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Abstract

This paper aims to reconcile two measures of return on shareholders' capital: on one hand, the expected return arising from the use of the Capital Asset Pricing Model (CAPM), and on the other, the realized Return on Equity (ROE) as an accounting measure of capital efficiency. Both metrics ultimately refer to the same underlying variable—the cost of equity K_e—yet they are seldom analyzed jointly in the literature. Using quarterly fundamental data for all S&P 500 constituents from 1996 to 2025, we construct aggregate earnings yields and book ROE series and compare them against realized index-level total returns. Our hypothesis is that, over sufficiently long horizons, both indicators should converge, since expected returns should equal realized returns when expectations are fulfilled on average. We find that the long-run annualized S&P 500 total return (10.1%) lies between the average aggregate earnings yield (4.3%) and the average book ROE (13.3%), with the wedge fully explained by the Price-to-Book ratio and the earnings growth rate through the Gordon Growth Model identity $E(R) = (\mathrm{ROE} - g)/(\mathrm{P/B}) + g$. The convergence tightens as the observation horizon lengthens, consistent with the theoretical prediction.

JEL Classification: G11, G12, C58, G31, G32.

Keywords: Beta, CAPM, ROE, expected returns, realized returns, equity valuation, earnings yield, price-to-book ratio.

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1 Introduction

Finance, at its core, is about expectations regarding cash flows, risk, and return in capital markets and hence decisions, and these are made forward-looking, yet in most situations, the past provides a reasonable estimate for the future. In the field of modern finance, measuring risk and estimating the expected return of an asset are fundamental aspects of investment decision-making.

The concept of return is inherently associated with exposure to risk in a world populated by risk-averse agents. A central challenge in financial analysis is determining an appropriate expected rate of return when valuing a financial asset. For equities, the expected return serves as the discount rate to evaluate the stream of future cash flows—principally dividends—in order to determine the present value of a share. In this context, the most widely used approach in practice is the Capital Asset Pricing Model (CAPM; Sharpe, 1964; Lintner, 1965), which, although applicable to any asset class, is predominantly associated with equity valuation.

While the CAPM provides a straightforward framework for computing the excess return that a stock should offer above the risk-free rate to compensate investors for systematic risk exposure, it is fundamentally a *forward-looking* model—it speaks to expected returns, though in most of the cases it is calculated using past data as a proxy for the future. On the other hand, the Return on Equity (ROE) measures the realized return on the capital invested by shareholders, including retained earnings reinvested by the firm. ROE is an accounting-based, *backward-looking* measure of capital use efficiency. But in the end, without earnings there are no dividends, and without dividends there is no value, so we combine the dimension of expected earnings with the dimension of them delivered over time.

The purpose of this paper is to reconcile, on the basis of historical data, these two metrics of return on shareholders' capital: realized cumulative returns measured through market prices (as predicted by the CAPM) and the accounting return on equity (ROE). We employ a diversified stock index—the S&P 500—to conduct this analysis, which serves two purposes: first, it substantially reduces idiosyncratic risk through diversification across approximately 500 large-capitalization companies; and second, it ensures a sample of established firms with consistent earnings records for which ROE can be meaningfully computed.

The remainder of the paper is organized as follows. Section 2 reviews the definitions of the CAPM expected return and ROE. Section 3 develops the theoretical relationship between both measures. Section 4 presents our empirical model and hypotheses. Section 5 describes the data sources and construction. Section 6 details our methodology. Section 7 presents the quantitative results. Section 8 extends the analysis to the joint behaviour of valuations, profitability and the cost of equity. Section 9 concludes.

2 Definitions: CAPM Expected Return and ROE

2.1 The CAPM Model

The Capital Asset Pricing Model is based on the return that a diversified investor would expect from an equity investment, given efficient and competitive capital markets.[1] The expected cost of equity for shareholders is given by:

$$K_e = R_f + \beta \cdot \big(E(R_m) - R_f\big) \tag{1}$$

where R_f is the risk-free rate, β measures the contribution of the asset's risk to a diversified portfolio, and $\big(E(R_m) - R_f\big)$ is the equity risk premium (ERP)—the excess return over a risk-free investment that a diversified investor expects from a market portfolio.[2]

In simple terms, the CAPM answers two fundamental questions for a stock investor: (i) How much systematic risk does the investment carry (β)? and (ii) What is the expected compensation for bearing market risk ($E(R_m) - R_f$)?

The rate obtained from the CAPM is also interpreted as the discount rate reflecting the opportunity risk-adjusted cost of capital—the return foregone by not investing in an alternative activity of comparable risk. Importantly, the model is forward-looking: although it uses historical price data as a proxy for future expectations, the underlying prices themselves embed expectations of future cash flows.

