A Unified Valuation Framework for Dividends, Free-Cash Flows, Residual Income, and Earnings Growth Based Models

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1. Introduction

Valuation techniques are important to practitioners and academics. Although theoretically equity value equals the present value of expected dividends, in practice, higher-level metrics such as free cash flows, earnings, and book values are used for valuation. This paper helps us understand these metrics by: (1) providing a common and simple theoretical framework that shows how these alternative valuation metrics can be used instead of dividends; (2) using the common framework to provide the theoretical underpinnings of earnings-based valuation.

Expected earnings and their growth are widely used for valuation based on the Gordon Growth Model and by assuming a fixed payout *k*, which yields $P_0=k.e_1/(r-g)$. Such a model is simply the dividend model masquerading as an earnings model because in reality firms do not have fixed payouts. Using a new valuation technique that does not rely on fixed payouts, we derive a formula that relates value to forthcoming earnings, short-term growth in earnings, and long-term economic growth. This technique unifies valuation methods because it can be used to derive the discounted free cash flow model and the book-value-based model. The derivations also clarify the relative merits and demerits of alternative valuation metrics.[1]

With easy access to spreadsheets that allow detailed models with complex numerical computations, one might wonder why one needs these higher-level metrics or parsimonious valuation shortcuts such as multiples. *First*, terminal value estimates are a big part of the values derived using spreadsheets and these terminal values are often based on estimated earnings

[1] Ohlson (1995) first provided a formal theoretical model based on book values and residual earnings without restricting payout policies. Feltham and Ohlson (1995) formally linked free cash flows to value. Ohlson and Juettner (2000) then linked earnings and earnings growth to value. This paper synthesizes this earlier work and makes the unified framework more accessible to those not familiar with the individual papers.

multiples at the end of the forecast horizon. These terminal value estimates are needed because it is generally quite difficult to forecast anything beyond 3-5 year horizon. For many companies, particularly high growth companies, the present value of terminal value accounts for as much as 80-90% of current value, which, in effect, makes the spreadsheet model a multiple-based model. *Second*, parsimonious representations such as multiples are useful because they are easy to compare, communicate, and negotiate, which makes them ideal for relative valuation. Investors find it difficult to internalize a complex spreadsheet-based valuation model, so they use shortcuts such as multiples to check the reasonableness of the value derived from a spreadsheet model.

The paper has three distinct sections. Section 2 compares the dividend discount model, the discounted cash flow model, and the residual income valuation model because these models are typically covered in valuation courses. Readers familiar with this material can skip section 2 without any loss of continuity. Section 3 provides a framework that unifies these models. The framework shows that there is no reason for us to restrict ourselves to dividends, cash flows, or residual earnings; one can use earnings directly for valuation. The framework lays the foundation of an earnings-based valuation framework. Section 4 provides a theoretical, yet easy to implement, earnings-based valuation model. This model fills a gap in classroom theory and shifts the focus to earnings and earnings growth, which is of prime importance in the real world.

2. The Well-Known Models

This section covers three well-known models that are covered in classrooms.

2.1. The Discounted Dividends Model (DDM): Cash distribution

Theoretical equity valuation starts with the present value of expected dividends [PVED]:

$$P_0 = \sum_{t=1}^{\infty} R^{-t} d_t$$

where

P_0 = equity value
$R = 1+r$ where r is the discount factor or the cost-of-equity capital
d_t = dividend expected at date t.

DDM has two well-known weaknesses. First, many growth companies do not plan to pay dividends within the forecast horizon. Second, unless the conditions of the Modigliani-Miller Theorem are violated, dividend policy is value neutral. That is, unless managers hoard cash or have suboptimal financing policies, little insight is obtained by focusing on dividends. Both weaknesses of DDM stem from a common problem – DDM does not focus on wealth generation but on wealth distribution.

