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Rethinking capital budgeting: embedding ex-ante alpha in the cost of capital

Agisilaos Papadogiannis
Independent Researcher

Abstract

Traditionally, the cost of capital is treated as equal to the full expected return. This Note introduces an effective cost of capital that adjusts the benchmark rate for a gain of capital term capturing the systematic effect of bias in cash-flow forecasts. The gain of capital provides a horizon-specific proxy for the systematic component of alpha, estimated for a given asset class and horizon and used ex ante as a correction within DCF valuation. In this way, the structural component of forecast bias is corrected, while residual ex post alpha remains possible but should be smaller. The framework separates valuation from capital budgeting: biased cash flows are discounted at the effective cost of capital, while project acceptance compares that effective rate to the risk-free rate, providing a more disciplined investment threshold.

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Contact: Agisilaos Papadogiannis - apapadogiannis@gmail.com.
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1. Introduction

Discounted cash flow (DCF) valuation remains a foundational tool in financial analysis and project evaluation (Williams, 1938; Damodaran, 2025). At its core lies the cost of capital, used both to discount expected cash flows and to benchmark investment performance (Brealey et al., 2022; Copeland et al., 2004; Modigliani and Miller, 1958). In DCF terms, the cost of capital c belongs in the denominator and reflects compensation for bearing systematic market risk, while systematic biases in cash-flow forecasts affect the numerator and are usually not modeled as a separate component.

In practice, expected returns often deviate from factor-implied benchmarks and are interpreted as alpha or ex post anomalies (Sharpe, 1964; Jensen, 1968). This Note attempts an alternative interpretation. It treats the systematic part of such deviations as a forward-looking adjustment that belongs inside the valuation model. We formalize this through the gain of capital $g_{t,T}$, a horizon-specific excess return term that reflects systematic bias in projected cash flows due to informational, behavioral, or modeling frictions, as documented in the literature on forecast errors and slow adjustment to fundamentals (e.g. Givoly et al., 2009; Easterwood and Nutt, 1999; La Porta, 1996).

The gain of capital is defined as a function of the benchmark cost of capital and a valuation ratio $K_{t,T}$ that summarizes the systematic misestimation profile of a given asset class and horizon. The ratio $K_{t,T}$ can be calibrated from historical valuation and return data and then used ex ante. Operationally, the analyst first computes a conventional DCF value PV_t^{bias} from current cash-flow projections and $c_{t,T}$, then applies the horizon-specific factor $K_{t,T}$ to obtain an adjusted fair value $PV_t^{\text{fair}} = K_{t,T} PV_t^{\text{bias}}$ that reflects the asset's characteristic tendency for forecasts to deviate from realized outcomes. The framework is intended to correct this structural component of cash-flow expectation bias; it does not eliminate all ex post alpha, which can still arise from new information, idiosyncratic shocks, and structural changes, but its magnitude should be reduced once the systematic component has been compensated.

On this basis, we define an effective cost of capital c_{eff} as the discount rate that keeps a biased DCF valuation internally consistent with fair value. The effective cost of capital is constructed from the benchmark rate $c_{t,T}$ and the gain of capital $g_{t,T}$ and serves as the operational input for discounting biased cash flows. For interpretive purposes, we also introduce an economic return $R_{t,T}^{\text{econ}}$, which expresses the expected gross return as the sum of the benchmark component and the gain of capital, but the analysis shows that c_{eff} is the quantity that should enter the DCF.

The framework has two main implications. First, valuation under systematic forecast bias should use the effective cost of capital c_{eff} rather than the benchmark rate $c_{t,T}$ (Sections 2 and 3). Second, capital budgeting decisions should benchmark c_{eff} against the risk-free rate r_f, which provides a disciplined threshold for project acceptance (Section 5). The broader motivation and bibliographic background on systematic cash-flow misestimation and related risk measures are developed in Papadogiannis (2026).