For the S&P 500 index as the market portfolio, $\beta = 1$ by construction, so:

$$K_e^{\text{SP500}} = E(R_m) \tag{2}$$

That is, the CAPM expected return for the index *is* the expected market return itself. Empirically, this is best proxied by the realized total return (price appreciation plus reinvested dividends) of the S&P 500 over extended horizons, using past data embedded in prices and price variations to estimate expected returns.

[1] The CAPM is a single-factor model. It has since evolved into multi-factor specifications (Fama and French, 1993; Carhart, 1997), though the original remains the most widely used in practice.

[2] In practice, additional risk premia such as sovereign risk spreads may be incorporated.

2.2 Return on Equity

On the other hand, Return on Equity (ROE) provides an accounting-based measure of how efficiently a firm uses shareholders' capital to generate profits. It is among the most widely used financial ratios by investors, analysts, and corporate executives.

ROE is defined as:

$$\text{ROE} = \frac{\text{Net Income}}{\text{Shareholders' Equity}} \tag{3}$$

where net income is profit after taxes and all expenses, and shareholders' equity comprises share capital, reserves, and retained earnings—the total funds contributed and eventually reinvested by shareholders or distributed as dividends (recall that without earnings, there are no dividends and hence no value).

A high ROE indicates effective use of shareholder capital, while a low ROE may signal managerial inefficiency or structural profitability problems. The metric enables comparisons of capital efficiency both across firms and over time.

ROE occupies a central role in value investing and fundamental analysis: without earnings there are no dividends, and hence no value. Practitioners routinely screen for companies that sustain high returns on equity without excessive leverage, viewing this as a hallmark of durable competitive advantages and efficient capital allocation. In the academic literature, the DuPont decomposition—which disaggregates ROE into profit margin, asset turnover, and financial leverage—has become a standard tool for diagnosing the sources of a firm's profitability and assessing its sustainability (Soliman, 2008). More broadly, ROE serves as the key input in residual income valuation models, where a firm's intrinsic value is expressed as book equity plus the present value of future excess returns (ROE minus the cost of equity) applied to book value (Ohlson, 1995). This direct link between ROE and equity valuation makes it a natural bridge between accounting fundamentals and market pricing—precisely the connection this paper seeks to formalize empirically.

Crucially, ROE measures the return on *book value* of equity, which in general differs from the return on *market value* of equity. This distinction is at the heart of the analysis that follows.

3 The Theoretical Relationship Between CAPM and ROE

At first glance, ROE and the CAPM expected return appear to belong to different domains: one is an accounting indicator on realized earnings, while the other is a financial risk metric arising from variations in stock prices, which embed the present value of future dividends. However, their relationship runs deeper than it may seem. Both converge on a common concept: the *cost of equity* (K_e), which constitutes a fundamental nexus for this work.

If a company's ROE exceeds its cost of capital (as computed via the CAPM), it is creating economic value for shareholders. Conversely, if the ROE falls below the cost of capital, the company is destroying value—even if it reports positive accounting profits. This is the essence of the Economic Value Added (EVA) framework (Stewart, 1991).

The formal bridge between the two metrics operates through the Price-to-Book (P/B) ratio. Define the *earnings yield* as:

$$\text{EY} = \frac{\text{Net Income}}{\text{Market Capitalization}} = \frac{\text{ROE}}{\text{P/B}} \tag{4}$$

This identity holds by construction, since P/B = Market Cap/Book Equity. The earnings yield represents the return on *market-priced* capital and is thus directly comparable to the cost of equity.

Under the Gordon Growth Model framework, the expected total return on equity can be derived as follows. The model states $P = D_1/(r - g)$, which rearranges to $r = D/P + g$, where D/P is the dividend yield and g is the sustainable growth rate. If the firm retains a fraction k of earnings, then $g = \text{ROE} \times k$, so the payout ratio is $(1 - k) = (\text{ROE} - g)/\text{ROE}$. The dividend yield can therefore be expressed as:

$$\frac{D}{P} = \text{EY} \times \frac{\text{ROE} - g}{\text{ROE}} = \frac{\text{ROE}}{\text{P/B}} \times \frac{\text{ROE} - g}{\text{ROE}} = \frac{\text{ROE} - g}{\text{P/B}} \tag{5}$$

Substituting back into the Gordon model, the expected return becomes:

$$E(R) = \frac{\text{ROE} - g}{\text{P/B}} + g \tag{6}$$

This decomposition yields three testable implications:

(i) The earnings yield EY = ROE/P/B overstates the dividend yield by the retained earnings component; the relevant yield for expected return computation is $(\text{ROE} - g)/\text{P/B}$, which accounts for the fraction of earnings reinvested to generate growth.

(ii) The book ROE alone overstates the return that shareholders earn on their market-priced investment, because P/B > 1 for the typical S&P 500 firm. However, part of the ROE is retained to fund growth g, so the realized return reflects both the distributed yield and the capital gains from reinvestment.

(iii) Over sufficiently long horizons, the realized return should converge to $(\text{ROE}-g)/\text{P/B}+g$, and the wedge between book ROE and realized returns should be jointly explained by the P/B ratio and the retention-funded growth rate.