The DCF model discussed next moves away from wealth distribution to wealth generation. However, by considering only cash and ignoring other assets and liabilities, the DCF model deals with a narrow aspect of a firm's wealth. That is, instead of focusing on wealth generation, DCF focuses only on cash generation.

2.2. Discounted Free Cash Flow (DCF) model: Cash generation

Free cash flows shift the focus away from dividends, which represent distribution of cash, to the generation of cash that can be eventually distributed to lenders and shareholders. Free cash flows are equal to the dividends that a firm could pay if it had no debt and had a full payout. In reality, firms use the free cash flows to pay debtholders, distribute dividends, or simply retain the cash. Thus, the present value of free cash flows equals the market value debt plus market value of equity minus cash. One can view free cash flows as "enterprise dividends" and view their present value as enterprise value.

$$EV_0 = \sum_{t=1}^{\infty} R^{-t} c_t$$

where
EV_0 = the enterprise value today
c_t = expected free cash flow, date t.

Adding cash and financial assets and backing out debt yields equity value as follows:

$$P_0 = Netcash_0 + \sum_{t=1}^{\infty} R^{-t} c_t$$

where

$Netcash_0$ = Net cash today, i.e., cash and investments minus debt. In practice, instead of adding "Netcash," analysts back out Netdebt, which is the negative of Netcash.

Cash may be king but free cash flows have three problems. First, it is difficult to measure free cash flows when the separation between operating and investing activities and financing activities is fuzzy. For example, when banks receive a deposit, they treat it as financing, which is excluded from free cash flows. Arguably, taking deposits is a bank's recurring business and should be operating and should be included in free cash flows. After all, banks treat the loans they make as investing, which are part of free cash flows.

Second, free cash flows are not wealth flows because wealth is more than just cash, which prompts accountants to use the concepts of recognition and matching to create a metric – earnings – that is contemporaneously matched with wealth generation. For example, if a company invests in PP&E, its cash flows can be negative. Yet, earnings will not be hit immediately with an expense because accountants allocate the capital spending as depreciation expense over the life of the asset. Thus, accountants focus not just on cash, but also on other assets such as PP&E. While one can manipulate the accrual and deferral judgments required to measure earnings, one can also manipulate free cash flows by timing payments, e.g., by delaying payments to suppliers.

Third, because free cash flows are not contemporaneous with wealth generation, it is difficult to forecast them directly. Instead, analysts forecast operating income first, then the operating assets and liabilities needed to support that operating income, and then derive the free cash flows by subtracting changes in net operating assets. That is, DCF models start with earnings forecasts. No wonder financial news covers earnings per share more than it covers cash flow per share. A valuation model must connect popular accounting metrics to value. The residual income valuation discussed next incorporates accounting metrics.

2.3. Residual income valuation models: Wealth and growth in wealth

The Residual Income Valuation (RIV) model moves the focus away from cash to book value of equity because the latter is a comprehensive measure of a firm's net wealth. It presents value as book value plus a premium for return on equity in excess of cost of equity capital:

$$P_0 = b_0 + \sum_{t=1}^{\infty} R^{-t} a_t$$

where

b_t = expected book value, date t

e_t = expected earnings, date t.

expected residual or abnormal earnings $a_t = e_t - r.b_{t-1} = ROE_t.b_{t-1} - r.b_{t-1} = (ROE_t - r).b_{t-1}$.

The price exceeds book value if return on equity (ROE) is expected to exceed cost of equity capital. The book value is the wealth that the firm has already created while the market premium reflects expectations that the firm will earn "abnormal or supernormal" profits due to "economic rents," i.e., ROE will exceed the cost of capital.