2. Systematic Cash-Flow Misestimation

Consider a project evaluated over a horizon $[t, T]$ with expected cash flows $\{CF_{t+1}, \ldots, CF_T\}$. Under standard valuation with unbiased forecasts, and under a forecasting regime with systematic directional errors due to behavioral, informational, or institutional frictions, the fair and biased present values discounted at the benchmark cost of capital $c_{t,T}$ are

$$
\begin{aligned}
PV_t^{\text{fair}} &= \sum_{i=1}^{T-t} \frac{CF_{t+i}}{(1+c_{t,T})^i}, \\
PV_t^{\text{bias}} &= \sum_{i=1}^{T-t} \frac{CF_{t+i}^{\text{bias}}}{(1+c_{t,T})^i},
\end{aligned}
\tag{1}
$$

where CF_{t+i}^{bias} captures the prevailing overestimation or underestimation of cash flows.

We summarize the resulting valuation distortion by the horizon-dependent ratio

$$
K_{t,T} := \frac{PV_t^{\text{fair}}}{PV_t^{\text{bias}}}. \tag{2}
$$

For a given asset class and forecasting regime, $K_{t,T} \neq 1$ indicates systematic cash-flow misestimation and can be viewed as an empirically calibratable distortion in present values, consistent with evidence on forecast errors and slow adjustment to fundamentals (e.g. Givoly et al., 2009; Easterwood and Nutt, 1999; La Porta, 1996). These studies document biased cash-flow and earnings forecasts, under-reaction to fundamental information, and delayed incorporation of news into prices, which supports treating the bias as a structural feature of the forecasting process rather than idiosyncratic project-level noise. Operationally, the analyst first computes PV_t^{bias} from current cash-flow projections and $c_{t,T}$, then applies a horizon-specific $K_{t,T}$ calibrated from historical valuation–return data to obtain an adjusted fair value $PV_t^{\text{fair}} = K_{t,T} PV_t^{\text{bias}}$.

We define the gain of capital $g_{t,T}$ as the horizon excess return implied by the valuation ratio $K_{t,T}$ once it is scaled by the benchmark growth path $(1 + c_{t,T})^{T-t}$:

$$
g_{t,T} := \left(K_{t,T} - 1\right)(1 + c_{t,T})^{T-t}. \tag{3}
$$

In this sense, $K_{t,T}$ summarizes the cumulative misestimation over $[t, T]$ in present-value terms, while $g_{t,T}$ expresses the same distortion as an equivalent horizon excess return relative to the benchmark growth path. Given $c_{t,T}$ and $K_{t,T}$, the gain of capital $g_{t,T}$ follows mechanically from this definition. It reconciles the biased valuation PV_t^{bias} with the fair present value PV_t^{fair} and may be positive or negative, depending on whether valuations are on average optimistic or pessimistic. In empirical applications, $K_{t,T}$ and $g_{t,T}$ should therefore be interpreted as capturing the systematic, calibratable part of cash-flow expectation bias for a given asset class and horizon; residual ex post alpha can still arise from new information and idiosyncratic shocks, but should in principle be smaller once this systematic component has been incorporated.

3. Effective Cost of Capital

Given systematic cash-flow misestimation, the question arises what discount rate keeps the biased DCF valuation consistent with the fair value implied by the benchmark cost of capital and the gain of capital.

From the definitions of the valuation ratio $K_{t,T}$ and the gain of capital in (2) and (3), it follows that

$$PV_t^{\text{fair}} = PV_t^{\text{bias}} K_{t,T} = PV_t^{\text{bias}} \left(1 + \frac{g_{t,T}}{(1 + c_{t,T})^{T-t}} \right). \tag{4}$$

We define the effective cost of capital c_{eff} for the horizon $[t, T]$ as the (unique) constant discount rate that, when applied to the biased cash–flow stream $\{CF_{t+i}^{\text{bias}}\}_{i=1}^{T-t}$, reproduces the fair present value PV_t^{fair} defined in (1) and is consistent with the link in (4). For discounting purposes, this stream is equivalent to a single horizon payoff $\widetilde{CF}_T^{\text{bias}}$ satisfying

$$PV_t^{\text{fair}} = \frac{\widetilde{CF}_T^{\text{bias}}}{(1 + c_{\text{eff}})^{T-t}}. \tag{5}$$

