THE APPLICATION OF FUNDAMENTAL VALUATION PRINCIPLES TO PROPERTY/CASUALTY INSURANCE COMPANIES

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SECTION 1 - Introduction

This paper explores the concepts underlying the valuation of an insurance company in the context of how other (non-insurance) companies are valued. Among actuaries, the value of an insurance company is often calculated as (i) adjusted net worth, plus (ii) the present value of future earnings, less (iii) the cost of capital. Among other financial professionals (e.g., chief financial officers, investment bankers, economists), value is often calculated as the present value of future cash flows. This paper will discuss both methods and explain under what circumstances the two methodologies derive equivalent value and under what circumstances the results of the two methods diverge. This paper also addresses recent developments in the insurance industry that could affect valuation, including the NAIC's codification of statutory accounting principles, fair value accounting, and the Gramm-Leach-Bliley Act of 1999.

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Why Value a Company?

Valuation of a property/casualty insurance company is an important feature of actuarial work. Much of the work arises from merger, acquisition, and divestiture activity, although the need for valuation arises from other sources. An insurance company valuation might be prepared for lending institutions or rating agencies. It might be performed as part of a taxable liquidation of an insurance company, reflecting the value of existing insurance policies in force. A valuation might also be prepared for the corporate management of insurance companies in order to provide the clearest picture of value and changes in value of the company over a given time period.

The assumptions underlying the valuation and, therefore, the computed value may differ for different uses[1]. As such, the purpose of the valuation and the source of the assumptions should be clearly identified.

Basic Principles of Valuation

Before discussing valuation methodologies, we introduce some basic principles.

1. The value of any business has two determining factors:

    i. The future earnings stream generated by a company's assets and liabilities.
    ii. The risk of the stream of earnings. This risk is reflected in the cost to the entity of acquiring capital, measured by the investors' required rate of return (i.e., the "hurdle rate").

[1] For example, in an acquisition, the purchaser may be able to lower expenses, grow a business faster because of the purchaser's current business, reduce the effective tax rate, or reduce the cost of capital for the acquired or target entity. These assumptions would serve to increase value of the target entity. These same assumptions may not be valid for valuing the target entity as a stand-alone business unit.

2. For a given level of future risk, the greater the expected profits[2], the greater the value of the business.

3. For a given level of future profitability, the greater the volatility (and, therefore, the higher the hurdle rate), the lower the value of the business.

4. A company has value in excess of its invested capital only when future returns are in excess of the hurdle rate.

5. When a company is expected to produce an earnings stream that yields a return on invested capital that is less than the hurdle rate, the economic value of the required capital is less than its face value. In this case, the logical action would be to liquidate assets.

[2] Expected profits refer to the present value of the expected earnings stream.

SECTION 2 - Valuation Methodologies

There are two methodologies prevalent in valuation literature that form the basis of our discussion of insurance company valuation:

(i) Discounted Cash Flow ("DCF")
(ii) Economic Value Added ("EVA")

A DCF model discounts free cash flows to the equity holders at the hurdle rate. The starting capital of the entity is *not* a direct element in the valuation formula[3].

An EVA model begins with the starting capital of the entity and defines value as:

Value = Initial capital invested + PV of expected "excess returns" to equity investors

Sturgis[4] refers to two methods in his paper on valuation:

1. The discounted value of maximum stockholder dividends.
2. Current net worth[5] plus the discounted value of future earnings less cost of capital.

The first method corresponds to DCF methodology. The second method is also discussed by Miccolis[6] and in other actuarial literature as:

ANW + PVFE – COC

Where:

ANW	=	adjusted net worth (statutory capital and surplus with a series of modifications)
PVFE	=	present value (PV) of future earnings attributable to in-force business and new business
COC	=	cost of capital = PV of [(hurdle rate × required starting capital for each period) – (investment earnings on capital excluded from future earnings)] [7]

[3] If the starting capital of the entity is higher (or lower) than capital required, it will generate a positive (or negative) cash flow to the investor at "time zero."
[4] Robert W. Sturgis, "Actuarial Valuation of Property/Casualty Insurance Companies"
[5] Throughout this paper, we use the terms capital, equity, net worth, and surplus interchangeably
[6] Robert S. Miccolis, "An Investigation of Methods, Assumptions, and Risk Modeling for the Valuation of Property/Casualty Insurance Companies"
[7] If future earnings include investment income on capital, the cost of capital calculation will be modified to be equal to the present value of (hurdle rate × starting capital each period).

This second method is a form of the EVA model, in which *PVFE – COC* equals the present value of expected excess returns.

Discounted Cash Flow

A company's value may be determined by discounting free cash flows to the equity owners of the company[8] at the cost of equity, or the hurdle rate. Free cash flow is often defined as the after-tax operating earnings of the company, decreased by earnings that will be retained in the company, or increased by capital releases to maintain an appropriate level of capital to support ongoing business of the company.

After-tax operating earnings usually constitute changes in capital during a period, other than capital infusions or distributions. For property/casualty insurance companies, however, there are gains and losses in surplus due to "below the line" adjustments[9] that do not flow through statutory earnings. Capital changes associated with the change in unrealized capital gains or losses, the change in non-admitted assets, the change in statutory reinsurance penalties, the change in foreign exchange adjustment, and the change in deferred income tax must be considered along with after-tax operating earnings when evaluating free cash flows. For the valuation formulas discussed throughout this paper, after-tax operating earnings include these direct charges and credits to statutory surplus.

A company creates value for its shareholders only when it earns a rate of return on invested capital ("ROIC") that exceeds its cost of capital or hurdle rate. ROIC and the proportion of after-tax operating earnings that the company invests for growth drive free cash flow, which in turn drives value. For some industries, regulatory or statutory restrictions create an additional consideration that limits dividendable free cash flow.

The DCF value of the business is often projected as two separate components: (a) the value of an explicit forecast period and (b) the value of all years subsequent to the explicit forecast period (the "terminal value"). Projections for the forecast period, which is usually five to ten years[10], typically include detailed annual earnings projections that reflect revenue projections, loss and expense projections, investment income projections, tax liabilities, after-tax operating earnings, assets, liabilities, initial capital and the marginal capital that needs to be invested in the company to grow the company at the expected annual growth rate.[11]

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[8] Free cash flows are released in the form of dividends or other capital releases to the equity owners.

[9] "Below the line" refers to the Underwriting and Investment Exhibit in the statutory Annual Statement prescribed by the NAIC. Direct charges and credits to surplus are shown below the line for Net Income, which is the starting point for regular taxable income.

[10] Five to ten years is typical because beyond that period it is usually too speculative to project detailed financials. A long-term earnings growth rate and a corresponding capital growth rate are selected to derive value beyond the forecast period.

[11] APPENDIX I – Sample Company Valuation addresses these earnings forecasts in detail and provides an example.

The value of the **forecast period** is:

$$FC_O + \sum_{x=1}^{n} \frac{OE_x - (C_{x-1} \times g_x)}{(1+h)^x}$$

Where:

n = the number of years in the forecast period (usually 5 to 10 years)

OE_x = after-tax operating earnings in year x (including gains and losses in capital that do not flow through earnings)

g_x = expected growth rate of capital in year x

C_{x-1} = capital at the end of year $x-1$; this equals capital at the beginning of year x

$C_{x-1} \times g_x$ = incremental capital required to fund future growth

h = hurdle rate

FC_0 = free capital at time zero – this represents capital that may be either released from the company at the valuation date if the company is over-capitalized or infused into the company at the valuation date if the company is under-capitalized
= $SC_0 - C_0$, the difference between SC_0, the starting capital of the entity, and C_0, the capital *needed* at the end of year zero/beginning of year 1

The value of the second component of DCF value is often referred to as the **terminal value**. The terminal value can be developed using a simplified formula based on (a) projected after-tax net operating profits in the first year *after* the forecast period, (b) the perpetual growth rate, and (c) the hurdle rate.

$$\textbf{Terminal value} = \sum_{x=n+1}^{\infty} \frac{OE_x - (C_{x-1} \times g)}{(1+h)^x}$$

$$= \frac{OE_{n+1} - (C_n \times g)}{(h-g)(1+h)^n}$$

Where:

n = the number of periods in the forecast period

C_n = the capital at the end of the last period of the forecast period

g = the expected perpetual growth rate of capital and of after-tax operating earnings

h	= the hurdle rate
OE_{n+1}	= after-tax operating earnings in the period after the forecast period
$OE_{n+1} - (C_n \times g)$	= free earnings, equal to after-tax earnings less amounts needed to be retained in the company to grow the capital at rate g.

This terminal value calculation gives credit for earnings into the future in perpetuity. Sometimes a higher hurdle rate is used for the terminal value than for the forecast period to reflect the increased uncertainty associated with operating earnings many years in the future. A discussion of considerations related to the selection of the hurdle rate is provided in **SECTION 4 – Parameterizing the Valuation Model**.

The terminal value can be thought of as the present value of the free earnings (in the period after the forecast period) multiplied by a price to earnings ("P/E") ratio. The P/E ratio is determined by the hurdle rate, h, and the growth rate, g, and is equal to $\frac{1}{h-g}$ [12].

If the hurdle rate is 15% and the growth rate is 5%, then the P/E ratio = $\frac{1}{.15-.05} = 10$.

In practice, the P/E ratio underlying the Terminal Value calculation can be selected by reviewing sale prices of recent insurance company transactions relative to earnings. Relating that P/E factor to an implicit growth rate and hurdle rate may make the price to earnings ratio more intuitive.

Economic Value Added

The value of a company can be written as the sum of the equity invested and the expected *excess returns* to investors from these and future investments.

Value = Initial capital invested + PV of expected "excess returns" to equity investors

The expected "excess returns" in each period are defined as:

(rate of return on capital invested – hurdle rate) × capital invested

= after-tax operating earnings – (hurdle rate × capital invested)

The general expression of EVA is:

$$Value = SC_0 + \sum_{x=1}^{\infty} \left[OE_x - \left(h \times C_{x-1} \right) \right] \times \left(1 + h \right)^{-x}$$

[12] The expected growth rate will typically be between 0% and the selected hurdle rate. If, however, the growth rate g were less than 0%, the resulting P/E ratio would decrease (as $h - g$ increases).

where:

SC_0 = Starting capital; this is equal to the sum of free capital and required capital at time 0 (FC_0 and C_0, respectively, as defined in the DCF discussion)

OE_x, C_x, and h have the same definitions as in the DCF discussion.

This formula represents the required capital at the valuation date (time = 0) plus the present value of future economic profits. Economic profits for time period x are defined as after-tax operating earnings (OE_x) reduced by the cost of capital, which is the product of the hurdle rate and the required capital at the beginning of each period ($h \times C_x$).

To calculate EVA, we need three basic inputs:

1. The level of capital needed for each period to support the investment, both initial capital invested and additional capital to support growth.

2. The actual rate of return earned on in the invested capital for each period, i.e., ROIC.

3. The selected hurdle rate

These are the same inputs as required for the DCF model.

To determine initial capital invested, we start with the book value of a company. The book value of an insurance company, however, is an amount that reflects the accounting decisions made over time on how to depreciate assets, whether reserves are discounted, and conservatism in estimating unrecoverable reinsurance, among other factors. As such, the book value of the company may be modified in the valuation formula to adjust for some of the accounting influence on assets and liabilities.

In valuing an insurance company, the initial capital invested is represented by the statutory capital and surplus[13] at the valuation date, modified with a series of adjustments discussed later in this paper. The surplus after modifications is often referred to as adjusted net worth (ANW). The capital needed to support growth is funded by retained earnings for the DCF model and reflected through the Cost of Capital calculation for the EVA model.

To evaluate the ROIC, an estimate of after-tax income earned by the firm in each period is needed. Again, the accounting measure of operating income has to be considered. For an insurance company valuation, this component represents the projection of future statutory earnings of the insurance entity, modified in consideration of initial valuation adjustments made to statutory capital, and inclusive of all direct charges and credits to statutory surplus. These earnings will include the runoff of the existing balance sheet

[13] The reasons for using statutory accounting values instead of GAAP or other accounting values are discussed in SECTION 4 – Parameterizing the Valuation Model.

assets and liabilities along with the earnings contributions from new and renewal business written. This component may also include investment income on the capital base.[14]

The earnings will reflect a specific growth rate (which could be positive, flat or negative) that must also be reflected in growth in capital needed to support the business. The ROIC represents the after-tax operating earnings in each period (including any "below the line" changes to capital during the period) as a ratio to the starting capital for the period.