By deriving market value as book value plus a premium over book value for expected growth in book value, RIV anchors valuation on book values. Such emphasis on book values is justified when book values approximate market values, e.g., for financial instruments that are marked to market. Thus, book value based valuation makes sense for financial institutions and is indeed often used to value them. However, the focus on book values is misplaced and out of touch with practice especially when accounting is conservative. For example, the most important assets of knowledge intensive firms are not shown on their books because investments in intellectual property are typically expensed as R&D when incurred.[2] Thus, their book values are understated and the ROE is overstated. Analysts valuing these firms typically do not use book value of equity as the starting point in their valuation. Instead, they focus on the earnings and earnings growth expected from these "off-balance sheet" assets. Analysts focus on future earnings because as explained later steady-state earnings are less affected by conservatism than are steady-state book values. Although earnings and earnings growth are heavily used for valuation, the theory of earnings-based valuation has been absent. We describe a popular approximation before moving on to a formal model incorporating earnings and earnings growth.

2.4. Discounted dividends model masquerading as earnings-based model

To model earnings growth, the Gordon Growth formula is typically adjusted as follows:

$$P_0 = \frac{K.e_1}{r - g}$$

where

$e_{t+1} = (1+g).e_t,\ t \geq 1,$ and the dividend payout is fixed according to $d_t = K.e_t$.

Such approximation is ad-hoc with no formal proof that it is correct. Moreover, empirically the payout is variable. For example, many firms pay no dividends during their initial growth phase and it is awkward if not impossible to use the above approximation to value these firms. Although dividend policy can be value neutral, it does affect earnings forecasts by affecting the interest earned on the retained cash. Therefore, arbitrary payout assumptions are not consistent with a pattern of earnings forecasts. A model relating earnings to value is needed. Such a model is derived from a unifying framework discussed next.

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[2] The Economic Value Added (EVA™) model from Stern and Stewart is a well-known and proprietary implementation of RIV that makes numerous accounting adjustments to "correct" for such conservatism.

3. The Unifying Framework for Equity Valuation

We build on the dividend discount model (DDM) using the following scheme to unify discounted free cash flow (DCF), residual income valuation (RIV), and earnings-based models. The framework highlights that from a mathematical point of view, one can use dividends, free cash flows, residual earnings, or earnings for valuation. The choice of the model therefore depends on how much a model helps those with human cognitive limitations to think about the future evolution of value drivers of a company. That is, the choice depends on "aesthetics" as defined by how well a model connects with an analyst's view of a company.

Let $y_0, y_1, y_2, ...$ be any sequence of numbers, subject only to the condition $y_t / R^t \to 0$ as $t \to \infty$, i.e., the present value of y_t sequence is finite. It follows that

$$0 = y_0 + R^{-1}(y_1 - Ry_0) + R^{-2}(y_2 - Ry_1) + R^{-3}(y_3 - Ry_2) + ...$$

Adding this expression to DDM, one obtains

$$P_0 = y_0 + \sum_{t=1}^{\infty} R^{-t} z_t$$

where

$$z_t = y_t + d_t - R.y_{t-1}$$

The mechanics above rely on two central ideas. First, y_0 anchors value. Second, we can focus on wealth generation rather than wealth distribution by constraining z_t such that it does not depend on dividend policy. We now apply this framework to DCF and RIV models.

3.1. Discounted free cash flow models

The valuation starts with "net cash" where "net cash" equals cash and short-term investments minus debt. Net cash is usually negative and is termed "net debt."

Put y_t = $netcash_t$ and assume that the net cash yields interest earnings ie_t=$r.netcash_{t-1}$.

$$\begin{aligned} z_t &\equiv netcash_t + d_t - R.netcash_{t-1} \\ &= d_t - ie_t + \Delta netcash_t \\ &= fcf_t \end{aligned}$$

where fcf_t is the free cash flow at date t.

