$  and possibly render it negative.

We can use the EBO model even if a firm did not use clean surplus accounting in the past, as long as future earnings satisfy clean surplus accounting. What about "dirty surplus" items currently reported in this year's shareholders' equity? Under Canadian and US GAAP, currency gains and losses on translation of foreign subsidiaries and mark-to-market accounting adjustments

## EXHIBIT 1

### TIMBERLAND INC. VALUATION USING MEAN ANALYST FORECASTS

#### EBO calculation

Year		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	EPS growth (from IBES)			0.1775	0.1775	0.1775	0.1775	0.1775					
	Forecasted EPS	2.08	3.22	3.79	4.46	5.26	6.19	7.29					
	Beg. of year BV/shr	9.550	11.630	14.850	18.642	23.106	28.363	34.553					
	Implied ROE		0.277	0.255	0.239	0.228	0.218	0.211					
ROE	(beg. ROE, from the DCF model)	0.218	0.277	0.255	0.239	0.228	0.218	0.211	0.211	0.211	0.211	0.211	0.211
Abnormal ROE	(ROE-r)	0.070	0.129	0.107	0.091	0.080	0.070	0.063	0.063	0.063	0.063	0.063	0.063
growth rate for B	(1-k)*(ROE-t)	0.000	0.218	0.277	0.255	0.239	0.228	0.218	0.211	0.211	0.211	0.211	0.211
Compounded growth		1.000	1.218	1.555	1.952	2.419	2.970	3.618	4.381	5.306	6.425	7.780	9.421
Growth*AROE		0.070	0.157	0.167	0.179	0.192	0.209	0.228	0.276	0.334	0.404	0.490	0.593
Required rate (r)		0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148
Discount rate		1.148	1.318	1.513	1.737	1.994	2.289	2.628	3.017	3.463	3.976	4.564	5.240
Div. payout rate (k)		0.000											
Add to P/B	PV (growth*AROE)	0.06	0.12	0.11	0.10	0.10	0.09	0.09	0.09	0.10	0.10	0.11	0.11
Cum P/B		1.06	1.18	1.29	1.39	1.49	1.58	1.67	1.76	1.86	1.96	2.06	2.18
Perpetuity beyond	(Assume this yr's AROE forever)	0.41	0.80	0.75	0.69	0.65	0.62	0.59	0.62	0.65	0.69	0.72	0.76
Total P/B	(P/B if we stop est. this period)	1.47	1.98	2.04	2.09	2.14	2.20	2.25	2.38	2.51	2.64	2.79	2.94
Estimated value per share		\$14.05	\$18.95	\$19.44	\$19.94	\$20.45	\$20.98	\$21.52	\$22.70	\$23.94	\$25.25	\$26.64	\$28.10

## EXHIBIT 2

### TIMBERLAND INC. VALUATION USING HIGH ANALYST FORECASTS

#### EBO calculation

Year		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	EPS growth (from IBES)			0.2500	0.2500	0.2500	0.2500	0.2500					
	Forecasted EPS	2.10	3.35	4.19	5.23	6.54	8.18	10.22					
	Beg. of year BV/shr	9.550	11.650	15.000	19.188	24.422	30.965	39.144					
	Implied ROE		0.288	0.279	0.273	0.268	0.264	0.261					
ROE		0.220	0.288	0.279	0.273	0.268	0.264	0.261	0.261	0.261	0.261	0.261	0.261
Abnormal ROE	(ROE-r)	0.072	0.140	0.131	0.125	0.120	0.116	0.113	0.113	0.113	0.113	0.113	0.113
growth rate for B	(1-k)*(ROE-t)	0.000	0.220	0.288	0.279	0.273	0.268	0.264	0.261	0.261	0.261	0.261	0.261
Compounded growth		1.000	1.220	1.571	2.009	2.557	3.242	4.099	5.169	6.519	8.222	10.370	13.078
Growth*AROE		0.072	0.170	0.206	0.251	0.307	0.377	0.464	0.585	0.738	0.931	1.174	1.480
Required rate (r)		0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148
Discount rate		1.148	1.318	1.513	1.737	1.994	2.289	2.628	3.017	3.463	3.976	4.564	5.240
Div. payout rate (k)		0.000											
Add to P/B	PV (growth*AROE)	0.06	0.13	0.14	0.14	0.15	0.16	0.18	0.19	0.21	0.23	0.26	0.28
Cum P/B		1.06	1.19	1.33	1.47	1.63	1.79	1.97	2.16	2.37	2.61	2.87	3.15
Perpetuity beyond	(Assume this yr's AROE forever)	0.42	0.87	0.92	0.98	1.04	1.11	1.19	1.31	1.44	1.58	1.74	1.91
Total P/B	(P/B if we stop est. this period)	1.49	2.06	2.25	2.45	2.67	2.90	3.16	3.47	3.81	4.19	4.60	5.06
Implied price	Estimated stock price	\$14.19	\$19.72	\$21.47	\$23.38	\$25.45	\$27.71	\$30.18	\$33.15	\$36.42	\$40.01	\$43.96	\$48.29

for long-term marketable securities are direct adjustments to book value. To my mind, the appropriate treatment for these dirty surplus items is to include them in the beginning book value. By so doing, we effectively mark the associated assets to their current market value. Since the timing and magnitude of such equity adjustment items are generally unforeseeable, they should not affect our expectation of future earnings.