4 Empirical Model and Hypotheses

Few research works directly relate the financial returns arising from the CAPM with the accounting returns captured by ROE, despite both being focused on measuring the return for shareholders. Murphy and AlSalman (2023) analyze 150 years of real stock returns and find a near one-to-one relationship between stock returns and real earnings yields, which provides some precedent for our approach.

Our work takes a complementary direction. We analyze the historical relationship between expected returns (proxied by realized S&P 500 total returns, consistent with $\beta = 1$ in the CAPM) and accounting returns (through aggregate ROE and earnings yield calculations) for all companies in the S&P 500 index. The choice of a broad index is deliberate, as it addresses two concerns:

- **Diversification:** aggregating across approximately 500 companies substantially reduces idiosyncratic noise.
- **Earnings maturity:** established index constituents are far more likely to have consistent positive earnings, making ROE calculations meaningful.

We formalize the following hypotheses:

Hypothesis 1 (Long-run convergence): Over expanding time horizons, the cumulative annualized total return of the S&P 500 converges toward the level predicted by the Gordon Growth Model:

$$\overline{R}_T \xrightarrow{T\to\infty} \frac{\overline{\text{ROE}}_T - \overline{g}_T}{\overline{\text{P/B}}_T} + \overline{g}_T \tag{7}$$

Hypothesis 2 (P/B wedge): The gap between the book ROE and the earnings yield is fully explained by the Price-to-Book ratio, with the accounting identity $\text{EY} = \text{ROE}/\text{P/B}$ holding exactly at each observation point.

Hypothesis 3 (Tightening with horizon): The cross-sectional dispersion between forward realized returns and the earnings yield decreases as the forward horizon increases, reflecting the diminishing impact of short-term earnings noise and valuation fluctuations.

5 Data

5.1 Data Source

All fundamental and price data are sourced from the Sharadar database, accessed through the Nasdaq Data Link platform. The Sharadar dataset provides point-in-time quarterly financial statements for all publicly traded U.S. equities, including net income, shareholders' equity, market capitalization, and share prices. Crucially, each record includes both the `calendardate` (the fiscal quarter-end to which the data pertains) and the `datekey` (the actual date on which the data was filed or became publicly available), enabling the construction of point-in-time analysis free from look-ahead bias.

S&P 500 constituent membership history is also obtained from Sharadar (`SHARADAR/SP500`), which records the date and action (added or removed) for every index change since inception of the database.

5.2 Sample Construction

The sample spans from Q1 1996 through Q3 2025 and comprises 57,912 firm-quarter observations across 1,134 unique tickers that were members of the S&P 500 at some point during the sample period. For each calendar quarter, we determine index membership by reconstructing each company's membership periods from the historical constituent change records, thereby accounting for both additions and deletions (survivorship bias correction).

5.3 Reporting Cutoff

A key methodological consideration is that S&P 500 components report their quarterly earnings on different dates within the post-quarter filing season. To ensure that our aggregate metrics reflect substantially complete information, we impose a 90-day cutoff: for each calendar quarter-end, we include only those records whose filing date (`datekey`) falls within 90 days of the quarter-end. Table 1 reports the coverage achieved at various cutoff thresholds.

Table 1: Reporting Coverage by Cutoff Lag

Cutoff (days after quarter-end)	Records included	Coverage (%)
45	41,477	71.6
60	50,177	86.7
75	54,481	94.1
90	**57,084**	**98.6**

The 90-day cutoff ensures that approximately 99% of constituent records are included each quarter, consistent with the convention used in the academic earnings literature (Fama and French, 1993).

5.4 Key Variables

For each firm-quarter observation passing the cutoff filter, we retain:

- **Net Income** (`netinc`): quarterly net income, used as the ROE numerator.
- **Shareholders' Equity** (`equity`): end-of-period book equity.
- **Market Capitalization** (`marketcap`): end-of-quarter market capitalization.
- **Share Price** (`price`): used to compute value-weighted quarterly returns.

6 Methodology

6.1 Aggregate Metric Construction

At each calendar quarter t, we compute aggregate S&P 500 metrics by summing across all constituent firms $i \in \mathcal{S}_t$ that are members of the index and have reported within the 90-day window:

$$\text{Total Net Income}_t = \sum_{i \in \mathcal{S}_t} \text{NI}_{i,t} \tag{8}$$

$$\text{Total Market Cap}_t = \sum_{i \in \mathcal{S}_t} \text{MCap}_{i,t} \tag{9}$$

$$\text{Total Book Equity}_t = \sum_{i \in \mathcal{S}_t} \text{Equity}_{i,t} \tag{10}$$

6.2 Annualization of Net Income

A single quarter's net income must be annualized before computing yields. We employ two approaches and compare their properties:

Trailing Twelve Months (TTM). The primary methodology sums the last four reported quarters:

$$\text{NI}_t^{\text{TTM}} = \sum_{k=0}^{3} \text{Total Net Income}_{t-k} \tag{11}$$

This approach smooths seasonal variation and provides a more stable estimate of annual earnings capacity.