By partitioning a firm's activities into operating and financial activities, the balance sheet and the income statement can be summarized by:

$$b_t = noa_t + netcash_t$$
$$e_t = oe_t + ie_t$$

where
b_t = book value of equity at time t
noa_t = operating assets net of operating liabilities, date t
oe_t = operating earnings, date t

Assume that the clean surplus relation holds, i.e., $\Delta b_t = e_t - d_t$. Substituting for b_t we get:

$$\Delta noa_t + \Delta netcash_t = e_t - d_t = oe_t + ie_t - d_t$$
$$oe_t - \Delta noa_t = d_t - ie_t + \Delta netcash = fcf_t$$

The derivation follows the steps that analysts use to forecast free cash flows: (1) forecast operating earnings (oe_t); (2) forecast net operating assets (noa_t); (3) forecast free cash flows as operating income minus the change in net operating assets ($oe_t - \Delta noa_t$).

The derivation shows that defining free cash flows requires defining net operating assets unambiguously, i.e., separating operating and investing activities from financing activities. As discussed earlier, such separation is often difficult to do for financial institutions, which makes it difficult to use DCF. If oe_t and Δnoa_t are affected only by operating and investing activities, then fcf_t and therefore z_t do not depend on financing policy. That is, free cash flow projections depend on financing policy only if one believes that the managers will not follow optimal financing policy, e.g., by hoarding cash or by not borrowing to pursue expansion plans.

3.2. Book value based models: Residual income valuation

Instead of starting with net cash, one can start with the book value of equity as follows. Put

$$y_t = b_t$$

so that

$$z_t \equiv b_t + d_t - R.b_{t-1}$$

Given clean surplus $\Delta b_t = e_t - d_t$, it follows that

$$z_t = e_t - r.b_{t-1}.$$

That is

$$P_0 = b_0 + \sum_{t=1}^{\infty} R^{-t} a_t$$

where

b_t = expected book value, date t

e_t = expected earnings, date t.

$a_t = e_t - r.b_{t-1}$, i.e., a_t is the expected residual or abnormal earnings.

As in the DCF model, z_t is independent of financing policy if the financing policy does not affect the firm's operating and investing decisions. The model anchors value on book value and adds a premium for the present value of abnormal growth in book value. The abnormal growth is the growth beyond what could be achieved by earning the normal rate of return on book value.

As discussed in Section 2.3, book value and its growth are popular valuation metrics only in certain industries such as banking. Analysts in many other industries focus on earnings and earnings growth. In the next section, we show that instead of starting the valuation with book value, one can start with capitalized forward earnings and then add a premium for abnormal earnings growth. We call this model the Forward Earnings Growth (FEG) model.

3.3. Forward Earnings Growth (FEG) model

The starting point in earnings-based valuation is earnings expected at the end of forthcoming year capitalized by the forward PE multiple. The multiple is usually adjusted upward for growth in expected earnings. We start with capitalized expected earnings by putting

$$y_t = e_{t+1} / r$$

which makes

$$z_t = \frac{1}{r}\left(e_{t+1} + r.d_t - R.e_t\right)$$
$$= \frac{1}{r}\left(\Delta e_{t+1} - r.(e_t - d_t)\right)$$

One interprets $r.z_t$ as the increase in expected earnings in excess of the increase due to reinvestment of wealth (e_t – d_t) during the period. The equity value equals capitalized forthcoming earnings plus a premium for growth in expected earnings in excess of the growth that could be realized by simply retaining the wealth generated in a savings account instead of paying dividends. This growth in "abnormal" earnings, rather than earnings, is what matters. We elaborate on this interpretation below.

3.3.1. Using a savings account to illustrate the intuition

There are two ways to value a savings account. The simplest way is to value a savings account based on the amount of cash in it, i.e.,

$$P_t = b_t$$

Alternatively, the value of a savings account equals capitalized expected earnings. The interest income expected from a savings account equals

$$e_{t+1} = r.b_t$$

which implies

$$P_t = \frac{e_{t+1}}{r} = b_t .$$

Let d_t be the withdrawal from the savings account. The remaining amount $(e_{t+1} - d_{t+1})$ increases the savings account balance and yields additional interest income:

$$\Delta e_{t+2} = r.(e_{t+1} - d_{t+1})$$

Such changes in future earnings are value neutral because the reinvestment or withdrawals have zero NPV. Thus, rising earnings alone do not cause price to exceed forthcoming capitalized earnings; the rise must exceed the interest that could be earned by reinvesting the wealth in a savings account. For a savings account, z_t=0 and there is no premium over capitalized forthcoming earnings. Also, $\partial e_{t+1} / \partial d_t = -r$ and $\partial e_t / \partial d_t = 0$. In general, if the last two conditions hold, then z_t does not depend on the dividend policy. That is, if the marginal investment has zero NPV, e.g., a savings account, then z_t does not depend on dividend policy.