Applying (4) to the equivalent payoff $\widetilde{CF}_T^{\text{bias}}$, the equality of present values can be written as

$$\frac{\widetilde{CF}_T^{\text{bias}}}{(1 + c_{\text{eff}})^{T-t}} = \frac{\widetilde{CF}_T^{\text{bias}}}{(1 + c_{t,T})^{T-t}} \left(1 + \frac{g_{t,T}}{(1 + c_{t,T})^{T-t}} \right). \tag{6}$$

Cancelling $\widetilde{CF}_T^{\text{bias}}$ from both sides of (6) yields an equality of discount factors and, by taking reciprocals, the corresponding gross factor:

$$\frac{1}{(1 + c_{\text{eff}})^{T-t}} = \frac{1 + \frac{g_{t,T}}{(1 + c_{t,T})^{T-t}}}{(1 + c_{t,T})^{T-t}} \quad \Rightarrow \quad (1 + c_{\text{eff}})^{T-t} = \frac{(1 + c_{t,T})^{T-t}}{1 + \frac{g_{t,T}}{(1 + c_{t,T})^{T-t}}}. \tag{7}$$

Finally, taking the $(T - t)$-th root yields the effective cost of capital

$$c_{\text{eff}} = \left(\frac{(1 + c_{t,T})^{T-t}}{1 + \frac{g_{t,T}}{(1 + c_{t,T})^{T-t}}} \right)^{\frac{1}{T-t}} - 1. \tag{8}$$

In this representation, the gain of capital $g_{t,T}$ is embedded in an adjusted discount rate c_{eff} that preserves internal consistency of the DCF valuation while summarizing the effects of both $c_{t,T}$ and systematic cash-flow bias in a single rate. The expression in (8) is well defined if and only if the term in the denominator is positive, that is,

$$1 + \frac{g_{t,T}}{(1 + c_{t,T})^{T-t}} > 0 \quad \Longleftrightarrow \quad g_{t,T} > -(1 + c_{t,T})^{T-t}. \tag{9}$$

When this condition holds, c_{eff} is real-valued and can be interpreted as an effective cost of capital for the biased cash-flow projections. When it is violated, the implied valuation factor becomes non-positive and a single effective discount rate can no longer represent the combined effect of $c_{t,T}$ and $g_{t,T}$, which signals a breakdown of the standard DCF approach. In such cases, practical valuation should rely more on alternative methods such as asset-based approaches (Damodaran, 2025; Copeland et al., 2004), scenario analysis (Benninga, 2014), or real options valuation (Trigeorgis, 1996).

Figure 1 illustrates how c_{eff} varies with the benchmark rate c for different values of g in the simple case $T - t = 1$. Lower (more negative) values of g raise c_{eff}, penalizing overoptimism in projected cash flows.