The third and final component needed to estimate the EVA is the hurdle rate. Considerations in the determination of the hurdle rate are discussed in **SECTION 4 – Parameterizing the Valuation Model.**

For the EVA model, "excess returns" are represented by the excess of (a) the operating earnings in each period over (b) the product of the starting capital for each period and the hurdle rate.[15] Recall that a company has value in excess of its capital invested only when ROIC exceeds the hurdle rate for the company. Therefore, a company has positive "excess returns" in a period only when the after-tax operating earnings for that period exceed the product of the hurdle rate and the required capital at the beginning of the period.

In the valuation formula:

$$ANW + PVFE - COC,$$

the term

$$PVFE - COC$$

represents these "excess returns."

"Excess returns" have positive value only when the future earnings exceed the "cost of capital." In this case, the "cost of capital" represents the present value of the (hurdle rate × starting capital) for each period for which earnings are projected. If investment earnings on the capital are excluded from future earnings, then the "cost of capital" calculation will be the present value of [(hurdle rate × starting capital) – investment earnings on the capital].

While the two calculations of excess returns should be mathematically equivalent, there are numerous practical advantages to including earnings on the capital in future earnings. First, the earnings projections will be more in line with historical earnings so one can review the reasonableness of the projections relative to past experience. Second, allocation of assets between capital and liabilities is unnecessary. Third, one does not

[14] If investment income on the capital base is excluded from earnings, the cost of capital calculation will be modified accordingly. This is discussed further in SECTION 3 – Valuation Results: EVA versus DCF.

[15] If operating earnings exclude investment income on capital, then the investment income on capital will be subtracted from term (b).

need to allocate taxes, tax loss carryforwards and other factors between investment earnings on capital and all other earnings.

In **APPENDIX I – Sample Company Valuation**, this paper will demonstrate that the two methodologies, DCF and EVA, produce equivalent values when specific conditions hold.[16] These conditions are:

1. The starting capital and after-tax operating income that is used to estimate free cash flows to the firm for a DCF valuation should be equal to the starting capital and after-tax operating income used to compute EVA. (For insurance company valuations, after-tax operating income should include "below the line" gains and losses in capital that do not flow through earnings.)

2. The capital invested that is used to compute excess returns in future periods should be the capital invested at the *beginning* of the period:

   $\text{Excess Return}_t = \text{after-tax operating income}_t - (\text{hurdle rate} \times \text{capital invested}_{t-1})$

3. Consistent assumptions about the value of the company after the explicit forecast period are required. That means that for both models, capital required, earnings growth rate, and the hurdle rate must be consistent in computing the terminal value.

4. The hurdle rate for the explicit forecast period must be the same as the hurdle rate after the explicit forecast period[17].

Relative or Market Multiple Valuation

While the value of a company may be derived from the DCF or EVA valuation methodologies, there are other more simplistic methods that are often used to corroborate or supplement more sophisticated models. In relative valuation, one estimates the value of a company by looking at how similar companies are priced. Relative valuation methods are typically based on market-based multiples of balance sheet or income statement values such as earnings, revenues, or book value.

Comparable Companies

The first step in the market multiple approach is to identify a peer group for the subject company. To select insurers for the peer group, it is common to rely on data for publicly traded insurers that meet certain criteria based on premium volume, mix of business, asset size, statutory or GAAP equity, and regulatory environment. These criteria are intended to assure that the peer group is reasonably comparable to the subject company. In selecting the criteria, however, it is important to balance precision and sample size.

[16] Aswath Damodaran, "Investment Valuation Tools and Techniques for Determining the Value of Any Asset," Second Edition

[17] While it is not uncommon for a higher hurdle rate to apply to earnings at a later date to account for the uncertainty, it is also common to apply one hurdle rate for all periods reflecting the expected cost of acquiring capital to perform an acquisition of such an entity, i.e. the required rate of return to investors.

While the analysis could be restricted to only those insurers that were virtually identical to the subject company, the sample size would likely be too small to yield meaningful results.

Valuation Bases

The market multiple valuation method estimates the "market price" of the subject company by reference to the multiples of its peer group. For example, if the peer group average ratio of price to earnings per share is 15.0, and the subject company's most recent annual earnings are $10 million, then the estimated market value of the subject company is $150 million. Typically, several alternative ratios will be used in performing a market multiple valuation. In most instances, the ratios employed include an operating multiple (such as the price/earnings ratio), a revenue multiple (such as price/premium or price/total revenues), and a balance sheet multiple (such as the price/book value ratio).

A relative valuation is more likely to reflect the current mood of the market because it is a measure of relative value, not intrinsic value.[18] While these methods serve a valuable purpose in the formulation of an opinion on the price the market may be willing to pay, they provide little guidance on the returns that will be achievable and the extent to which capital outlaid now can be repaid.

[18] Aswath Damodaran, "Investment Valuation Tools and Techniques for Determining the Value of Any Asset," Second Edition

SECTION 3 –Valuation Results: EVA versus DCF

Introduction

The following examples illustrate the DCF and EVA valuation methodologies and derive relevant conclusions related to use of the two methods. This section focuses on the mechanics and properties of the DCF and EVA valuation calculations. **APPENDIX I – Sample Company Valuation** will provide a property/casualty insurance company example.

We will demonstrate two equivalent forms of the EVA model. The first form, "**EVA(a)**" will follow the basic EVA formula structure in which:

excess returns = after-tax operating income – (hurdle rate × capital invested)

The second form, "**EVA(b),**" will use the following definition:

excess returns = after-tax earnings on insurance operations excluding investment income on capital
- ((hurdle rate – average investment rate for capital) × capital invested)

Excess returns for EVA(a) and EVA(b) are equivalent in theory. However, while EVA(b) is discussed in actuarial literature on company valuation,[19] there are a number of advantages to using the EVA(a) model in practice. The advantages, previously disclosed, are:

(1) The earnings projections will be more in line with historical earnings so one can review the reasonableness of the projections relative to past experience.
(2) It is not necessary to allocate assets between capital and liabilities.
(3) It is not necessary to allocate taxes, tax carryforwards and other factors between investment earnings on capital and all other earnings.

Basic Model Assumptions

We will use the following assumptions to demonstrate the basic calculations for the DCF and EVA models applied to a property/casualty insurer.

- The capital at time 0, just prior to projected year 1, is $100. For a property/casualty insurance company, this amount is the surplus.
- We tested expected growth rate values of g = 0% and g = 3%.
- Investment income return on capital is 4% per annum.
- The hurdle rate is 15% per annum.

[19] Robert W. Sturgis, "Actuarial Valuation of Property/Casualty Insurance Companies"

- Capital is determined based on a premium to capital ratio of 2:1.

- We separately identify total earnings as investment income on the capital and earnings from insurance operations.[20]

- The investment income on the capital component equals the product of the investment income percentage and the capital at the beginning of the year.

- We show the insurance operation earnings component as a percentage of premiums earned for the year. Premium-related earnings encompass underwriting profits and investment earnings associated with all non-capital assets.

For projection scenarios in which the hurdle rate is exactly achieved, earnings are 5.5% of earned premium[21]. For projection scenarios in which the hurdle rate is not achieved, earnings are 5% of premium. When earnings exceed the hurdle rate requirement, this percentage is 6%.

We compiled projection scenarios using two time horizons. First, we estimated the company's value using a 10-year forecast period. We also estimated the continuing value using the present value of earnings beyond 10 years using the same model assumptions.

This time horizon is important in valuing an actual company. The 10-year forecast period value will be based on detailed financial projections by line of business as shown in **APPENDIX I – Sample Company Valuation**. The terminal value will be based on the simplified assumptions with respect to (i) expected growth in earnings by future period and (ii) expected changes in capital required by future period.

Total Earnings Equal Hurdle Rate and the Company is Not Growing

Table 1 displays the company value results for the three models in which the annual total earnings relative to capital equals the hurdle rate and neither the company's capital nor business is growing. Exhibits 1A, 1B, and 1C show the calculations leading to these results.

[20] A number of judgments regarding asset allocation and tax allocation must be made to do this in practice.
[21] 5.5% = 15% hurdle rate less 4% investment income on capital, yielding 11%, which is divided by premium-to-surplus ratio of 2.

Table 1
Valuation Results
Total Earnings Equal Hurdle Rate
No Growth

Model	10 Year Forecast Period[22]	Terminal Value	In Perpetuity (Total)
DCF	75.28	24.72	100.00
EVA(a)	100.00	0.00	100.00
EVA(b)	100.00	0.00	100.00

The *In Perpetuity* results are 100.00, equal to the starting capital of the company. For the DCF model, the value calculation simplifies to $\frac{OE_1 - 0}{h - 0} = (100 \times 15\%) \div 15\% =$ 100. For the EVA(a) model, Exhibit 1A shows that for each forecasted year the total earnings are exactly offset by the cost of capital. This result, of course, follows because both earnings and cost of capital are 15% of each year's starting capital of 100. The same progression is demonstrated by the EVA(b) model except earnings are only 100 × 11% (earnings on insurance operations only) offset by cost of capital of 100 × (15% – 4%).

As noted in the *Basic Principles of Valuation* section, a company has value in excess of its capital invested or hurdle rate only when future returns are in excess of the hurdle rate requirement. In the DCF model, the present value of the perpetual cash flow is equal to the starting capital because annual earnings of 15% of capital, discounted at 15% annually, yields the starting capital. In the EVA models, excess returns are always 0 and, therefore, the only contribution to value is the capital.

Looking at the modeled time periods (10-year forecast period and terminal value) reveals a fundamental difference in the DCF and EVA models. The DCF model must be computed *in perpetuity* (forecast period plus terminal value) to capture the capital value in the company. The EVA models, however, recognize the value of the capital "immediately" as it incorporates the capital amount directly in the value computation. *Therefore, the EVA model will produce higher estimates of value than DCF when earnings are not valued in perpetuity*.

Total Earnings Equal Hurdle Rate and the Company is Growing

Table 2 displays the company value results for the three models in which the annual total earnings relative to capital equals the hurdle rate and the company's capital and earnings are growing by 3% per annum. Exhibits 2A, 2B and 2C show the calculations leading to these results.

[22] Excess earnings are 0, so value for the EVA methods is equal to the starting capital.

Table 2
Valuation Results
Total Earnings Equal Hurdle Rate
Earnings (and Capital) Growing @ 3% per annum

Model	10 Year Forecast Period	Terminal Value	In Perpetuity (Total)
DCF	66.78	33.22	100.00
EVA(a)	100.00	0.00	100.00
EVA(b)	100.00	0.00	100.00

The results in Table 2 are nearly identical to the value results shown in Table 1 in which no business growth was modeled. Basically, the EVA models behave exactly the same – the earnings each year are exactly offset by the cost of capital. Incorporating growth into the model only changes the earnings and cost of capital amounts for each year, not the difference between the two values. However, this basic demonstration still emphasizes the relationship of earnings to hurdle rate as the determinant of value, positive or negative, in conjunction with starting capital.

The components of the DCF model result do change from a no-growth to growth assumption. The value amount for the 10-year forecast decreases and is exactly offset by an increase in the terminal value. The "total" *in perpetuity* amount, however, is not affected by growth because annual earnings are still equivalent to the hurdle rate. Growth, however, shifts more of the company's value to later projected years at the expense of earlier projected years. This "value shift" occurs because the DCF model accounts for capital growth via a reinvestment of a portion of annual earnings, thereby reducing free cash flows.

Funding Capital Growth: Comparing the DCF and EVA Models

The DCF and EVA models have different treatments of the costs associated with growing the capital base of the company. We think of the DCF model as a reinvestment for growth process and the EVA model as a capital borrowing process.

Exhibit 2A, Column (8) shows the annual capital reinvestment amount necessary for the DCF model to account for the 3% growth in capital. The capital reinvestment amount is taken from current year earnings to fund the following year starting capital – Column (2) equals Column (8) shifted one year. The DCF model fully funds capital growth, thereby reducing "free cash flows" for valuation.