3.3.2. Why earnings dominate book values: The role of canceling differences

For a savings account, the book-value-based valuation and earnings-based valuation are equivalent. Real firms, however, are not savings accounts. For real firms, the following applies:

$$e_{t+1} \neq r.b_t$$

$$P_t = \frac{e_{t+1}}{r} + premium1$$

$$P_t = b_t + premium2$$

In many industries, analysts focus on earnings rather than book value. We think they do so because it is easier to forecast steady state earnings rather than steady state book values. As shown below earnings computed under different accounting policies are the same in steady state but book values differ. For example, conservatism understates book values in steady state but does not affect earnings in steady state, which makes capitalized earnings closer to value as compared to book values. That is, premium1 in the above equations is smaller than premium2.

Compare two firms: Capitalize and Conservative with identical cash flows as shown below:

	Y1	Y2	Y3
Receipts and revenues	25	50	50
Expenditure for software development	20	20	20
Net cash flow	5	30	30

The only difference between the two firms is that Capitalize expenses the software expenditures over two years while Conservative expenses the software expenditures immediately. As shown below, in Year 1, they report different expenses, but when they reach steady state in Year 2 and beyond, they report the same expenses and same net income. Their balance sheets, however, differ even in steady state. Thus, accounting policy differences affect earnings only when the firms are growing or shrinking but they affect book values even in steady state. All ratios such as ROE and ROA that use book values are also affected even in steady state.

Capitalize's financial statements:

	Y1	Y2	Y3
Revenue	25	50	50
Expense	10	20	20
Net income	15	30	30
Ending assets:			
Cash	5	35	65
Capitalized software	10	10	10
Ending equity:			
Retained earnings	15	45	75

Conservative's financial statements:

	Y1	Y2	Y3
Revenue	25	50	50
Expense	20	20	20
Net income	5	30	30
Ending assets:			
Cash	5	35	65
Capitalized software	0	0	0
Ending equity:			
Retained earnings	5	35	65

Forecasting a "normal" year is a key part of forecasting. The example above shows that to forecast steady state earnings one need not worry about accounting policies but to forecast book values one must, which is difficult. This partly explains why analysts focus more on earnings than book values.

Valuation theory until now has focused either on book values or on free cash flows. In practice, the former is not popular and latter is usually derived from earnings. The next section bridges the gap between the use of earnings in practice and a lack of theory by providing a simple and usable earnings-based valuation model.

4. A Parameterization of the Forward Earnings Growth Model

Let us revisit the earnings-based valuation formula derived earlier.

$$P_0 = y_0 + \sum_{t=1}^{\infty} R^{-t} z_t$$

where

$$y_t = e_{t+1} / r$$

$$z_t = \frac{1}{r}\left(e_{t+1} + r.d_t - R.e_t\right).$$

By imposing some structure on the pattern on z_t, we derive a short formula.To make the model more realistic yet simple we do not restrict on one-year ahead z_t allowing z_1 to be any positive number. After year 1, we assume z_t grows at a constant rate.