Quarterly × 4 (Q×4). The alternative simply annualizes the most recent quarter:

$$\mathrm{NI}_t^{Q\times 4} = 4 \times \text{Total Net Income}_t \tag{12}$$

This approach is more responsive to recent conditions but amplifies quarterly volatility.

6.3 Earnings Yield and Book ROE

Using the annualized net income, we compute:

$$\mathrm{EY}_t = \frac{\mathrm{NI}_t^{\mathrm{ann}}}{\text{Total Market Cap}_t} \tag{13}$$

$$\mathrm{ROE}_t = \frac{\mathrm{NI}_t^{\mathrm{ann}}}{\text{Total Book Equity}_t} \tag{14}$$

$$\mathrm{P/B}_t = \frac{\text{Total Market Cap}_t}{\text{Total Book Equity}_t} \tag{15}$$

6.4 S&P 500 Quarterly Returns

Since external market data sources were unavailable, we construct the S&P 500 value-weighted quarterly return directly from constituent-level data. For each pair of consecutive quarters $(t-1, t)$:

1. Identify firms present in both quarters with valid prices and market capitalizations.
2. Compute each firm's quarterly price return: $r_{i,t} = P_{i,t}/P_{i,t-1} - 1$.
3. Aggregate using beginning-of-period market cap weights: $R_t^{\mathrm{price}} = \sum_i w_{i,t-1} \cdot r_{i,t}$, where $w_{i,t-1} = \mathrm{MCap}_{i,t-1}/\sum_j \mathrm{MCap}_{j,t-1}$.
4. Add an estimated quarterly dividend yield of 0.45% (1.8% annualized) for total return: $R_t^{\mathrm{total}} = R_t^{\mathrm{price}} + 0.0045$.

The resulting annualized total return over the full sample (1996–2025) is 10.12%, consistent with the widely reported long-run S&P 500 total return, validating this construction.

6.5 Forward Returns

For each quarter t, we compute forward cumulative total returns over horizons of $h \in \{4, 12, 20\}$ quarters (corresponding to 1, 3, and 5 years):

$$R_{t\to t+h} = \prod_{k=1}^{h}(1 + R^{\text{total}}_{t+k}) - 1 \tag{16}$$

and annualize as $R^{\text{ann}}_{t,h} = (1 + R_{t\to t+h})^{4/h} - 1$.

7 Quantitative Results

7.1 Summary Statistics

Table 2 presents descriptive statistics for the key variables over the 118 quarterly observations from Q2 1996 through Q3 2025.

Table 2: Summary Statistics: S&P 500 Aggregate Metrics (1996–2025)

Metric	Mean	Median	Std. Dev.	Min	Max	N
Earnings Yield TTM (%)	4.28	4.36	1.35	0.01	7.31	118
Earnings Yield Q×4 (%)	4.54	4.53	1.93	−10.01	7.67	118
Book ROE TTM (%)	13.39	13.90	3.83	0.03	19.95	118
Book ROE Q×4 (%)	14.36	14.98	4.86	−16.05	21.81	118
Price/Book Ratio	3.25	3.02	0.90	1.60	5.36	118
Fwd 1-Year Total Return (%)	11.01	13.68	16.66	−42.23	48.12	115
Fwd 3-Year Ann. Return (%)	8.90	10.95	9.71	−14.85	30.82	107
Fwd 5-Year Ann. Return (%)	8.11	10.47	6.81	−5.88	20.55	99

Three findings emerge from Table 2. First, the long-run annualized total return (10.12%) sits approximately midway between the average earnings yield (4.28%) and the average book ROE (13.39%). Second, the average P/B ratio of 3.25 explains the wedge: 13.39%/3.25 ≈ 4.12%, which closely matches the average earnings yield. Third, the Q×4 methodology produces similar means but substantially higher volatility (standard deviation of 1.93% vs. 1.35% for the earnings yield, and 4.86% vs. 3.83% for book ROE), including negative extremes during the 2008–2009 financial crisis.

7.2 Time Series Dynamics

Figure 1 presents the time series of forward 1-year total returns alongside the earnings yield (Panel A) and book ROE (Panel B), as well as the relationship between both accounting metrics and the P/B ratio (Panel C).