In the EVA models, the cost for growing the capital is a part of the cost of capital calculation. For the EVA(a) model, Exhibit 2B, Columns (10a) and (10b) show the components of the cost of capital related to the initial and additional capital for growth, respectively. The growth-related earnings reduction equals the product of the hurdle rate and the cumulative additional capital amount beyond the initial capital. This increment can be thought of as the interest payment on "borrowed" capital used to fund business growth.

Although the negative cash flows necessary to support capital growth are different for the DCF and EVA models, the present values of the cash flows are identical when considered *in perpetuity*. The DCF model reinvestment to grow the capital is a larger offset to earnings in early forecasted years than the EVA model required return on additional capital amounts. By the 9th forecasted year, though, the EVA model capital growth cost (Exhibit 2B, Column 10b) overtakes the DCF model reinvestment amount (Exhibit 2A, Column 8).

Total Earnings Not Equal to Hurdle Rate and the Company is Not Growing

Table 3 displays the company value results for the three models in the scenario in which the annual total earnings relative to capital *does not* equal the hurdle rate and the company is not growing. Exhibits 3A, 3B, 3C, 4A, 4B and 4C show the calculations leading to these results.

Table 3
Valuation Results
Total Earnings Not Equal to Hurdle Rate
No Growth

Model	10-Year Forecast Period	Terminal Value	In Perpetuity (Total)
Earnings Less Than Hurdle Rate			
DCF	70.26	23.07	93.33
EVA(a)	94.98	(1.65)	93.33
EVA(b)	94.98	(1.65)	93.33
Earnings Greater Than Hurdle Rate			
DCF	80.30	26.37	106.67
EVA(a)	105.02	1.65	106.67
EVA(b)	105.02	1.65	106.67

Table 3 reaffirms the *in perpetuity* equivalency of the DCF and EVA models. Like the previous examples, the 10-year and terminal values are different between the DCF and EVA valuations but the *in perpetuity* valuations are equal. The equivalency of the DCF and EVA models in perpetuity will be shown on an algebraic basis in the Appendix.

When the earnings are not equal to the hurdle rate there is a marginal value (positive or negative) in addition to the initial capital. As expected, when hurdle rate requirement exceeds earnings, the value of the company drops below the value of the starting capital ($100 in this example). Likewise, when earnings exceed the hurdle rate, there is additional value beyond the initial capital. In Exhibits 3A, 3B, and 3C, the total annual earnings is 16% and the cost of capital is dictated by the hurdle rate, 15%, leaving an excess return on capital of 1% for each year in the future. The present value of the 1% marginal profit in return on capital of 100 is 6.67 *in perpetuity*. Referring to Exhibits 4A, 4B, and 4C, a 1% marginal loss in return on capital of 100 leads to a value decrease of 6.67.

Total Earnings Not Equal to Hurdle Rate and the Company is Growing

Table 4 displays the company value results for the three models in the scenarios in which the annual total earnings relative to capital *does not* equal the hurdle rate and the company's capital and earnings are growing by 3% per annum. Exhibits 5A, 5B, 5C, 6A, 6B, and 6C show the calculations leading to these results.

Table 4
Valuation Results
Total Earnings Not Equal to Hurdle Rate
Earnings and Capital Growing @ 3% per annum

Model	10 Year Forecast Period	Terminal Value	In Perpetuity (Total)
Earnings Less Than Hurdle Rate			
DCF	61.22	30.45	91.67
EVA(a)	94.43	(2.76)	91.67
EVA(b)	94.43	(2.76)	91.67
Earnings Greater Than Hurdle Rate			
DCF	72.35	35.99	108.33
EVA(a)	105.57	2.76	108.33
EVA(b)	105.57	2.76	108.33

The impact of growth on the company's value is to increase the portion of value contributed in the future. If the company's earnings are not achieving the hurdle rate, growing the business further lowers value. When earnings exceed the hurdle rate, growth produces increased value.

The DCF model results show that capital growth, necessary to support business and earnings growth, reduces free cash flow in the short term in return for an increase in future earnings. Looking at the *Earnings Greater Than Hurdle Rate* scenario, the 10-year forecast period value with no growth is 80.30, dropping to 72.35 with 3% annual growth. However, the comparable terminal value amounts increase from 26.37 to 35.99 yielding an *in perpetuity* gain in total value of 1.66 with growth (108.33 with 3% growth versus 106.67 with 0% growth). In the early projection years, the reinvestment earnings to grow the capital (thereby reducing free cash flows) exceed the marginal increase in earnings on the additional capital. This reverses itself in later projection years, resulting in higher terminal values.

Comparison of DCF and EVA Models

The parameterization of the DCF and EVA models presented in the paper cause the models to produce equal value if considered in perpetuity. The parameters selected to populate the models should be equivalent as they are independent of which model is used. For example, the appropriate hurdle rate does not depend on the model selected. The Appendix discusses the formula assumptions necessary to ensure the equivalency

property. The equivalency of these valuation methodologies is expected because each model is measuring the same value contributors, just using different formula structures.

In the DCF model, the starting capital is used only to determine free cash flow at time 0. The principle of a DCF valuation is that an investment, a company for our discussion, is worth the value of its future earnings. If the capital leads to future earnings (by investment and supporting profitable business), then value will emerge. If future earnings are less than the hurdle rate, then the capital invested in this entity is less than its face value[23].

The EVA model (both forms, EVA(a) and EVA(b)) includes the full starting capital for its determination of value, but at a cost represented by the Cost of Capital calculation. Column 10a in the EVA model calculations (Exhibits 1B, 2B, 3B, 4B, 5B, and 6B) shows the cost of the initial capital. The present value of this negative cash flow in perpetuity exactly offsets the value contributed by immediate recognition of the capital in the EVA formula. If the capital does not provide earnings equal to or greater than the hurdle rate in the form of excess profits, then the capital does not substantiate its value and is worth less than 100 cents on the dollar.

That the EVA model counts the initial capital amount as value and the DCF model does not leads to significant differences in value contributors between the forecast period value and the terminal value. Tables 1, 2, 3, and 4 all show that the 10-year forecast period results for the EVA model are close (and sometimes equal) to the *in perpetuity* time frame results. In the EVA model, therefore, excluding earnings beyond a certain time period does not have a material effect on value. In contrast, a significant portion of the value indicated by the DCF model is captured as terminal value. In these examples, in which the total earnings of the company are set close or equal to the hurdle rate, the EVA model approaches *in perpetuity* value faster.

Table 5 shows model value results in which earnings related to operations are 0.0%.

Table 5
Valuation Results
Earnings on Operations =0.0%
Total Earnings = 4.0% (Investment Only)
No Growth

Model	10 Year Forecast Period	Terminal Value	In Perpetuity (Total)
DCF	20.08	6.59	26.67
EVA(a)	44.79	(18.13)	26.67
EVA(b)	44.79	(18.13)	26.67

[23] The value of capital is worth 100 cents on the dollar if you can release the capital at time zero. Otherwise, the capital is worth the present value of the distributable earnings generated by the capital. If distributable earnings represent a return lower than the hurdle rate, then capital is worth less than 100 cents on the dollar.

For a scenario in which the company's earnings potential is low, the DCF model produces value closer to the *in perpetuity* value in the 10-year period than the EVA model. The DCF model is not "fooled" by the value of the stated initial capital in the short term. The DCF model considers only the earnings potential of the capital, not the capital itself. The result is further exaggerated when growth is incorporated as shown in Table 6.

Table 6
Valuation Results
Earnings on Operations = 0.0%
Total Earnings = 4.0% (Investment Only)
Earnings and Capital Growing @ 3% per annum

Model	10 Year Forecast Period	Terminal Value	In Perpetuity (Total)
DCF	5.57	2.77	8.33
EVA(a)	38.78	(30.45)	8.33
EVA(b)	38.78	(30.45)	8.33

Comparison of EVA(a) and EVA(b)

We present two versions of the EVA model: EVA(a) and EVA(b). The EVA(a) version defines excess earnings as the difference in after-tax operating income and the cost of invested capital. After-tax operating income is recognized for the company as a whole; the amount is not segregated into investment versus operational earnings. Likewise, the cost of capital relies on the product of the "full" hurdle rate and the amount of capital.

The EVA(b) model formula defines earnings and cost of capital differently. The EVA(b) model formula does not include investment earnings related to the capital as earnings. In the context of a property/casualty insurer, earnings are only underwriting earnings from premium written and investment income on assets supporting the liabilities ensuing from writing insurance policies. Under EVA(b), earnings are lower, but so is the cost of capital. The cost of capital is the hurdle rate less the investment income rate the company will earn on its capital, in a sense, the shortfall in investment earnings relative to the hurdle rate.

From the basic valuation examples presented in this section, the two forms of the EVA produce identical results. EVA(a) follows from financial valuation fundamentals.[24] EVA(b) is often regarded as the "actuarial valuation method." Sturgis[25] describes the economic value of a property/casualty insurance company as composed of three parts: (i) current net worth, plus (ii) the discounted value of future earnings, less (iii) cost of capital, where future earnings and cost of capital are defined per our EVA(b) model.

[24] McKinsey & Company, Inc., "Valuation Measuring and Managing the Value of Companies," Third Edition

[25] Robert S. Miccolis, "An Investigation of Methods, Assumptions, and Risk Modeling for the Valuation of Property/Casualty Insurance Companies"

Miccolis describes a computation similar to Sturgis to determine an insurer's economic value: (i) adjusted surplus, plus (ii) discounted value of future earnings, less (iii) cost of capital. Miccolis, however, is unclear regarding the computation for the cost of capital.

We consider the EVA(a) model to be the preferred structure for applying the economic value added model. EVA(a) is more straightforward to apply and avoids potential complications. It relies on financial estimates of earnings that are comparable to actual financial projections for a property/casualty insurer. To use the EVA(b) model, one must attempt to isolate the source of earnings between amounts earned from premium written and investment income on the capital. This approach further necessitates an allocation of invested assets between those supporting the liabilities and assets underlying the capital and surplus. In addition, splitting earnings into its "component" parts raises potential tax application questions that complicate the valuation process.

SECTION 4 – Parameterizing the Valuation Model

Accounting

Insurance companies in the United States use multiple forms of accounting. Statutory accounting principles (SAP) are used for reporting to state regulatory authorities and generally accepted accounting principles (GAAP) are used for reporting to the Securities and Exchange Commission and the public. Tax accounting underlies the computation of taxable income. SAP focuses on the current solvency of an insurance company and its ability to meet its obligations. Due to this focus on protection of policyholders, assets and liabilities are generally valued conservatively on the statutory balance sheet, although the result is dependent on specific company or financial conditions.

Historically, noteworthy differences between GAAP and SAP for property/casualty insurance companies related to:

1. Deferred acquisition costs ("DAC")
2. Deferred tax assets ("DTA") and liabilities ("DTL")
3. Premium deficiency reserve ("PDR")
4. Valuation of bonds

- Deferred acquisition costs

  The asset associated with DAC recognizes that the unearned premium reserve ("UEPR") may be overstated because it funds expenses (e.g., agents' commissions) that are typically paid at the beginning of the policy and have already been incurred on the income statement. As the unearned premium reserve is earned, this overstatement disappears.[26] Statutory accounting does not permit recognition of the value of this asset until it materializes in future statutory earnings. In isolation, this difference in the treatment of the DAC asset would cause GAAP equity always to be greater than or equal to SAP equity.

- Deferred tax assets and liabilities

  Deferred tax assets and liabilities are created primarily from taxes resulting from discounted loss reserves and unrealized gains and losses. For a growing company, the tax calculation results in an "overpayment" of taxes initially related to discounted incurred losses, offset by a lower payment in subsequent years when claims are paid. This difference is solely a timing issue, as the total amount of taxes that will be paid for profits associated with a block of business or block of assets does not change. The prepayment of taxes (or tax credit for unrealized losses) is corrected as the business runs off or the assets are sold.

[26] For a going concern, we acknowledge that it is replaced by equity in the unearned premium reserves for the following year's business.