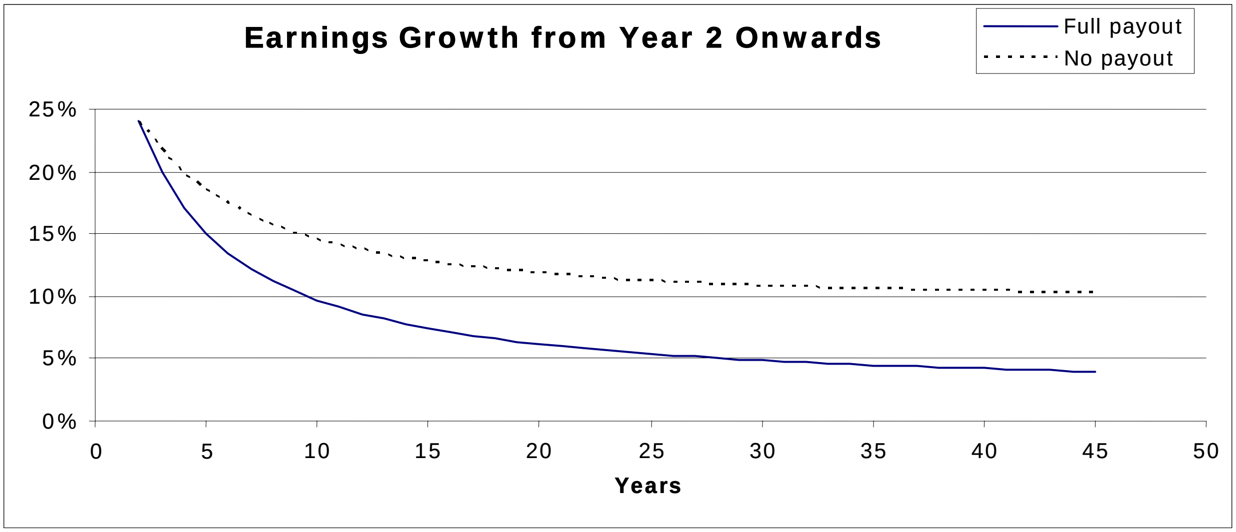
Specifically,

$$z_{t+1} = \gamma z_t,\ \ t \geq 1$$

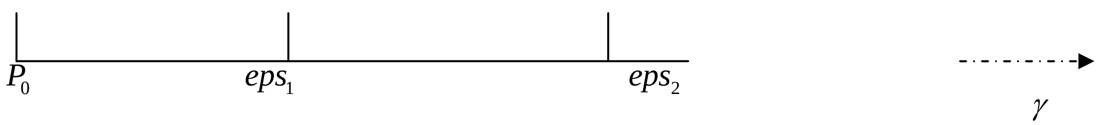
where $\gamma \geq 1$ is some presumed growth parameter and $z_1 > 0$. [If $z_1 = 0$, then $P_0 = \frac{eps_1}{r}$.]

Note that z_t depends on e_{t+1}. By not restricting z_0 and z_1, the model does not restrict either eps_1 or eps_2 thereby allowing three degrees of freedom: eps_1, eps_2, and γ. Note also that z_t does not equal earnings itself; rather it reflects the capitalized change in earnings adjusted for dividends. Thus, $eps_3 \neq \gamma\ eps_2$. The following chart shows EPS patterns under the assumption:

eps_1 = 100; eps_2 = 124; r= 10%; γ= 1.03; dividend payout ratio=100% and *0%*.



With full payout, the very long-term growth in earnings tends to γ-1 [3%]. With no payout, the very long-term growth in earnings tends to *r* [10%] because the retained cash builds up and swamps out the operating assets and the firm starts to look like cash in a savings account.



Straightforward algebra yields the following valuation formula:

$$P_0 = \frac{eps_1}{r}\left[\frac{g_s - \gamma}{r - \gamma}\right]$$

where

$g_s = \dfrac{eps_2 - eps_1}{eps_1} + \dfrac{r \bullet dps_1}{eps_1} =$ Dividend adjusted short-term earnings growth. $r \bullet dps_1$ equals earnings foregone in year 2 from dividends paid in year 1 and is usually small relative to Δeps_2.