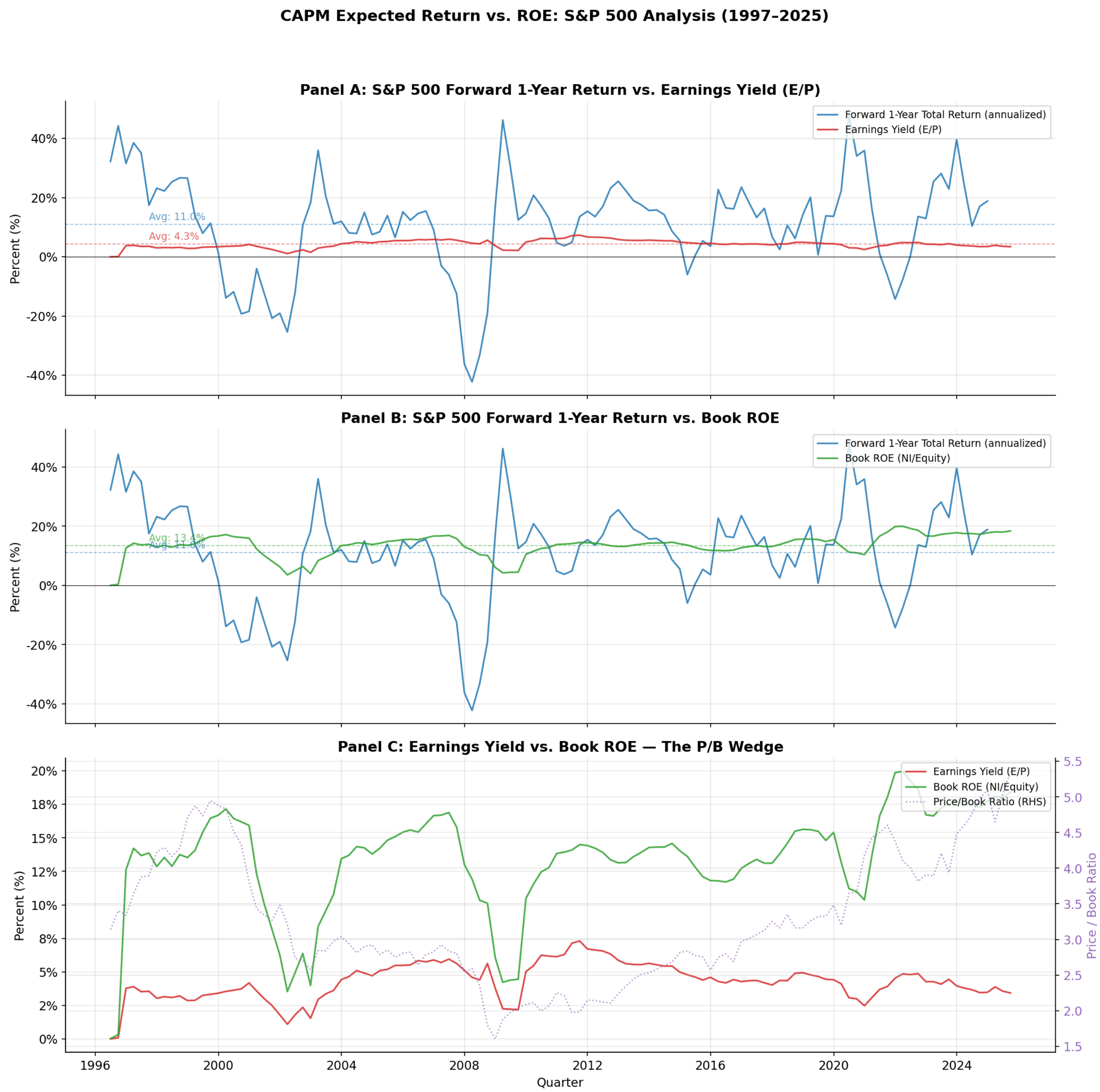

Figure 1: S&P 500 Forward 1-Year Return, Earnings Yield, and Book ROE (1997–2025). Panel A shows the forward 1-year total return versus the earnings yield; Panel B shows the forward return versus book ROE; Panel C displays the earnings yield and book ROE with the Price/Book ratio on the secondary axis, illustrating the P/B wedge.

Several patterns are noteworthy. The earnings yield is relatively stable, fluctuating within a 3–7% band throughout most of the sample, while the forward 1-year return is far more volatile (ranging from −42% to +48%). The book ROE shows moderate cyclical variation around its 13% mean, with a pronounced collapse during the Global Financial Crisis (2008–2009) and the COVID-19 shock (Q1 2020). Panel C reveals a clear visual inverse relationship between the earnings yield and the P/B ratio: when valuations are elevated (high P/B), the earnings yield compresses, widening the gap between book ROE and what shareholders earn on market-priced capital.

7.3 Book ROE and Realized Returns: Level Comparison

Figure 2 overlays both ROE series (TTM and Q×4) with the realized 1-year forward total return on a common scale, allowing direct visual comparison of their levels and amplitudes.