With the introduction of DTA and DTL for statutory accounting, these assets and liabilities are now recognized on the balance sheet before the business runs off or the assets are sold. For many companies, this change increases their statutory capital.

- Premium deficiency reserves

  The PDR is required when the unearned premium reserve is expected to be insufficient to fund the future loss and expense payments originating from those policies. This reserve will reduce statutory capital.

- Valuation of bonds

  In general, SAP requires bonds to be held at amortized cost (although bonds that are not "in good standing" are carried at market value). GAAP, on the other hand, uses amortized cost for only "held-to-maturity" bonds, which the company has both the intent and ability to hold to maturity. For those bonds in the company's active trading portfolio, GAAP requires market value treatment on the balance sheet.

With the codification of statutory accounting principles, which became effective January 1, 2001, deferred tax assets, deferred tax liabilities and premium deficiency reserves were recognized on the statutory balance sheet. The most significant difference that remains relates to deferred acquisition costs.

As stated in Actuarial Standard of Practice (ASOP) No. 19, for insurance companies, statutory (or regulatory) earnings form the basis for determining distributable earnings, since the availability of dividends to equity owners is constrained by the amount of accumulated earnings and minimum capital and surplus requirements. Both of these amounts must be determined on a statutory accounting basis. Distributable earnings consist of statutory earnings, adjusted as appropriate in recognition of minimum capital and surplus levels necessary to support existing business. Therefore, statutory accounting determines the earnings available to the equity owners.

While future earnings calculated according to GAAP or another basis will often be of interest to the user of an actuarial appraisal, the free cash flow calculations contemplated within the definition of actuarial appraisal in ASOP No. 19 should be developed in consideration of statutory earnings, rather than some other basis.

GAAP earnings and GAAP net worth, however, are often the basis of the relative valuation methods involving market multiples.

As the major difference between GAAP and SAP accounting is DAC, which may be recognized as an asset on the GAAP balance sheet immediately instead of through future earnings, GAAP net worth is typically higher than SAP net worth. SAP net worth may be greater, however, when the amortized value of bonds in the SAP asset portfolio is higher than the market value of bonds in the GAAP asset portfolio.

Estimating Free Cash Flows or Value Added

Estimating free cash flows for a DCF valuation or changes in value of the company in each period for an EVA valuation requires the use of after-tax operating earnings from accounting statements. However, accounting earnings may not represent true earnings because of limitations in accounting rules and the firms' own actions.

For a property/casualty insurance company, changes in the equity of the firm derive from not only (a) after-tax operating earnings (net income in the statutory income statement) and (b) capital infusions or distributions, but also from (c) "below the line" adjustments to capital. These adjustments represent items that do not flow through the statutory income statement for changes in unrealized capital gains/losses, changes in non-admitted assets, changes in provisions for reinsurance, change in foreign exchange adjustment and changes in deferred income taxes. To the extent that these adjustments increase (decrease) the equity of the firm, they also increase (decrease) free cash flows for the DCF valuation methodology and increase (decrease) excess returns for the EVA valuation methodology.

For a property/casualty insurer, estimating after-tax operating earnings (including "below the line" statutory adjustments to capital) typically requires rigorous analysis. For the purpose of analysis, the sources of future earnings can be sub-divided into two broad categories: the runoff of the existing balance sheet and future written business.

Runoff of the Existing Balance Sheet

The runoff of the existing balance sheet produces earnings associated with (i) underwriting profit imbedded in the UEPR[27], (ii) investment income on the assets supporting (a) the loss reserves (inclusive of all loss, allocated loss adjustment expense and unallocated loss adjustment expense reserves) and (b) UEPR liabilities until all the associated claims are paid, and (iii) investment income on the capital base supporting the runoff of the business.[28]

The earnings associated with new (or renewal) business derives from (i) the underwriting profit generated by the business, (ii) the investment income on the assets generated by the premium, supporting loss reserves and UEPRs until all of the claims are paid, and (iii) investment income on the capital base supporting the writing of the new business.

Developing financial projections (income statements, balance sheets, and cash flows) related to running off the existing balance sheet liabilities, assuming no new or renewal business is written, will provide the basic elements for valuing the company in runoff. The key factors involved are (i) the payout of the loss reserves, (ii) the ultimate losses and expenses associated with the unearned premium reserve, (iii) the payout of the losses

[27] Profit imbedded in the UEPR represents underwriting profit and profit associated with the prepaid expenses (corresponding to the deferred acquisition cost asset established for GAAP accounting).

[28] For an EVA valuation, if one projects earnings with a capital base of zero (an EVA(b) scenario), this component will be zero.

and expenses associated with the unearned premium reserve, (iv) the capital needed each year to support the company in runoff and (v) the investment yield earned on assets until all claims are paid and all capital is released. In practice, when running off a company that writes personal lines business, renewals may be mandated for several years by the regulatory authorities. In those instances, running off the company might also reflect the writing of some renewal business.

When it is important to understand the value associated with the runoff of the business separate from value associated with the writing of new (or renewal) business, we recommend the following approach. Value the company in runoff reflecting the level of capital required to run off the company. Then, value the company reflecting earnings and capital needs associated with maintaining the company as a going concern. That is, earnings projections and capital needs are developed for the combination of running off the existing balance sheet and writing new business. The value of solely writing new business should be computed as the difference between the two valuations.

The suggested approach is beneficial on both a practical and theoretical basis. On a theoretical basis, the valuation of the runoff company relative to the going concern improves the determination of capital required for new business. On a practical basis, both valuations will use the same starting balance sheet.

Future Written Business

For property/casualty insurance companies, in contrast with life insurance companies, the distinction between new and renewal business is often not meaningful for developing financial projections for future written business. For direct writers of personal lines business, however, for whom the initial cost of acquiring new business and the associated expected loss ratio differs substantially from the expenses and loss ratios associated with renewal business, the distinction between new and renewal business may be very important for developing financial projections.

Financial projections are usually developed by line of business or business segment that corresponds to the detail in which the company being valued provides its premium forecasts. The key elements to be estimated by year are:

By line of business:

- Gross written premium
- Net written premium
- Accident year gross and ceded loss and loss expense ratios
- Gross commissions and ceding commissions
- Other overhead expenses (premium taxes, general and administrative expenses, other acquisition costs)
- Collection schedules for premium
- Payment schedules for commissions and other overhead expenses
- Payment pattern for gross and ceded accident year loss and loss adjustment expense

- Collection pattern for ceded reinsurance recoveries

For the book of business in total:

- Investment yield on investible assets
- Capital needed to support the entire book of business
- Federal income taxes applicable to earnings

The primary contributors to investment earnings are the timing differences between the collection of premium and the payment of claims and loss adjustment expense. For most lines of business, there is little delay in premium payment by the policyholder. When premiums are paid in installments, however, or when audit premiums represent a significant portion of the ultimate collected premium, it is important to evaluate the lag because of the resulting impact on the investment income calculation. Reinsurance recoveries may need to be projected on a contract-by-contract basis if the indemnification terms vary significantly.

In determining the future earnings from new and renewal business, projected loss and expense ratios are the most important components to be modeled. As Miccolis[29] and Ryan & Larner[30] note in their papers on valuation, issues to be considered in the projection of future loss and expense ratios include:

- Changes in price levels
- Trends in loss severity, claim frequency, and exposure base
- Historical industry results
- Underwriting cycles
- Target rates of return
- Expected future growth rates
- Degree of competition in market
- Regulatory environment
- Exposure to catastrophes
- Changes in ceded reinsurance (coverage, terms, pricing)

Present Value of Future Earnings

Once the future earning stream (including gains and losses in capital that do not flow through earnings) from running off the existing balance sheet and future written business has been estimated, it is discounted to present value at the selected hurdle rate. For an EVA valuation, the future earnings stream is used directly without consideration of capital infusions or distributions. For a DCF valuation, the future earnings stream (a) less

[29]Robert S. Miccolis, "An Investigation of Methods, Assumptions, and Risk Modeling for the Valuation of Property/Casualty Insurance Companies"
[30]J.P. Ryan and K.P.W. Larner, "The Valuation of General Insurance Companies"

earnings retained for capital growth or (b) plus additional capital released represents free cash flows.

Adjusted Net Worth ("ANW")

In valuing a company, it is common practice to adjust the equity of the firm at time zero to consider value (positive or negative) associated with reserve deficiencies or redundancies, market value of assets, non-admitted assets, and statutory provisions for reinsurance, among other factors.

The adjustments to statutory equity in the computation of ANW for an EVA valuation (and free cash flow at time 0, "FC_0," for a DCF valuation) represent an effort to adjust the starting statutory balance sheet to its true market value. These adjustments described by Miccolis and Ryan & Larner and summarized below represent an attempt to recognize the market value of some items on the statutory balance sheet. For example, common adjustments include reflecting assets at market value and eliminating goodwill. In contrast, there are usually no comparable adjustments for liabilities. For loss reserves and unearned premium reserves, market value would reflect future investment income plus a provision for risk. Instead of market value adjustments, any value associated with the liabilities (other than adjusting reserves to their actuarially indicated amount) is recognized through the present value of future earnings.

Since statutory accounting determines free cash flows to investors, one could support the position that adjustments to the equity of the firm at time zero should be limited to tax-affected reserve adjustments (to bring carried reserves to the actuarial indicated level) and other changes that "true up" the statutory balance sheet. Adjustments to statutory capital to compute ANW that are not permitted under statutory accounting will not change statutory capital and, therefore, will not affect free cash flows. Many financial experts, however, insist that assets be adjusted to their market value at the date of valuation. Further, goodwill carried on the balance sheet is almost always eliminated for valuation, even though it is now a statutory asset. Experts continue to disagree on how these adjustments should be handled for valuation.

Either way, if the net worth or the equity of the firm is adjusted to recognize non-admitted assets, or reflect the market value of all assets, then the firm's future earnings or changes in capital must be adjusted to prevent double counting this value. For example, if all assets are marked to market for the valuation, then future earnings of the firm must not reflect any realized gains or losses associated with assets unless the market values change. Further, if non-admitted assets are added back to the starting net worth of the firm, then any capital increases associated with the recognition of non-admitted assets must be eliminated from future financial projections.

Any adjustments to the starting capital to determine ANW will cause the EVA and DCF valuation results to diverge unless the same adjustments are made for both valuation methodologies. Otherwise, for DCF, these values will be recognized on a discounted basis through future earnings or "below the line" adjustments to equity. For EVA, they

will be recognized at time zero, thereby reflecting no present value discount in the computation of value.

The common adjustments to the starting capital ("SC_0") for valuation are listed below. Only items 1 and 6 are consistent with statutory accounting principles and, therefore, will have the same effect on EVA and DCF valuations. The other adjustments to ANW, unless also assumed to impact SC_0 for DCF, thereby affecting FC_0, will cause the EVA and DCF valuation results to diverge. The direction (positive or negative) of the difference between the EVA and DCF valuation result will be dependent on the direction (positive or negative) of the tax-affected adjustments for items 2, 3, 4 and 5.

1. Loss reserve adequacy

   For a property/casualty insurance company, policyholder claim obligations are usually the largest liability on the statutory balance sheet. As a result, it is critical to assess the reasonableness of the carried loss and loss adjustment expense (LAE) reserves as of the valuation date to meet unpaid claim obligations.

   Adjustments for the loss reserve position should be made directly against statutory equity as of the valuation date for both DCF and EVA valuations. Adjustments to the carried loss reserves will impact ANW for an EVA valuation and FC_0 for a DCF valuation.

2. Market value of assets

   Traditionally, the majority of property/casualty insurance companies' investment portfolios have been placed in bonds, especially U.S. Treasury or other federal agency instruments. SAP requires bonds "in good standing" to be valued at amortized cost. For the purpose of a valuation, however, bonds should be valued at market value in order to reflect what an independent buyer would actually pay to purchase the securities.

   Common and preferred stocks, which represent the next largest portion of most property/casualty insurance companies' portfolios, are recorded at values provided by the NAIC's Securities Valuation Office. These values are typically equal to market value and thus are less likely to require an additional adjustment. Other investable assets should also be adjusted to market value, but are a much smaller component of the total portfolio and thus the adjustments are likely to have a smaller impact on the adjusted net worth.