$\gamma = \frac{eps_t - eps_{t-1}}{eps_{t-1}}$ as $t \to \infty$. γ equals growth in expected earnings with full payout. In the very long run, one can expect all firms to be identical. Hence, one can reasonably suggest that γ is the same for all firms and it approximates the steady state GNP growth of 3-4%.

The valuation formula is easy to implement using EPS forecasts. It implies that P_0 / eps_1 increases as short-term or long-term *eps* growth increases and cost-of-capital decreases. The valuation formula is consistent with the fact that the P_0 / eps_1 generally exceeds *1/r*.

4.1. Better "comps": Compare implied cost of capital instead of PE or PEG ratio

To assess relative pricing, investors compare key valuation ratios such as EBITDA multiple, PE multiple, or the PEG ratio (which equals PE multiple divided by growth). For a metric to be useful for such "comps" it must be easy to compute from readily available data and should capture key valuation variables. We discuss how the PE and the PEG ratios are used as "comps" and then propose a better "comp".

Two stocks have different price to forward earnings ratio because of the following reasons:

- They have different earnings growth beyond one year.
- They have different risk.
- One or both of them is mispriced.
- "Stale" or non-representative measures of the market's earnings expectations: Because the earnings expectations of the market are not observable, analysts are forced to use a proxy for market expectations such as consensus earnings forecasts from IBES or Firstcall. This can cause forward PE ratios to be noisy if the consensus forecast is "stale" or incorrectly measured. In other words, the PE ratio might be high if the market has revised the forecast

upward but the consensus forecast has not been updated, or the IBES or Firstcall consensus forecast understates market expectations. That is, a high PE ratio might be followed by upward revisions in earnings or earnings growth, and vice versa.

One can *try* to correct for different growth in expected earnings by dividing the PE ratio by the growth in expected earnings. If this adjustment is correct, then the differences in PEG ratios must be due to risk or mispricing. The analysts can then assess whether risk differences justify PEG differences. The problem is: How exactly should one correct the PE ratio for growth? A formal model is needed to ascertain whether a PE ratio is high or low for a given level of growth.

Our valuation formula is a better way of incorporating expected earnings as well as growth in expected earnings. One can infer the implicit discount rate that relates current price to expected earnings and using the following "square root" formula:

$$r = A + \sqrt{A^2 + \frac{eps_1}{P_0} \times \left(\frac{\Delta eps_2}{eps_1} - (\gamma - 1) \right)}$$

where

$$A \equiv \frac{1}{2}\left(\gamma - 1 + \frac{dps_1}{P_0} \right)$$

and

$$1 \le \gamma < (1 + r)$$

If you assume $\gamma = 1$ and $dps_1 = 0$, then the above formula reduces to the following:

$$r = \sqrt{\frac{eps_1}{P_0} \times \frac{eps_2 - eps_1}{eps_1}} = \sqrt{\frac{earnings\ growth}{PE\ ratio}} = \sqrt{\frac{1}{PEG\ ratio}}$$

Similar to the PEG ratio, the implicit cost of equity capital depends on risk, mispricing, and stale data. Empirical studies have shown that the implied cost of the capital has more validity than the PEG ratio because it is better related to observable risk factors and a very high implied cost of capital is followed by a downward revision in earnings expectations and vice versa.

5. Summary and Conclusion

The paper proceeds in three steps. First it presents and critiques the extant valuation approaches namely the discounted-dividends model (DDM), the discounted free cash flows model (DCF), and the residual income valuation model (RIV). Second, it presents a framework to unify these extant models and to derive a model based on earnings and earnings growth, which are the two most heavily watched metrics in the real world. Third, it presents a parsimonious parameterization of the earnings-based model that is easy to implement and yet provides powerful insights into a firm's value and its perceived risk.

The main benefit of the earnings-based approach is that it provides a firm theoretical foundation for accounting metrics that the real world relies upon but which until now could not be defended or understood theoretically without resorting to unrealistic assumptions that equated earnings to dividends or cash flows.

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