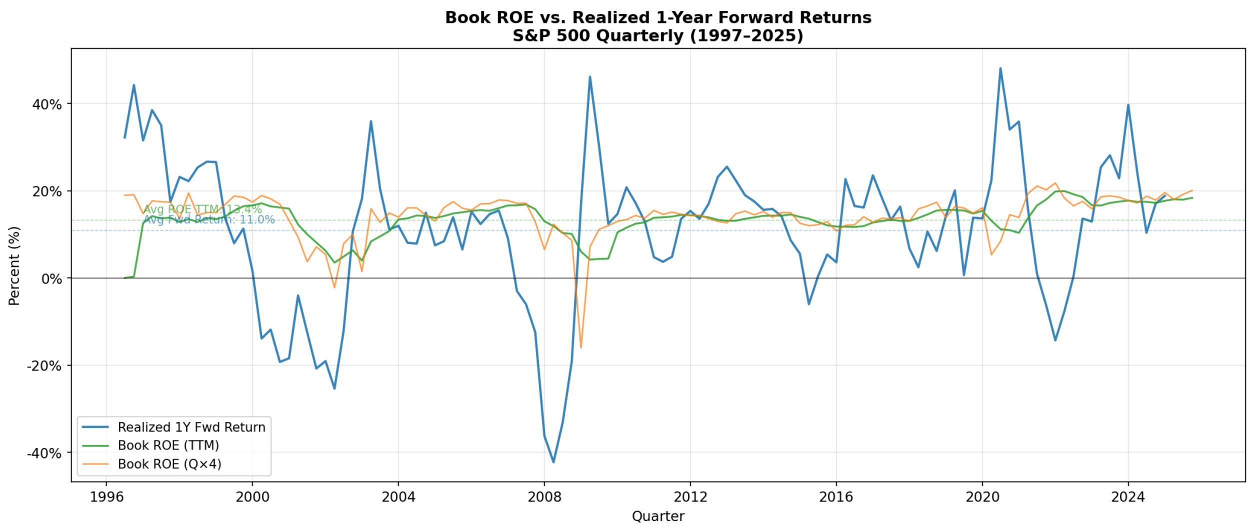

Figure 2: Book ROE (TTM and Q×4) versus realized 1-year forward total return, S&P 500 quarterly (1997–2025). All three series share the same y-axis, revealing that while their long-run means are comparable (≈11–13%), the forward return fluctuates with far greater amplitude.

Three observations emerge. First, both ROE measures and the realized forward return share a similar long-run mean neighborhood (11–13%), confirming that they measure different facets of the same underlying variable—the return on shareholders' capital. Second, the forward return series oscillates with far greater amplitude: its total range spans approximately 90 percentage points (−42% to +48%), compared to 20 percentage points for ROE TTM and 38 percentage points for ROE Q×4. Market prices embed changing expectations, investor sentiment, and discount rate fluctuations that accounting ROE, by construction, does not capture. Third, the Q×4 series is visibly noisier than TTM, particularly during the 2008–2009 crisis where it dips sharply negative while TTM remains near zero—a pattern we examine further in Section 7.8.

7.4 Volatility Dynamics: Accounting Stability vs. Market Fluctuations

To quantify the amplitude difference observed in Figure 2, we compute rolling 5-year (20-quarter) volatility for each series. Importantly, we use the *full-sample mean* as the fixed reference point rather than the rolling window mean, so that the volatility measure captures deviations from the long-run equilibrium level:

$$\sigma_t = \sqrt{\frac{1}{N} \sum_{i \in \text{window}} (x_i - \bar{x}_{\text{full}})^2} \tag{17}$$

where $\bar{x}_{\text{full}}$ is the full-sample average and $N = 20$ quarters. Figure 3 presents the results.