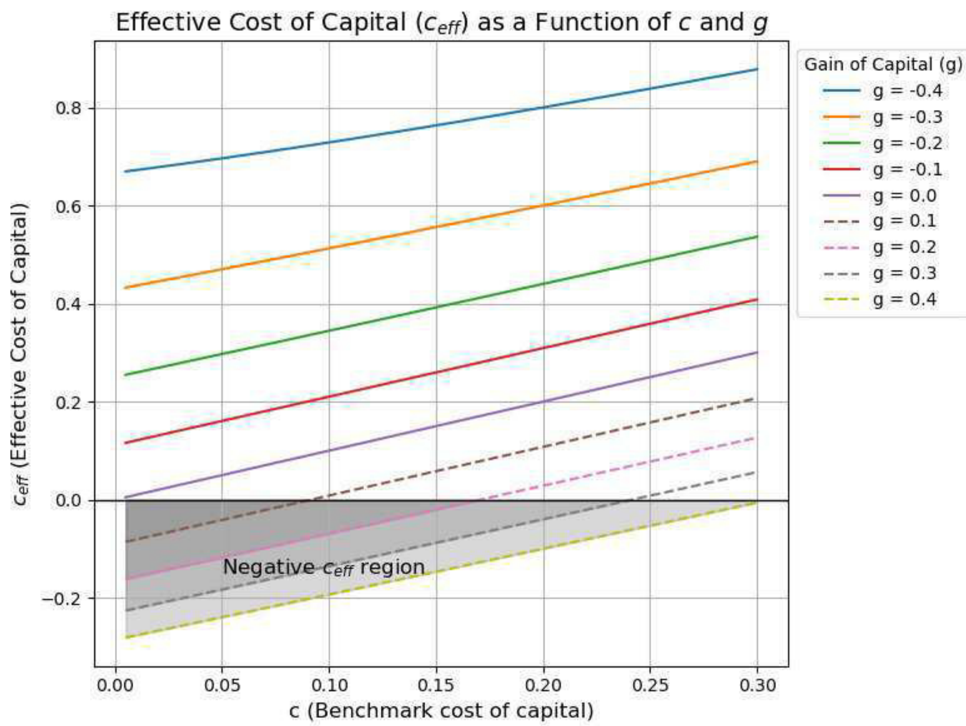

Figure 1: Effective cost of capital c_{eff} as a function of the benchmark rate c, for various values of the gain of capital g. The investment horizon is set to $T - t = 1$. Lower values of g raise c_{eff}, penalizing overoptimism in projected cash flows.

4. Economic Return and Its Components

We define the economic return over the horizon $[t, T]$ as a conceptual identity for the full expected return when both the benchmark cost of capital and the gain of capital are taken into account:

$$1 + R_{t,T}^{\text{econ}} := (1 + c_{t,T})^{T-t} + g_{t,T}, \tag{10}$$

where $(1 + c_{t,T})^{T-t}$ is the return implied by the cost of capital and $g_{t,T}$ is the gain of capital from Section 2. This identity serves only as an interpretive device for separating the benchmark component from the effect of systematic cash-flow misestimation and is not used directly to discount cash flows.

The discount rate that enters the DCF is the effective cost of capital c_{eff} derived in Section 3, which summarizes the combined effect of $c_{t,T}$ and $g_{t,T}$ in a single rate. In the special case without misestimation, the two notions coincide:

$$g_{t,T} = 0 \quad \Longrightarrow \quad c_{\text{eff}} = c_{t,T} \quad \text{and} \quad R^{\text{econ}}_{t,T} = (1 + c_{t,T})^{T-t} - 1. \tag{11}$$

When $g_{t,T} \neq 0$, $R^{\text{econ}}_{t,T}$ provides intuition about the total return implied by expectations, while c_{eff} is the quantity that preserves valuation consistency. In empirical applications, the gain of capital should therefore be viewed as correcting the systematic, calibratable component of cash-flow expectation bias for a given asset class and horizon; ex post alpha can still arise from new information, idiosyncratic shocks, and structural changes that are not captured by $K_{t,T}$, but its magnitude should be smaller once this systematic component has been incorporated.

5. Valuation and Capital Budgeting

When future cash flows are systematically misestimated, a benchmark cost of capital c is no longer sufficient to guide valuation and investment decisions (Brealey et al., 2022; Papadogiannis, 2026). The effective cost of capital c_{eff} adjusts the discount rate to reflect both the benchmark component and the gain of capital g, and is constructed from c and g so as to preserve valuation consistency under systematic bias.

This framework separates two functions:

- **Valuation.** If the gain of capital satisfies $g > -(1+c)^{T-t}$, equivalently $K_{t,T} > 0$, the effective discount rate c_{eff} is well defined and can be used to discount biased cash flows. If this condition is violated, the valuation ratio $K_{t,T}$ becomes non-positive, so a positive biased present value no longer maps into a meaningful fair value and the DCF model effectively breaks down. In such cases, alternative valuation methods such as asset-based approaches, scenario analysis, or real options valuation should be considered (Damodaran, 2025; Pignataro, 2022).

- **Capital budgeting.** To enforce investment discipline, c_{eff} is compared to the risk-free rate r_f. If $c_{\text{eff}} > r_f$, it is used in the NPV calculation; otherwise, the project is evaluated using r_f as a conservative benchmark. Extremely high values of c_{eff} may signal unrealistic assumptions, such as overly optimistic forecasts or structural modeling bias, in which case expectations or the valuation model should be reassessed before proceeding.