3. Inclusion of non-admitted assets

   Some states do not admit certain assets on the statutory balance sheet because they either do not conform to the laws and regulations of the state or are not readily convertible to liquid assets. Exclusion from the balance sheet results in a charge to statutory equity. For the purpose of a valuation, however, one should include any

portion of non-admitted assets that has financial value and may be convertible to cash.

Examples of non-admitted assets include:

- Agents' balances overdue by 90 days or longer
- Bills receivable that have not been taken for premium
- Furniture, equipment (other than electronic data processing [EDP] equipment and software), and supplies
- Leasehold improvements

In some cases, there may be overlap with the adjustment of assets to market value. For example, when the market value of real estate is below its net book value, the excess of book over market value is recorded as a non-admitted asset while the admitted asset, which underlies the amount of statutory surplus, is equal to the market value. Care should be taken to ensure that there is no double-counting.

4. Accounting goodwill

   SAP for purchases define *goodwill* as the difference between the cost of acquiring a subsidiary, controlled, or affiliated entity and the purchaser's share of the book value of the acquired entity. Positive goodwill exists when the cost of the acquired entity is greater than the purchaser's share of the book value. According to codified SAP, however, positive goodwill from all sources is limited in the aggregate to 10% of the parent's capital and surplus (adjusted to exclude any net positive goodwill, EDP equipment and software).

   Assets for goodwill are generally assumed to have zero value until such value emerges through future earnings.

5. Provision for reinsurance

   SAP produce a "provision for reinsurance" that is calculated in Schedule F of the NAIC Annual Statement and is carried forward to the statutory balance sheet as a liability. This provision is intended to be a measure of conservatism to reflect unsecured reinsurance placed with unauthorized companies and collectibility issues with all reinsurers.

   In a valuation, a more detailed review of collectibility issues is worthwhile in order to estimate any additions (or further reductions) to equity to reflect a more rigorous estimate of reinsurance recoverables.

6. Tax issues regarding all of the above

   Any adjustments to the statutory balance sheet may also have a corresponding impact on the company's federal income tax liability. The federal tax liability, or deferrable

tax asset, is based on statutory net income and a series of adjustments. Any adjustments made to statutory equity for valuation should be tax-affected.

In mergers or acquisitions, taxes are particularly difficult to address because one must consider the tax position of both parties.

Hurdle Rate

The hurdle rate used in a valuation should reflect the cost to the firm of acquiring the capital necessary to make the acquisition or perform the transaction in question. Typically, this value will be provided by management based on its appraisal of the acquisition's relative risk and required return. When not provided by management, the hurdle rate can be estimated using a variety of security valuation methods.[31] In either case, when establishing the hurdle rate, it is important for the analyst to consider several issues including the following:

1. Risks attributable to business activities of the acquisition

   The risk attributable to the business activities of the acquisition determines the cost of the capital required to make the acquisition. This risk measure should not be confused with the risk associated with the acquiring entity, which may be different. The risk of a firm, in total, reflects an interaction of the risks of its underlying business activities. The cost of capital of any particular activity may differ from that of the firm as a whole.

2. Consideration of multiple hurdle rates

   If the target acquisition is engaged in several activities (e.g., different lines of business) of varying risk, it may be appropriate to consider projecting several streams of free cash flow and discounting them at different rates. An alternative to this approach may be to allocate capital to business activity in such a way as to equalize risk across lines. If this approach is used, then a single discount rate for all cash flows may be appropriate.

   One reason to consider the latter approach is that one can generally observe the hurdle rate only for the firm as a whole, and not for its component parts. Thus, the hurdle rates reflect the average risk of the firm's activities and are not necessarily appropriate for any single business. If there were large samples of publicly traded firms specializing in particular lines of business, then it would be possible in theory to observe the hurdle rate for those specific activities. In practice, however, there are a limited number of publicly traded insurers and they tend to be multi-line firms involved in a wide variety of businesses (many of which have substantially different risk profiles). These considerations support using a single hurdle rate reflecting

[31] The most prominent models in widespread use are the capital asset pricing model (CAPM) and the dividend valuation model (sometimes known as the DCF or Gordon growth model). Both models are described in numerous sources, including Investment Valuation by Damodaran.

average risk activities, and then adjusting the amount of required capital so that the risk of the acquisition is equivalent to the average risk of the firm.

3. Method of financing the acquisition

   If the acquisition is to be financed with a mix of debt and preferred and common equity, then the appropriate hurdle rate should reflect the weighted average after-tax costs to the firm of acquiring capital through these vehicles. The capital structure underlying the acquisition, and not necessarily the existing capital structure of the acquiring entity, is the relevant issue. For example, if a firm is currently financed with a mix of debt and equity, but intends to pursue an acquisition financed solely by equity, then the relevant hurdle rate is the equity cost of capital.

4. Consistency with other assumptions

   The discount rate depends on relative risk, which in turn depends on several factors that may be related to other aspects of the valuation. For example, in addition to the intrinsic risk of its specific business activities, the cost of capital for a firm will depend, among other things, on the firm's leverage and mix of assets. Both of these factors, however, will have an impact on the projected free cash flow that forms the foundation of the valuation. There must be consistency between the assumptions used to develop the cash flows and those used to develop the discount rate[32].

Capital Needs

The capital required to support an insurance company is a key assumption in the valuation process.

For the DCF methodology, capital requirements dictate the amount of capital to be retained in the company to support ongoing operations, thereby determining distributable earnings and associated value. For the EVA methodology, capital requirements dictate the capital that underlies the cost of capital calculation. The higher the capital requirement, the higher the cost of capital element of the valuation formula.

Property/casualty insurance companies are subject to statutory capital requirements. Statutory capital requirements are determinable through the property/casualty insurance industry's risk-based capital (RBC) requirements. The results can be viewed as minimum capital requirements. Often, larger capital investments are required to satisfy the financial rating agencies such as A.M. Best, Standard & Poor's, and Moody's in order to maintain desirable financial ratings. All of these factors are considerations in determining capital requirements for valuation.

Premium-to-surplus ratios, loss reserves-to-surplus ratios, and multiples of RBC have been used in valuation to determine capital needs. These are typically based on

[32] The discount rate is often viewed as the sum of a risk-free rate and a market risk premium (CAPM). The value of the market risk premium is a topic of debate among financial economists.

comparable ratios for "peer companies," which are companies with premium volume and lines of business comparable to the subject company. In these instances, it is essential that the selected capital match or exceed RBC requirements.

In actuarial and finance literature, there are many articles and papers related to capital requirements and capital allocation for insurers. Theories about capital requirements range from simplistic rules of thumb (e.g., maintenance of a premium-to-surplus ratio of 2.0) to intricate risk models.

In practice, it is common for insurance companies to maintain a level of capital that is sufficient for a desired financial rating.

Cost of Capital

We defined the cost of capital ("COC") as the present value of each period's starting capital multiplied by the hurdle rate. The COC is used to measure excess returns in each period for the EVA valuation methodology. Excess returns are computed as the difference between operating earnings in each period (inclusive of gains and losses in capital that do not flow through earnings) and the COC. This concept is more thoroughly discussed in **SECTION 2 – Valuation Methodologies** and **SECTION 3 – Valuation Results: EVA versus DCF**.

Economists and other financial professionals equate the term cost of capital with the hurdle rate. Care should be taken in using and understanding the meaning of the term in a particular context.

SECTION 5 – Recent Changes and Other Considerations

There are a variety of changes that have occurred over the past 15 years that may affect the valuation of a property/casualty insurer. While many of these changes may not affect valuation methodology, they are relatively new developments that require consideration in the determination of value.

Accounting[33]

- Codification of Statutory Accounting Principles

The starting point for valuation based on EVA and DCF methodologies is the statutory balance sheet. One significant change with respect to the determination of statutory surplus is the 2001 codification of statutory accounting principles ("SAP").

With the introduction of codified SAP, there are at least two key changes that affect statutory surplus for many companies: (i) the treatment of deferred taxes, and (ii) the requirement to establish a premium deficiency reserve. Both of these changes mitigate the differences between statutory and GAAP accounting.

Codified SAP now requires the accrual of a deferred tax asset ("DTA") or liability ("DTL"). Consider a company that purchases one share of stock on January 1, 2001 for $100. If the company holds the stock and it appreciates to $1,000 as of December 31, 2001, the company will be required to accrue a DTL for the unrealized capital gain. (The DTL is calculated as $t \times [1{,}000 - 100]$, where t is the corporate tax rate.) Conversely, the determination of federal taxes using discounted loss reserves results in the accrual of a DTA. As a result, a company's statutory surplus is affected by necessary adjustments for DTA's and DTL's.

A premium deficiency reserve ("PDR") is required to supplement the unearned premium reserve ("UEPR") when the UEPR is inadequate to fund for future liabilities related to the unearned exposure.

Each of these changes resulting from codification affects the starting statutory surplus in a valuation and, as a result, the entity's future earnings. Prior to codification, a shortfall in the UEPR or the value of a DTL or DTA would have been recognized in future earnings as losses are incurred or assets are sold. Codified SAP reflects the associated value immediately on the balance sheet. In computing value prior to codification, the value associated with the PDR, DTA, or DTL would have been recognized on a discounted basis through the present value of future earnings component of the DCF or EVA valuation methods. After codification, value associated with the PDR, DTA or DTL is as recorded in the statutory balance sheet.

[33] One might question why accounting changes should affect value. As statutory earnings and statutory capital influence free cash flows (when either capital can be released from a company or additional capital contributions are required), accounting changes that affect statutory income or statutory surplus influence value.

- Fair Value Accounting

Financial assets and liabilities are accounted for in numerous ways under current U.S. accounting rules. For property/casualty insurance companies there is GAAP accounting, statutory accounting and tax accounting. Each of the various measuring approaches has its advantages and disadvantages. In general, GAAP accounting for property/casualty insurance companies is accounting for a "going concern." It reflects adjustments that make insurance financials comparable to other industries. Statutory accounting is a more conservative form of accounting to meet regulatory requirements targeted at protecting policyholders. Tax accounting is the basis of the tax calculation.

Historically, many financial assets were accounted for at cost or amortized cost. These values are readily available and verifiable. Many financial liabilities were at ultimate settlement value, which is a value that in many cases is contractually set and thus readily available and auditable.

The adoption of Financial Accounting Standard ("FAS") 115, which requires market value accounting for assets held in a "trading portfolio," led to the discussion of fair value accounting for financial assets and liabilities. With the adoption of FAS 115, several parties raised concerns with requiring assets to be held at market value when the liabilities were not reported at market values. Since then, the Financial Accounting Standards Board has stated a vision of having all financial assets and liabilities reported at fair value, which is considered an economic value.

The "fair value" of an asset or liability could be defined as estimated market value or as the actual market value when a sufficiently active market exists. If no sufficiently similar assets or liabilities exist by which to estimate a market value, the estimated market value is based on present value of future cash flows adjusted for risks.

Fair value accounting is most commonly an issue for financial assets or liabilities. Financial assets are generally either cash or contractual rights to receive cash or other financial assets. Financial liabilities are generally obligations to provide financial assets.

Fair value accounting may have an important influence in valuing property/casualty insurance companies. If a fair value accounting approach is adopted for statutory accounting, recognition of many flows will be accelerated relative to statutory accounting. As such, the introduction of fair value accounting will change the value estimates derived from the methods described in this paper, with value estimates increasing if accelerated revenues are higher than accelerated expenses and value estimates decreasing when the reverse is true[34].

[34] The impact on value is relevant whether these accelerated revenues and expenses are recognized in the income statement or solely as a direct adjustment to surplus. As both after-tax operating income and amount of capital affect free cash flows, either change could influence value.

For example, any imbedded value associated with investment income on the loss and LAE reserves or profit in the unearned premium reserve would be reflected in fair value accounting at the time the loss or unearned premium reserve is reported. However, fair value accounting, at least initially, may not consider cash flows and associated profits with policy renewals or new business. Therefore, the fair value accounting net worth of an insurance company, initially, may approximate its runoff value.