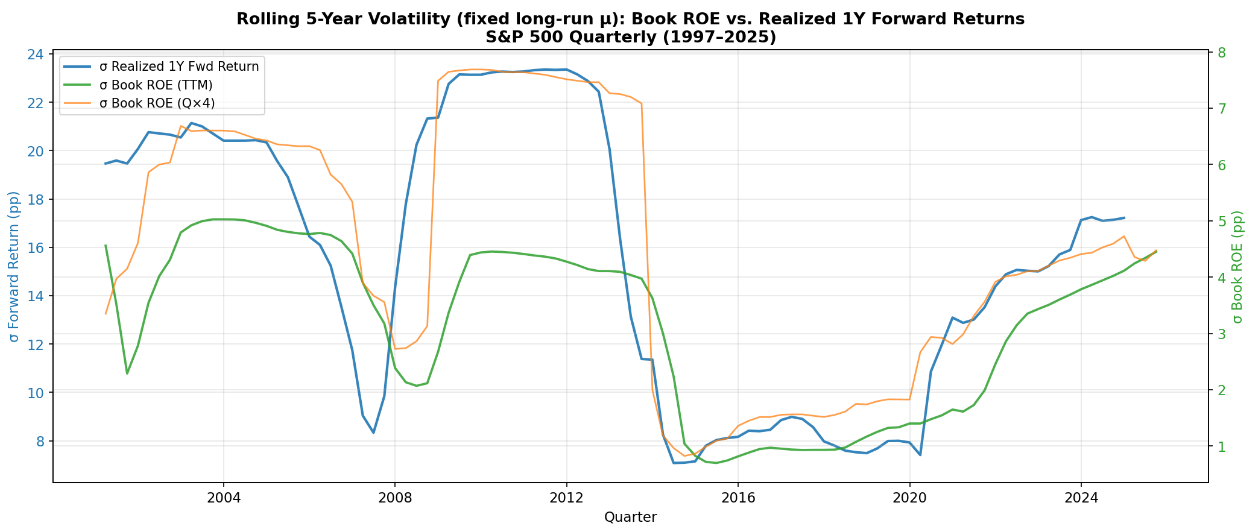

Figure 3: Rolling 5-year volatility (computed around the fixed full-sample mean) of the realized 1-year forward return (left axis) and book ROE under TTM and Q×4 methodologies (right axis). Return volatility averages approximately 5× higher than ROE TTM volatility.

The rolling volatility analysis reveals several patterns. Return volatility averages 15.4 percentage points over the sample, compared to 3.1 percentage points for ROE TTM—a ratio of approximately 5:1. This confirms that market returns are far more volatile than the underlying accounting fundamentals they are meant to reflect. The Q×4 ROE volatility averages 4.5 percentage points, consistently exceeding the TTM measure by roughly 45%, which further supports the adoption of TTM as the more stable and reliable methodology.

Notably, the volatilities co-move over time: all three series spike during the Global Financial Crisis (2008–2010) and compress during the low-volatility period of 2013–2016, suggesting that accounting and market risk respond to common macroeconomic shocks but with very different amplification factors. This volatility gap is consistent with our theoretical framework: market returns reflect not only changes in fundamentals (ROE) but also fluctuations in the Price-to-Book multiple and growth expectations, which introduce additional variance beyond what accounting measures capture.

The difference in volatility is a distinctive factor given it is a proxy for risk. Market prices (in other terms, the present value of foreseen future dividends) are changing constantly due to expectations and guessing about future earnings, but in the end, what is important is delivered returns on capital (delivered earnings), and its volatility. In terms of valuation and corporate finance, we regard ROE as a better estimate for the realized returns.

7.5 The Accounting Identity

Figure 4 verifies that the accounting identity in Equation (4) holds exactly in the data (Panel B), and presents a return decomposition (Panel A) in which the forward 1-year return is broken into two components: the current earnings yield and a residual that captures both the growth rate and the valuation change effects. Note that under the Gordon model, the expected return is $(\text{ROE}-g)/\text{P/B}+g$, which is *less* than $\text{EY}+g = \text{ROE}/\text{P/B}+g$ because part of the earnings yield is retained to fund growth rather than distributed to shareholders. The residual in Panel A therefore reflects the combined effect of earnings growth, the retention rate, and changes in the P/B multiple.

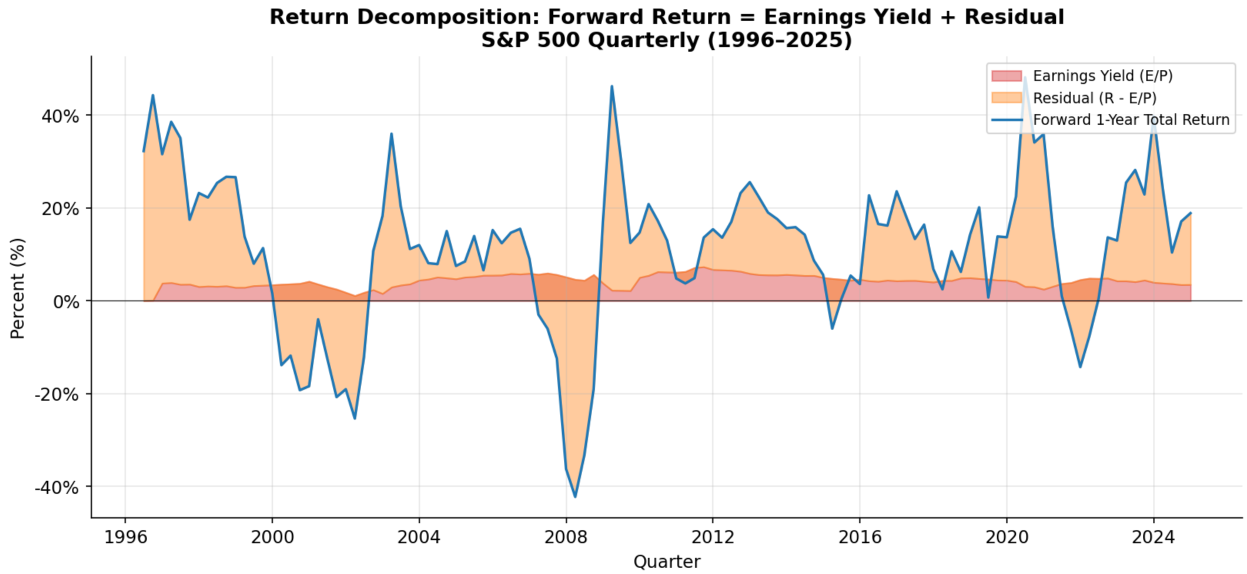

Figure 4: Return decomposition and accounting identity verification. Panel A decomposes the forward 1-year return into the earnings yield component and a residual capturing growth, retention, and valuation effects. Panel B confirms that EY = ROE/(P/B) holds exactly by construction across the entire sample.