Should a firm's dividend policy affect firm valuation? The short answer is that it should not, but we need to use a realistic  $k$  value for a given ROE and  $r_c$ . If Miller and Modigliani are correct, the mere payment of dividends does not affect shareholder wealth. This assumption is not obvious in the EBO formula, since it includes the dividend payout ratio ( $k$ ). If we increase the dividend payout rate without any other changes, however, the P/B ratio can go up (if the firm earns less than cost of capital) or down (if it is earning more than  $r_c$ ). In reality, though, if we increase the dividend payout rate yet want to maintain the same level of operations, we must borrow more, increasing both  $r_c$  (the cost of equity) and future ROEs. According to Miller and Modigliani, these effects offset each other and firm value stays the same.

How do we get a realistic  $k$  value? The appropriate choice depends on the choice of future ROEs. If you use analysts' current EPS forecasts to predict future ROEs, for example, the appropriate  $k$  is the payout ratio implicit in the forecasts. Typically, this would be the firm's current dividend payout ratio, which is obtainable from recent financial statements. Using a much higher or lower dividend payout ratio can result in distorted firm value estimates — unreasonably high  $k$  values will inflate firm value. The distortion arises because, if EPS forecasts are constant, higher dividend payout implies a firm must have higher ROEs. In other words, the firm can generate the same earnings with less capital.

Forecasting future ROEs is arguably the most challenging and important part of the EBO valuation exercise. Although it is more an art than a science, there are some useful benchmarks. This year's ROE (adjusted for nonrecurring items) provides a good starting point for esti-

imating next year's ROE. In large samples, the correlation between the current year's ROEs and the next is greater than 0.5. One approach is to begin with this year's ROE and make adjustments based on a firm's future prospects and other accounting and economic factors.

The ROEs of other firms in the same industry are also useful benchmarks, because those firms tend to have similar risk profiles and accounting policies. In large samples, extreme ROEs tend to mean-revert to industry norms. Therefore, in making ROE forecasts of more than five years, it is prudent to project a gradual pattern of reversion toward the industry mean. The sustainability of a firm's competitive advantage within an industry is, of course, a major consideration. Similarly, a realistic forecast requires the analyst to gauge the quality of current earnings when predicting future earnings. Indeed, the art of projecting future ROEs integrates business skills from corporate strategy, accounting, finance and marketing.

Another source of information useful in making ROE forecasts is the EPS projections of financial analysts, presented by services such as IBES, Zack's, or Value Line. The typical report contains high, median and low EPS forecasts by analysts for the next two years, plus a projected earnings growth rate for the following five years. In the EBO formula, next year's ROE is the forecasted net income (or EPS), divided by current shareholders' equity (or book value per share). Using EPS forecasts and the clean surplus assumption, we can get an EBO projection of the stock price based on seven years' data. For greater forecast horizons, one technique I find useful is to allow the projected ROE to mean-revert to the industry average from the ninth to 15th year.

Equation 4 expresses firm value in terms of an infinite series. For practical purposes, the explicit forecast period is much shorter — typically five to 15 years. As in DCF analyses, the best forecast period should be the length of time necessary for the company to reach long-term competitive equilibrium. My experience suggests that periods of about 15 years generally give value estimates that have the strongest correlation with stock prices.

Another important implementation issue involves the calculation of a terminal value, an estimate of the value of the firm arising from EVAs earned after the explicit forecasting period. An advantage of the EBO method is that the terminal value is generally much smaller than that in DCF analyses, because the EBO approach forecasts only the residual income, not the entire future cash flow. Moreover, the impact of the terminal value can be minimized by a longer forecasting horizon and mean-reverting the projected ROE toward industry average. Nevertheless, the calculation of terminal value is an important part of the EBO valuation process.

A simple way to estimate the terminal value using the EBO method is to take the next term in the EBO formula expansion and treat it as a perpetuity. If the explicit forecast period ends after  $T$  periods, for example, the terminal value is:

$$(\text{AROE}_{T+1} * \text{growth in BV}_T) / [r_c * (1 + r_c)^T]$$

where  $\text{AROE}_{T+1}$  is the projected abnormal ROE for the next period, and  $\text{growth in BV}_T$  is  $B_T/B_0$ . In dividing by  $r_c$ , we implicitly assume the firm will earn, in perpetuity, an abnormal return on equity equal to  $\text{AROE}_{T+1}$  on an asset base of size  $B_T$ . Book value may grow beyond period  $T$ , but the additional growth will not contribute to wealth creation. In other words, we assume that beyond period  $T+1$ , new growth will earn only the cost of capital, so that the AROE on growth beyond  $T+2$  is zero. This assumes that abnormal returns due to barriers-to-entry are eventually eroded away in a competitive environment.