Regulatory Changes

- Risk-Based Capital Requirements

In 1993, the NAIC adopted RBC standards for property/casualty insurers. These standards are used by regulators to help to identify insurers that require regulatory attention and, as a result, the standards may be viewed as minimum capital requirements. As such, these requirements affect valuation because they can form a key determinant in the amount of capital a company must hold. Further changes in RBC could affect insurance company valuations if there are changes in required capital levels.

- Gramm-Leach-Bliley Act

The Financial Services Modernization Act of 1999 (Gramm-Leach-Bliley Act or "GLBA") enabled closer alignment of insurance companies and other financial institutions such as banks and securities firms. A primary feature of GLBA is that a bank holding company or foreign bank that meets certain eligibility criteria may become a financial holding company ("FHC"). FHC's are authorized to engage in a range of financial activities such as insurance agency and underwriting activities, merchant banking activities, and securities underwriting and dealing.

To date, GLBA has not had a significant impact on the property/casualty insurance industry because there are very few affiliations of insurance companies with other financial institutions. The 1998 merger of Citicorp and Travelers Group to form Citigroup was the first merger between an insurer and a bank since such mergers were prohibited in 1933. (In August 2002, however, Citicorp spun off the property/casualty operations of Travelers to end the affiliation of the banking institution and life insurance operation with the property/casualty insurance operation.) There has been no subsequent merger activity between property/casualty insurers and other financial institutions since the Citicorp merger.

Nonetheless, if a property/casualty insurer were affiliated with an FHC, the affiliation might affect certain assumptions related to the valuation of the insurer. The Federal Reserve Board, which regulates FHC's, is prohibited from directly imposing capital requirements on insurance affiliates, but it does establish capital requirements for FHC's. These FHC capital requirements may have an implicit influence on the capital level of an insurance subsidiary.

Stochastic Analysis of Insurance Company Financial Results

A unique feature of property and casualty insurance is the stochastic nature of claim emergence and settlement. In general, it is difficult to predict the timing of cash flows related to policyholder claims. While almost every line of business has the potential to generate unexpected claim experience, catastrophic insured events are particularly difficult to estimate due to the low frequency and high severity of these events. These events may have a severe and adverse impact on the operating earnings of an insurer and thus should be considered during the financial projection process. There are two broad approaches to modeling future financial projections: scenario testing and stochastic modeling.

Scenario testing is a deterministic approach in which results are projected from a specific set of conditions and assumptions. With this static approach, the user defines a scenario that reflects assumptions about various components of the company. The user is able to define the specific interrelationships of components and evaluate the impact of changes in different factors on the financial projections. This approach produces results that are easy to explain and easy to modify by incorporating one or more alternative assumptions.

Stochastic modeling has become increasingly popular in recent years for the property/casualty industry via dynamic financial analysis ("DFA"). Underlying stochastic models are probability distributions for each of the stochastic variables reflected in the model. Based on the probability distributions and a random number generator, the stochastic model produces a range of outcomes from which probabilities may be determined for the results. Its flexibility and ability to test the impact of a wide range of variables simultaneously make it an appealing approach. With respect to the implementation of stochastic modeling, however, the probability distributions for the stochastic variables and the correlations between components are critical to a meaningful model.

Over the past ten to fifteen years considerable emphasis has been placed on the DFA of insurance company financial results to evaluate capital needs, capital allocation, ceded reinsurance structures, and the risk associated with specific business initiatives. Since valuation formulas include the present value of future earnings, stochastic modeling of insurance financial results would seem like a natural adjunct to valuation.

In practice, valuing an insurance company is often undertaken in a limited timeframe. Valuation is usually based on expected value results for earnings with sensitivity tests related to changes in premium growth rates, changes in loss ratios, changes in hurdle rates, and changes in annual investment yields.

The contribution from stochastic modeling for valuation is that it would provide better definition of "risk" (the distribution of possible outcomes around the expected value) and could be used to derive better estimates of the cost of capital.

Exposure to Natural Catastrophes

As noted by Gorvett, et al.[35], exposure to natural catastrophes has had a very significant impact on the performance of the property/casualty insurance industry worldwide. As a result, the major catastrophic events during the past fifteen years have accelerated the evolution of the modeling of natural catastrophes and also led to a recent proposal to create a pre-funded catastrophe reserve on the statutory balance sheet.

Though the range of sophistication of catastrophe models varies widely, there are three essential elements of most models regardless of whether the model is deterministic or stochastic. First, there must be an estimate of the intensity of the underlying peril. This estimate is often simulated based on historical information about catastrophes related to the particular peril. Second, for the underlying peril, the model requires an estimate of the total damage caused by the peril. For a given peril, the damage estimate is primarily dependent on the geographical location of the risk and the value and construction type of the structure affected by the peril. The final key element is an estimate of the loss to the insurer – this is based directly on the location of policies written and limits provided.

For the purpose of insurer valuation, the primary benefit of catastrophe modeling is related to scenario testing. While it is beneficial to understand the expected average severity of natural catastrophes, catastrophe models are unable to help identify the future timing of these events. As a result, the future earnings stream of an insurer with significant insurance exposure to natural catastrophes is much more difficult to predict.

Due to the immediate and extremely adverse impact catastrophes may have on the balance sheets of property/casualty insurers and reinsurers, there has been a recent NAIC proposal to establish a tax-deferred pre-funded catastrophe reserve. The intent of this proposal is to establish a simple mechanism by which insurers and reinsurers can prudently manage risk created by exposure to natural catastrophes. This mechanism is intended to reduce the uncertainty related to the future earnings stream of insurers with significant exposure to natural catastrophes. The focus of the current proposal is on exposure of property insurance coverages to natural mega-catastrophes (e.g., Hurricane Andrew in 1992) that are expected to occur in the future.

As currently proposed, this "reserve" can be more appropriately viewed as segregated surplus. For the purpose of solvency regulation, the pre-funded nature of this reserve is also expected to come with restrictions on how it may be taken down over time.

This reserve and its funding mechanism will lead to additional considerations related to the determination of starting capital and future earnings for the purpose of a valuation. If the catastrophe reserve is immediately funded out of existing capital and as a liability, the entity's starting capital for the purpose of valuation will be reduced. If, however, the reserve is considered to be segregated surplus, the value of the company will not change. An alternative pre-funding approach is to contribute a percentage of premiums to the

[35] CAS – Foundations of Casualty Actuarial Science, 4th edition, Chapter 10 ("Special Issues")

catastrophe reserve fund. This would have no impact on starting capital, but would affect future earnings. The direction of the change, however, is uncertain.

SECTION 6 - Closing

The valuation of a property/casualty insurance company is an important feature of actuarial work. Much of the actuarial literature on valuation focuses on the method referred to throughout this paper as Economic Value Added. Other financial service professionals, however, often rely on a discounted cash flow approach to valuation. One of the principal intentions of this paper is to demonstrate that, with a common set of assumptions, the EVA and DCF modeling approaches will produce equivalent values. For both methods, the key factors underlying value are (1) the projection of future income, (2) the required capital, and (3) the hurdle rate. Developing future income estimates, appropriate growth assumptions (and the resultant capital needs), and the appropriate hurdle rate for the entity required sophisticated analysis. Furthermore, there are aspects of valuation, such as the determination of adjustments to the starting capital of the entity, for which experts have varying points of view. Recent changes such as the development of fair value accounting principles will provide further ideas on the valuation of assets and liabilities of a property/casualty insurance company.

We hope that this paper will help actuaries and other financial professionals to explain the valuation process for property/casualty insurance.

SECTION 7 – Sources

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APPENDIX I – Sample Company Valuation

This section presents a detailed example of valuing a property/casualty insurance company. The modeled valuation will focus on:

- Modeling aspects of a property/casualty insurer given current financial statements, investment assumptions, underwriting assumptions for current and future business, and loss and expense payment assumptions;

- Determination of future earnings from projected financial statements based on selected surplus and business volume constraints;

- Application of DCF and EVA valuation approaches using an existing balance sheet and projected financial statement amounts (balance sheet, income statement, and cash flow exhibits);

- Testing the sensitivity of indicated value to changes in key assumptions (risk-based capital-to-surplus requirement, loss ratios, investment yield, hurdle rate, growth rate).

Our objective is to provide a thorough and functional discussion of the valuation of a property/casualty insurance company valuation and a basic discussion of the development of earnings projections. The actuary or other professional preparing the valuation will, of course, undertake extensive analysis to develop premium, loss, and expense assumptions, investment yields, and other factors to project earnings. We present many assumptions "as given" without further explanation.

Valuation Estimates Based on Financial Model Results

The valuation results for the sample company, Primary Stock Insurance Company or "PSIC", rely on two basic assumption sets:

1. Financial modeling assumptions underlying financial statement projections; and

2. Valuation assumptions underlying the application of the DCF and EVA methodologies yielding value estimates of PSIC based on the financial statement projections.

Exhibit 7 shows the value estimates for PSIC for each method and the principal components for applying the valuation formulae. The fundamental financial amounts entering the valuation calculations are current and future year-end surplus estimates and future total income estimates. Basic financial modeling assumptions will be discussed later in this section; the primary focus is the application of the valuation methodologies with the modeled surplus and income amounts given specific valuation assumptions.

The valuation assumptions are:

1. A valuation date of December 31, 2001.

2. PSIC's risk-based capital ("RBC") indication at each year-end dictates the statutory surplus at the respective year-end. The example uses a surplus-to-RBC relationship of 2-to-1 where the RBC indication is the Company Action Level (100% of the RBC calculation).[36]

3. A hurdle rate of 15% per annum for all future years.

4. After the explicit forecast period ending December 31, 2011, we assume the surplus and total company income will increase at 2% per annum indefinitely.

For each valuation methodology, future valuation amounts are modeled in two distinct time periods: the explicit forecast period (10 years for the example, 2002 through 2011) and all subsequent years (2012 and later). For our sample company valuation, the explicit forecast period income and surplus estimates (via the RBC calculation) rely on financial modeling procedures. Valuation indications for all subsequent years were estimated using the respective method's value formulae starting one year after the explicit forecast period. For the DCF method, this calculation develops to the terminal value. For the EVA method this calculation develops the "continuing value added" after the explicit forecast period.

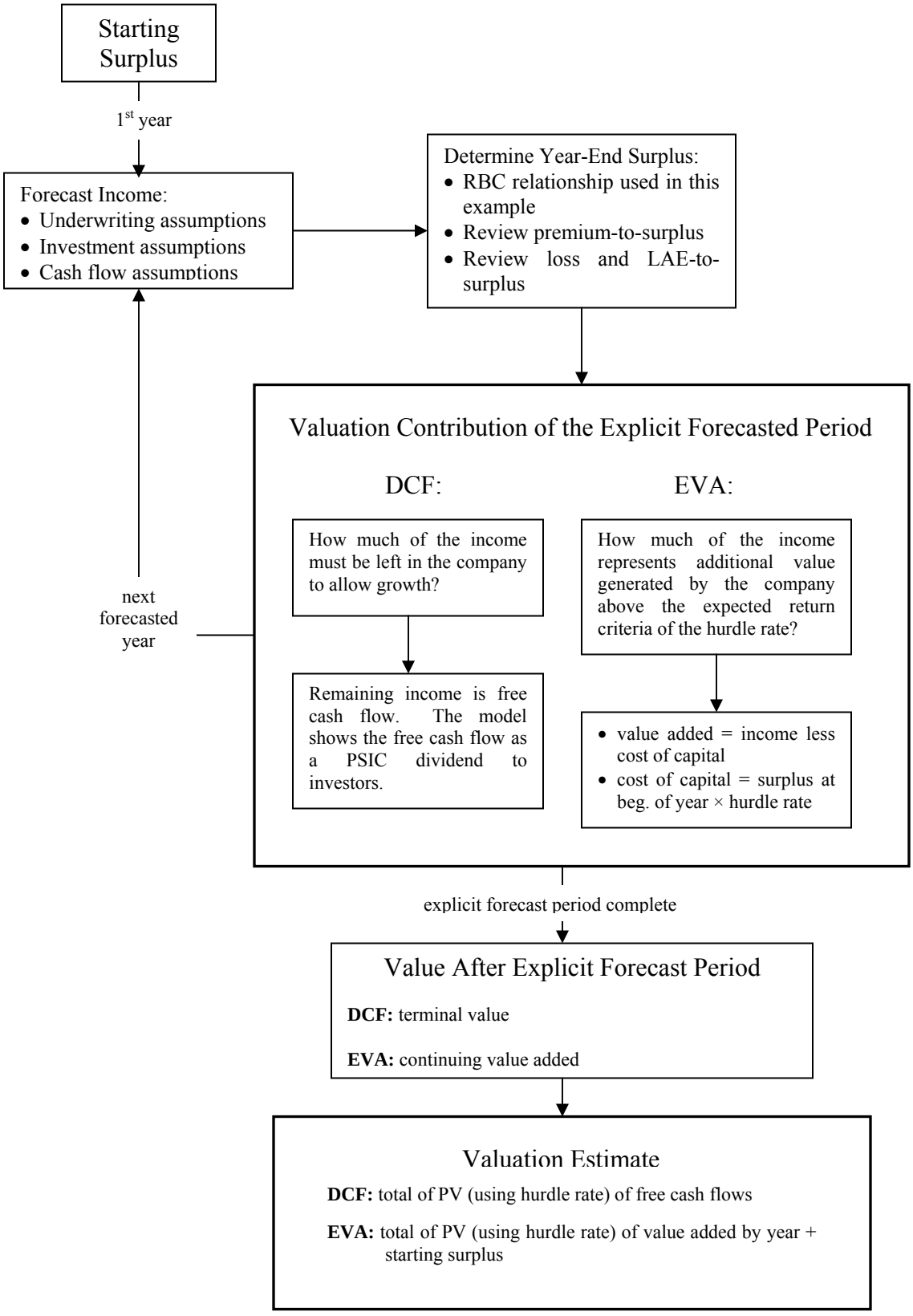
Both models yield value of approximately $88 million as of December 31, 2001. The comparison of the value components for the two methodologies parallels observations made in **SECTION 3 – Valuation Results: EVA versus DCF** about the scenario in which a company achieves more than the hurdle rate and is growing.