The valuation logic is shown in Figure 2, where the use of c_{eff} ensures consistency under biased expectations. Figure 3 illustrates the capital budgeting decision process, which compares c_{eff} to the risk-free rate r_f and highlights when extreme values warrant a reassessment of inputs or model structure.

In practice, neither c nor g is directly observed. The benchmark cost of capital c is typically estimated from market data or factor models, and the underlying valuation ratio $K_{t,T}$, and thus $g_{t,T}$, can be calibrated from historical combinations of valuations and subsequent realized returns for the relevant asset class and horizon, as illustrated in Papadogiannis (2026, Section 7). This use of historical information is analogous to the way betas or risk premia are estimated and then applied ex ante to new investment decisions.

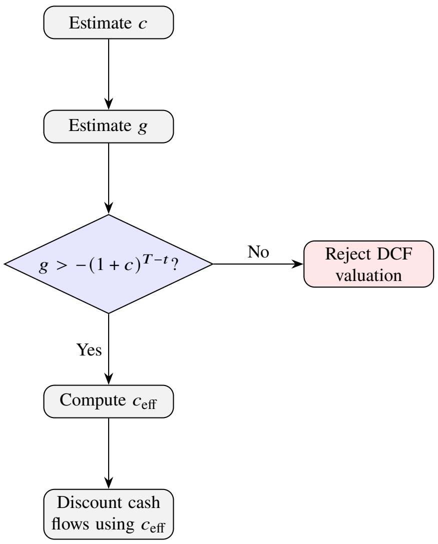

Figure 2: Valuation algorithm under biased cash-flow expectations.

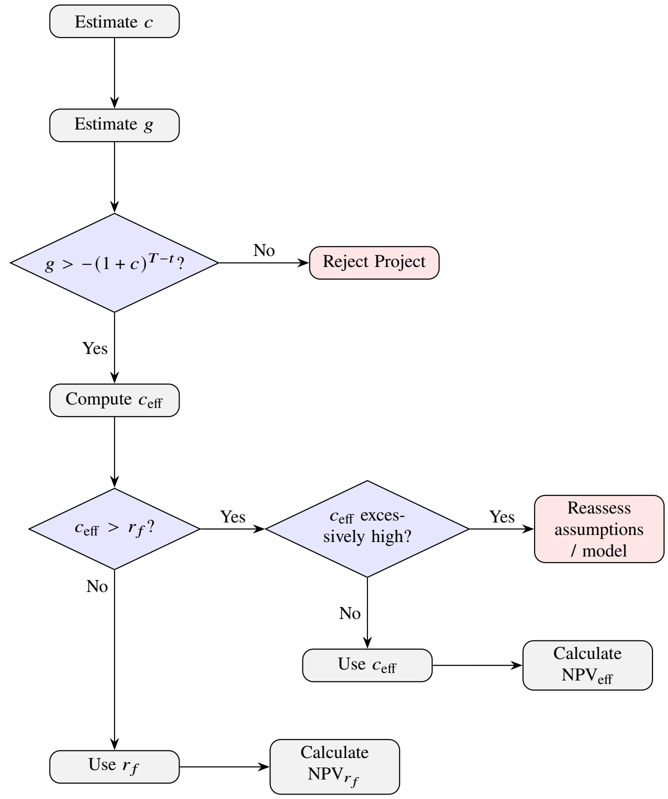

Figure 3: Capital budgeting decision algorithm.

6. Conclusion

This Note reinterprets part of *alpha* as an intrinsic, forward-looking component of valuation, captured by the gain of capital g (for a given horizon), rather than treating all deviations as purely ex post anomalies. By linking g to a valuation ratio K and combining it with the benchmark cost of capital c, we obtain an effective cost of capital c_{eff} that keeps biased DCF valuations consistent with fair value. This reframing separates valuation from investment: biased cash flows are discounted at c_{eff}, while project acceptance compares c_{eff} to the risk-free rate r_f, yielding a more disciplined capital-budgeting rule under biased expectations. In empirical use, the framework is intended to correct the systematic, calibratable component of expectation bias; residual ex post alpha can still arise from new information, idiosyncratic shocks, and structural changes outside the scope of K, but its magnitude should be reduced.

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