Accounting-based valuation techniques naturally depend on reported accounting numbers. A commonly raised concern is how vulnerable these numbers are to managerial misrepresentations or other biases arising from the accounting system, such as conservatism. Accounting numbers are conservative, in that assets are often written off faster than economics might dictate. Research and development expenditures under US GAAP, for instance, must be expensed in the year incurred. Canadian standards are slightly less conservative but, in either

case, GAAP result in deflated book values and earnings in earlier years and increased earnings and ROEs in later years. Firms with large R&D costs, therefore, typically have low book values and high ROEs.

In theory, conservatism should not affect EBO valuations. Ohlson shows that, in an infinite-horizon valuation, the mechanics of double-entry bookkeeping under clean surplus accounting automatically allow for conservatism. In other words, the decrease in book value caused by conservative accounting is exactly offset by an increase in future ROEs, so the computed firm value is unaffected.

Feltham and Ohlson show, however, that in finite-horizon valuations the level of accounting conservatism affects the terminal value calculation.<sup>14</sup> The terminal value approaches zero only if the accounting system is unbiased (that is, not conservative). With extreme conservatism, the task of estimating terminal value can get difficult, because at period T+1, the ROE forecast must incorporate the effect of future reversals in accruals, which stem from premature asset write-offs in prior periods. Eugene Imhoff and I showed that, for some fast-growing biotech firms, EBO valuation with a 10-year horizon can significantly understate firm value. This understatement is largely corrected when R&D costs are capitalized.<sup>15</sup>

We can thus define a finite-horizon (T-period) EBO valuation equation:

$$P_t^* = B_t + \sum_{i=1}^T \frac{(ROE_{t+i} - r_e) * B_{t+i}}{(1 + r_e)^i} + \frac{(ROE_{t+T+1} - r_e) * B_{t+T+1}}{r_e(1 + r_e)^T} \quad (6)$$

The EBO value in Equation 6 can be estimated with just four parameters. My students do this by using extracts from recent financial statements (to obtain  $k$  and  $B_t$ ), an estimate of  $r_e$ , and a set of recent EPS forecasts from IBES or Zack's.

Exhibit 1 uses Equation 6 to compute the EBO value per share of Timberland Inc., a manufacturer of leather boots and outdoor apparel. The input parameters are:

- Book value — \$9.55 per share as of January 1993.
- Cost of equity ( $r_e$ ) — Timberland, a small firm in the specialty retail industry, is riskier than a blue-chip industrial firm. Based on a  $\beta$  of 1.3 and a riskless rate of 7%, the firm's cost of

equity can be calculated as:  $r_e = .07 + 1.3(.06) = .148$ .

- Dividend payout ratio — Timberland has never paid dividends, so  $k = 0$ .
- Forecasted future earnings — at the time, the mean IBES earnings per share estimates were \$2.08 for fiscal 1993, \$3.22 for fiscal 1994, then growing at 17.75% for the next five years.

The spreadsheet in Exhibit 2 uses the high, rather than mean, IBES forecasts. The estimated stock price for each year represents the EBO estimate of the firm's fundamental value per share today, assuming the firm performs as predicted for T years.

Exhibit 1 shows, for instance, that if the firm's earnings are equal to the mean forecast, and if it can sustain an ROE of .211 until 2004, then its fundamental value per share is \$28.10. Alternatively, if Timberland produces the same earnings for the next seven years but can sustain an ROE of .211 only until 2000, its fundamental value per share is \$22.70. By varying the four input parameters, it is easy to examine the sensitivity of the EBO value to the key valuation assumptions.

At the time this information was collected, Timberland shares sold for about \$60, far above the EBO value estimates. Exhibit 2 shows that even if the earnings forecast of the most optimistic analysts were realized and the company sustained an ROE of 26.1% until 2004, the stock would be worth only \$48.29. When my students analysed Timberland in January 1994, they were troubled by the discrepancy between the EBO value and the stock price, to the point that many were skeptical of the EBO model. Their skepticism disappeared in the next two months, however, as Timberland's shares lost two-thirds of their market value. The stock is still trading at about \$20.

In short, the EBO model has advantages over traditional valuation methods. It shows how shareholders' wealth is related to the numbers on income statements and balance sheets. DCF is a more flexible valuation tool in practice, because it allows for specific adjustments to each cash flow item. Thus, DCF is like a high-priced camera with full manual controls, while EBO is more like one with auto-focus and auto-ex-

posure. My students and I like to use EBO as a primary filter for identifying over- and undervalued firms, following up with detailed DCF analyses.



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## NOTES

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