- The EVA method recognizes value amounts in the forecast process faster than the DCF method. As of the end of the explicit forecast period, through 2011, the EVA method value estimate is $73.9 million ($42.1 million surplus plus $31.8 million as the present value of future value added in years 2001 through 2011). The DCF method value estimate is $54.7 million representing the present value of free cash flow for years 2001 through 2011.

- The present value of the reinvestment cost (retained earnings) of $21.9 million (for all years) for DCF equals the present value of the cost of growth capital for EVA. The DCF reinvestment cost over the 10-year explicit forecast period ($18.97 million) is greater than the EVA cost of growth capital during the same period ($10.14 million). The difference is offset in modeled amounts for 2012 and subsequent – $2.96 million for DCF and $11.79 million for EVA.[37]

[36] Feldblum, "NAIC Property/Casualty Insurance Company Risk-Based Capital Requirements"
[37] DCF (18.97 + 2.96) = EVA (10.14 + 11.79) = 21.93

The following diagram shows the steps in the development of value presented in Exhibit 7.



The recorded statutory surplus for PSIC as of December 31, 2001 is $45.00 million. However, this amount exceeds the selected capitalization standard result of 2.0 × $21.07 million (the RBC indication at December 31, 2001) or $42.13 million. The "excess" surplus is recognized as free cash flow/value added for both DCF and EVA at December 31, 2001 (time 0) and our valuation models begin with a statutory surplus of $42.13 million. For the EVA model, the surplus of $42.13 million is recognized immediately as value. It is also the basis of the Cost of Capital calculation in the first period. For the DCF model, the surplus of $42.13 million contributes to value only through the investment income it earns in subsequent periods.

No other adjustments were made to the starting surplus for valuation. Carried reserves were assumed to be at the actuarially indicated amount. There was no difference between market value and book value of investments and no other adjustments were deemed warranted.

After establishing PSIC's adjusted net worth, the valuation process requires the total statutory income and RBC amounts for the first future projection year, 2002, from the financial model constructed for PSIC. Exhibit 8, Changes in Statutory Surplus, shows the estimated future income for PSIC during 2002 to be $10.44 million. The PSIC valuation model includes income from two categories: statutory net income and changes in unrealized capital gains. Exhibit 9 shows the computation of statutory net income. Unrealized capital gains stem from increases in market value for preferred and common stock investments.

The projected RBC for year-end 2002 is $23.25 million leading to a December 31, 2002 required surplus of $46.5 million. Exhibit 12 shows PSIC's RBC calculation. During 2002, the required surplus increases by $4.37 million, from $42.13 million to $46.51 million.

The DCF methodology determines value from free cash flow estimates; for 2002 free cash equals $10.44 million of income less earnings retained to fund surplus growth of $4.37 million. Exhibit 8 shows the $6.07 million free cash flow ($10.44 – $4.37 = $6.07) as a stockholder dividend. The contribution to value of the 2002 free cash flow is the PV of $6.07 million using the 15% hurdle rate.

The EVA methodology values returns in excess of the cost of capital. For 2002, excess returns equal $10.44 million of income less the cost of capital of $6.32 million, or $4.12 million. The cost of capital equals the surplus as of the end of the prior year, $42.13 million, multiplied by the hurdle rate of 15%. The contribution to value of the 2002 excess returns is the PV of $4.12 million using the 15% selected hurdle rate, or $3.59 million.

As shown on Exhibit 7, the application of the DCF and EVA methodologies given the total income, RBC, surplus projections, and valuation assumptions is repeated for each year in the 10-year explicit forecast period. The PV of free cash flow for the DCF

method during the 10-year period is $54.69 million. The PV of excess returns for the EVA method through the 10-year period is $31.81. The PV of excess returns plus the starting surplus of $42.13 million yields the EVA indicated value through year 10 of $73.94 million.

The All Years value of PSIC under both valuation methods includes the PV contribution of value amounts beyond the explicit forecast period**.** The amount shown in the "Total '12 to ∞" column in Exhibit 7 rely on perpetuity formula calculations rather than annual detailed financial projections for 2012 and subsequent years. Appendix and **SECTION 1 – Introduction** show these formulae for both methods and the algebraic derivation. The key assumptions for these calculations are:

- The expected annual growth rate of surplus and total income after 2011 is 2%. Thus, the implicitly projected surplus for 2012 is $77.86 million × 1.02 = $79.42 million and the income for 2012 is $18.71 million × 1.02 = $19.08 million.

- The hurdle rate is 15% for calculating the cost of capital for the EVA method and for determining the PV of 2012 and subsequent value amounts.

Both methods produce a valuation result of $88.03 million.

DCF	
(1) Present value of free cash flow during the explicit forecast period	$54.69
(2) Terminal value (present value of free cash flow subsequent to the explicit forecast period)	33.33
Total	$88.03
EVA	
(1) Adjusted net worth (starting surplus)	$42.13
(2) Present value of value added amounts during the explicit forecast period	31.81
(3) Present value of continuing value added subsequent to the explicit forecast period	14.08
Total	$88.03

Overview of the Financial Model

The property/casualty insurer financial model for the PSIC valuation performs all of the necessary computations to produce prospective statutory and GAAP financial statements. The major functions of the model are: (i) runoff of loss and LAE reserves, (ii) payout of loss and loss adjustment expenses stemming from the earning of the unearned premium reserve, (iii) estimation of the level of future written premium and associated earned premium and application of the loss and expense ratio assumptions, (iv) calculation of investment income, and (v) calculation of federal income tax due.

There are two items of note before discussing the details of PSIC financial model projections. First, the model does not reflect all the changes resulting from the NAIC's codification of statutory accounting principles. An example is the recognition of a statutory asset or liability for deferred taxes. Even without these items, the financial model results provide significant insight into the considerations and calculations for valuing a property/casualty insurance company. Second, the GAAP balance sheet and income statements are provided for the interested reader. The GAAP results are not discussed in the text because the valuation estimate relies exclusively on amounts computed using statutory accounting.

Exhibit 11 is the Detailed Statutory Balance Sheet for PSIC. The "Actual 2001" column shows amounts from PSIC's December 31, 2001 statutory Annual Statement. Balance sheet items are either the sum of amounts from individual lines of business or for PSIC in total. Investment and cash amounts, items (1a) through (1g) and the Total Investments & Cash subtotal, are not segregated by line; neither are capital and surplus.

The remaining assets (receivables) and liabilities (payables and loss, LAE, and unearned premium reserves) are the sums of individual line of business amounts. In this example, PSIC wrote and continues to write three lines of business: workers' compensation, auto liability, and general liability, all on a primary basis. Exhibits 18, 19, and 20 show the December 31, 2001 balance sheet amounts and business assumptions for the workers' compensation, auto liability, and general liability books of business, respectively.

The largest single balance sheet item from the line of business data is the net loss and ALAE reserve. Sheet 6 for Exhibits 18, 19, and 20 show the loss and LAE reserves as of December 31, 2001 for accident years 2001 and prior for each line of business. Sheet 5 for each line of business shows the payment patterns for the respective 2001 balance sheet reserve amounts.

Sheet 4 for Exhibits 18, 19, and 20 shows the other balance sheet items associated with each line of business as of December 31, 2001.

Exhibit 9 is PSIC's Statutory Income Statement. Exhibit 8, Change in Statutory Surplus, uses net income from Exhibit 9. The annual change in statutory surplus equals net income plus change in unrealized capital gains. Net income has three basic components: underwriting income plus investment income less federal income taxes. (The PSIC model does not include any "other income" amounts.) PSIC's underwriting income equals the sum of individual line of business underwriting income amounts. Investment income and federal income taxes are computed for PSIC in total. Investment income includes investment income on the capital along with the assets generated by line of business.

Sheet 1 for Exhibits 18, 19, and 20 provides the underwriting income by line of business. Sheet 2 provides the calculation notes for the components of the line of business underwriting income. The principal assumptions are:

Net Earned Premium

- Direct written premium ("DWP") annual growth is 4%
- 50% of DWP is earned in year written, 50% in the following year
- Workers compensation and general liability have excess reinsurance; 10% of the DWP is ceded

Net Incurred Loss and LAE

- As shown in Sheet 4 of Exhibits 18, 19, and 20, the selected loss and LAE ratios for each line of business are:

	Direct Loss Ratio	ALAE to Loss Ratio	ULAE to Loss Ratio	Ceded Loss Ratio
Workers' Comp	70.0%	8.0%	8.5%	100.0%
Auto Liability	64.0%	8.5%	7.5%	N/A
General Liability	68.0%	15.0%	8.5%	100.0%

- These gross loss, gross LAE, and ceded ratios are applied to the December 31, 2001 unearned premium reserve and earned premium generated by forecasted written premium.

Total Underwriting Year Expenses

- As shown in Sheet 4 of Exhibits 18, 19, and 20, the underwriting expense ratios for each line of business are (DWP = direct written premium, CWP = ceded written premium):

	Agents' Commission	Premium Tax	Other Underwriting Expenses		Reinsurance Commissions
	(%DWP)	(%DWP)	(%DEP)	(%DWP)	(%CWP)
Workers' Comp	10.0%	3.0%	3.0%	2.25%	0.0%
Auto Liability	15.0%	2.0%	2.25%	3.25%	N/A
General Liability	12.5%	2.0%	4.0%	1.0%	0.0%

Investment income is shown in row (5) of the Statutory Income Statement (Exhibit 9). The sources of investment income are realized capital gains, interest income, and dividends. The annual yield rates (pre-tax) for each asset type are:

Realized Capital Gains

Preferred Stocks	2.5%
Common Stocks	4.0%
Real Estate	4.0%

Interest Income

Taxable Bonds	6.0%
Non-taxable Bonds	4.0%
Cash	3.0%
Real Estate	4.0%
Other	2.0%

Dividends

Preferred Stocks	5.0%
Common Stocks	2.0%

The distribution of invested assets and cash is:

Taxable Bonds	42.0%
Non-taxable Bonds	24.0%
Preferred Stocks	1.0%
Common Stocks	25.0%
Cash	5.0%
Real Estate	1.0%
Other	2.0%
Total	100.0%

Invested assets held at the beginning of a forecasted year will earn a full year of investment income based on the above yield percentages. Investment income is also earned on new cash generated by PSIC's insurance operations. The financial model assumes that cash from operations is collected and invested at the mid-point of each forecasted year. The collected cash is invested according the distribution of invested assets and cash shown above. Thus, the distribution is constant for all forecasted years.

Cash flows from operations are shown in Exhibit 13. Premium collections, loss and LAE payments, and underwriting expense payments are modeled for each line of business. Sheet 3 of Exhibits 18, 19, and 20 shows the cash flow from underwriting for each line of business, respectively. In addition to the premium, loss, LAE and underwriting expense assumptions, the line of business underwriting cash flow relies on the following assumptions:

- Loss and LAE payment patterns for each line of business shown in Sheet 5 of Exhibits 18, 19, and 20, respectively. The payment patterns apply to reserves carried as of December 31, 2001 and loss and LAE incurred in 2002 and subsequent accident years.

- Lag of 1 month in collection of direct premium.

- Lag of 3 months in paying ceded premium.

- Lag of 1 month in collection of ceded loss recovery.

Federal income tax is the final component for computing net statutory income. The PSIC model followed the 2001 instructions for computing federal income tax for U.S. property/casualty insurance companies.

Total income for valuation equals net statutory income plus unrealized capital gains as shown in Changes in Statutory Surplus, Exhibit 8. Unrealized capital gains are computed as total annual capital gains in equity investments less realized capital gains. The capital gain percentages are:

Preferred Stocks	11.0%
Common Stocks	9.5%

Sensitivity Testing

Table 7 shows the sensitivity of DCF and EVA value estimates to changes in underlying assumptions. Exhibit 21 shows additional detail related to each of these alternative scenarios.

For ease of reference, the assumptions underlying the base case are listed below:

- Starting capital as of December 31, 2001 = $42.13 million
- Surplus-RBC ratio = 2.0
- Workers' compensation loss ratio = 70%
- Auto liability loss ratio = 64%
- General liability loss ratio = 68%
- Average investment yield = 4.26% (weighted average of yields by asset type)
- Premium growth = 3%
- Hurdle rate = 15% for explicit forecast period and subsequent years

Table 7
Sensitivity Testing of Alternative Assumptions

	DCF Model			EVA Model		
	2001-2011	2012 to ∞	Total	2001-2011	2012 to ∞	Total
Base Case	54.7	33.3	88.0	73.9	14.1	88.0
Change in Assumption						
Surplus-RBC ratio = 2.5	43.1	34.7	77.7	67.3	10.4	77.7
Base loss ratios +2%	46.0	30.4	76.4	66.0	10.4	76.4
Base loss ratios –2%	63.3	36.2	99.5	81.8	17.7	99.5
Investment yield +100 basis pts	67.6	39.8	107.5	86.9	20.6	107.5
Investment yield –100 basis pts	41.6	26.8	68.4	60.9	7.5	68.4
Premium growth = 0%	58.1	26.3	84.4	72.5	11.9	84.4
Premium growth = 6%	52.4	37.3	89.8	74.6	15.1	89.8
Hurdle rate +3%	48.3	20.9	69.3	63.2	6.1	69.3
Hurdle rate –3%	62.5	56.4	118.9	87.5	31.4	118.9

Table 8 shows the changes in value implied by the alternative assumptions. **SECTION 3 – Valuation Results: EVA versus DCF** discusses the similarities and differences of the models' structure and results using varying assumptions.

Table 8
Changes from Base Case in Valuation Estimates

	DCF Model			EVA Model		
	2001-2011	2012 to ∞	Total	2001-2011	2012 to ∞	Total
Surplus-RBC ratio = 2.5	(11.6)	1.3	(10.3)	(6.7)	(3.7)	(10.3)
Base loss ratios +2%	(8.7)	(2.9)	(11.7)	(8.0)	(3.7)	(11.7)
Base loss ratios –2%	8.6	2.9	11.5	7.9	3.6	11.5
Investment yield +100 basis pts	12.9	6.5	19.4	12.9	6.5	19.4
Investment yield –100 basis pts	(13.1)	(6.6)	(19.6)	(13.1)	(6.6)	(19.6)
Premium growth = 0%	3.4	(7.0)	(3.6)	(1.4)	(2.2)	(3.6)
Premium growth = 6%	(2.3)	4.0	1.7	0.7	1.1	1.7
Hurdle rate +3%	(6.4)	(12.4)	(18.8)	(10.7)	(8.0)	(18.8)
Hurdle rate –3%	7.8	23.1	30.9	13.6	17.3	30.9

These tables show that company value is very sensitive to changes in the assumptions underlying the valuation. Every sensitivity test alters value by at least 10%, except for the premium growth assumptions. Large changes in premium growth assumptions had small impact on value because the underwriting profits of the insurance company are modest. This is apparent in Exhibit 9, which shows the underwriting income contribution to pre-tax operating income for 2001 through 2011.

The hurdle rate for the entire valuation period is also a key assumption. Decreasing the hurdle rate from 15% to 12% for all projection periods increases value by 35%.

An increase in the required surplus (raising the surplus to RBC ratio from 2.0 to 2.5) lowers value. This result is logical in that the higher the capital required, the lower the free cash flows for DCF and the higher the cost of capital for EVA.

Value is also very sensitive to changes in the investment yield for the asset portfolio. This result is logical for this company in that over 95% of the pre-tax operating income is related to investment income (as shown in Exhibit 9).

Valuation results will always be sensitive to small changes in loss ratios as shown in Tables 7 and 8. A reduction in loss ratio of 2% for each lines of business results in a increase in value of 13%.

Since the value of any company is a function of the assumptions used, as noted in **SECTION 1 – Introduction,** a valuation report should clearly identify the source of every assumption. The report should specify whether the assumption was provided by

the subject company, derived from historical experience, provided by a potential investor, or developed from other sources. The source of an assumption may be an indication of whether the assumption is conservative, optimistic, or unbiased.

APPENDIX II – Demonstration of Algebraic Equivalence of EVA and DCF

The general expression for value based on the Discounted Cash Flow (DCF) approach is:

(DCF-1) $$Value = FC_0 + \sum_{x=1}^{\infty} \left[OE_x - \Delta C_x \right] \times (1+h)^{-x}$$

where:

FC_0 = Free cash available at time 0 to be released to shareholders

OE_x = After-tax operating earnings generated in time period x

ΔC_x = Change in required capital over time period x = C_x - C_{x-1},
where C_x = required capital at the end of time period x (this is equivalent to the required capital at the beginning of time period x+1)

h = Hurdle rate (required return on capital)

Equation DCF-1 represents the sum of the free cash available at time 0 and the present value of future free cash flows, where future free cash flows ($OE_x - \Delta C_x$) are defined as after-tax operating earnings less the amount of required capital reinvestment. For ease of illustration, we have made the simplifying assumption that all cash flows occur at the end of the period.

Distributing and separating Equation DCF-1 into two separate sums, we produce:

(DCF-2) $$Value = FC_0 + \sum_{x=1}^{\infty} OE_x \times (1+h)^{-x} - \sum_{x=1}^{\infty} \Delta C_x \times (1+h)^{-x}$$

If we assume that both operating earnings and capital grow at constant rate g, then:

$$OE_x = OE_{x-1} \times (1+g) = OE_1 \times (1+g)^{x-1}$$

and

$$C_x = C_{x-1} \times (1+g) = C_0 \times (1+g)^x \text{, so}$$

$$\Delta C_x = C_x - C_{x-1} = C_{x-1} \times g = C_0 \times (1+g)^{x-1} \times g$$

Substituting into equation DCF-2, the DCF value becomes:

(DCF-3) $$Value = FC_0 + \sum_{x=1}^{\infty} OE_1 \times (1+g)^{x-1} \times (1+h)^{-x} - \sum_{x=1}^{\infty} C_0 \times g \times (1+g)^{x-1} \times (1+h)^{-x}.$$

By factoring out the constants, this equation is rewritten as:

(DCF-4) $$Value = FC_0 + \frac{OE_1}{(1+h)} \sum_{x=1}^{\infty} \left[\frac{(1+g)}{(1+h)} \right]^{x-1} - \frac{C_0 \times g}{(1+h)} \sum_{x=1}^{\infty} \left[\frac{(1+g)}{(1+h)} \right]^{x-1}.$$

Note that *g*, the growth rate, will always be less than *h*, the hurdle rate. As a result, the sum of the infinite geometric series can be solved easily as A ÷ (1 – R), where A is the first term in the series and R is the multiplicative factor used to generate the next term in the series.

The sum converges to $\frac{1}{1 - \frac{(1+g)}{(1+h)}}$, which may be rewritten as $\frac{1+h}{h-g}$.

When we substitute this into Equation DCF-4, the (1 + *h*) terms cancel, so the formula for value based on a DCF approach becomes:

(DCF-5) $$Value = FC_0 + \frac{OE_1}{(h-g)} - \frac{C_0 \times g}{(h-g)}$$

This is appropriately viewed as the sum of all free cash flows, or initial capital plus the present value of future earnings, minus the present value of future required capital reinvestments.

The general expression of EVA is:

$$\textbf{(EVA-1)} \quad Value = SC_0 + \sum_{x=1}^{\infty} \left[OE_x - \left(h \times C_{x-1} \right) \right] \times \left(1 + h \right)^{-x}$$

where:

SC_0 = Starting capital; this is equal to the sum of free capital and required capital at time 0 (FC_0 and C_0, respectively, as defined in the DCF discussion)

OE_x, C_x, and h have the same definitions as in the DCF discussion.

This formula represents the required capital at the valuation date (time = 0) plus the present value of future economic profits. Economic profits for time period x are defined as after-tax operating earnings (OE_x) reduced by the cost of capital, which is the product of the hurdle rate and the required capital at the beginning of each period ($h \times C_x$).

Distributing and separating Equation EVA-1 into two separate sums, we produce:

$$\textbf{(EVA-2)} \quad Value = SC_0 + \sum_{x=1}^{\infty} OE_x \times \left(1 + h \right)^{-x} - \sum_{x=1}^{\infty} \left(h \times C_{x-1} \right) \times \left(1 + h \right)^{-x}$$

Based on a constant growth rate g for both after-tax operating earnings and capital and the identities defined above in the DCF discussion, the formula for EVA value is restated:

$$\textbf{(EVA-3)} \quad Value = SC_0 + \sum_{x=1}^{\infty} OE_1 \times \left(1 + g \right)^{x-1} \times \left(1 + h \right)^{-x} - \sum_{x=1}^{\infty} h \times C_0 \times \left(1 + g \right)^{x-1} \times \left(1 + h \right)^{-x}$$

By factoring out the constants, this may be rewritten as:

$$\textbf{(EVA-4)} \quad Value = SC_0 + \frac{OE_1}{\left(1 + h \right)} \sum_{x=1}^{\infty} \left[\frac{\left(1 + g \right)}{\left(1 + h \right)} \right]^{x-1} - \frac{\left(h \times C_0 \right)}{\left(1 + h \right)} \sum_{x=1}^{\infty} \left[\frac{\left(1 + g \right)}{\left(1 + h \right)} \right]^{x-1}$$

Again, we use identities defined in the DCF discussion to simplify Equation EVA-4 to the following:

$$\textbf{(EVA-5)} \quad Value = SC_0 + \frac{OE_1}{\left(h - g \right)} - \frac{h \times C_0}{\left(h - g \right)}$$

This can also be expressed as:

(EVA-6) $$Value = SC_0 + \frac{OE_1}{(h-g)} - \frac{(h-g+g)\times C_0}{(h-g)}$$

or

(EVA-7) $$Value = SC_0 + \frac{OE_1}{(h-g)} - \frac{(h-g)\times C_0}{(h-g)} - \frac{g\times C_0}{(h-g)}$$

or

(EVA-8) $$Value = SC_0 + \frac{OE_1}{(h-g)} - C_0 - \frac{g\times C_0}{(h-g)}$$

or

(EVA-9) $$Value = FC_0 + C_0 + \frac{OE_1}{(h-g)} - C_0 - \frac{g\times C_0}{(h-g)}$$

or

(EVA-10) $$Value = FC_0 + \frac{OE_1}{(h-g)} - \frac{g\times C_0}{(h-g)}$$

This is the same result as for the DCF model, as shown in Equation DCF-5.