The decomposition in Panel A shows that the earnings yield provides a relatively stable component (the red area), while the residual (orange area) drives most of the variation in realized returns. This is consistent with the view that short-term return variation is dominated by changes in expectations and valuation multiples rather than by contemporaneous earnings.

7.6 Long-Run Convergence

Figure 5 presents the core test of our hypothesis. Panel A shows the cumulative annualized return alongside the expanding average of the earnings yield and book ROE from the start of the sample. Panel B displays the same analysis using rolling 5-year windows.

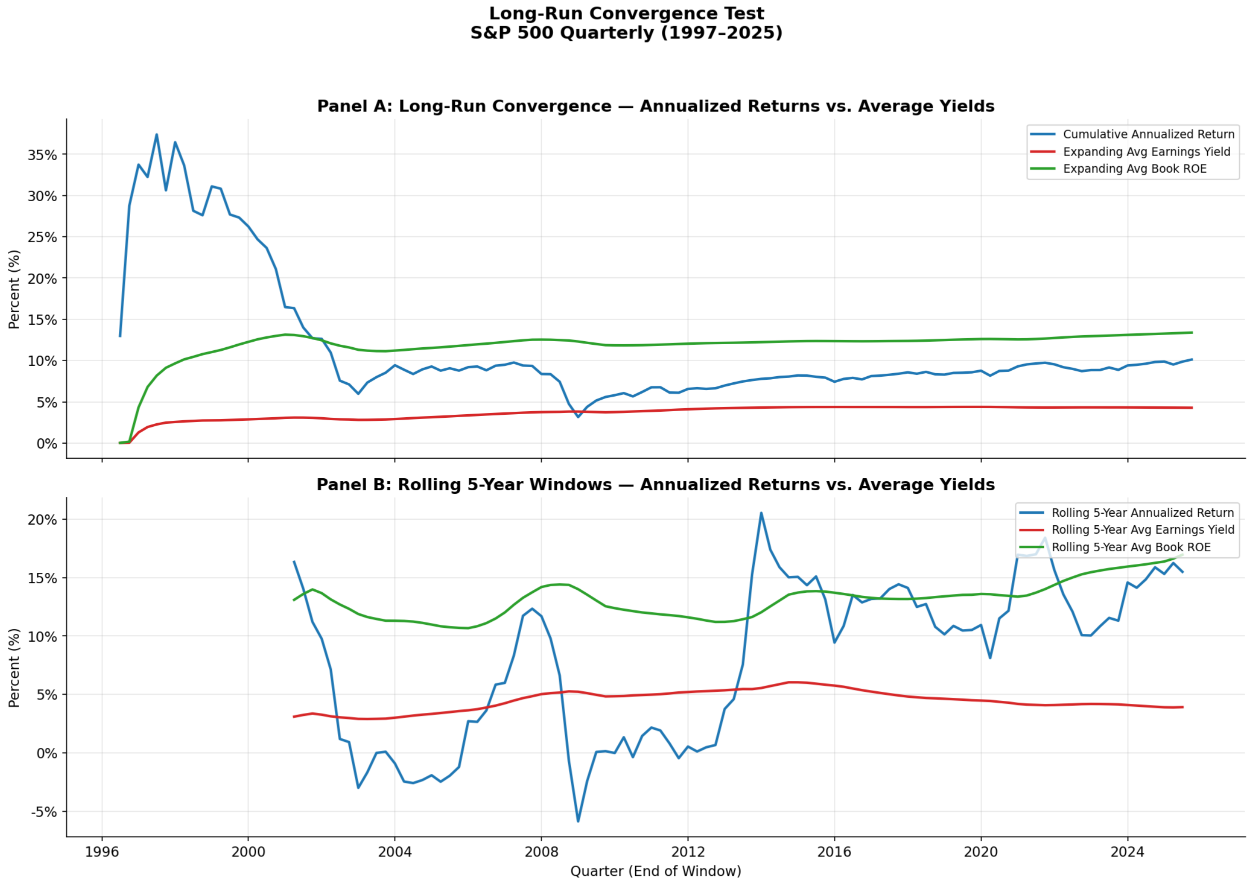

Figure 5: Long-run convergence test. Panel A: cumulative annualized return versus the expanding average earnings yield and book ROE from sample inception. The annualized return converges toward a level between the two accounting metrics. Panel B: rolling 5-year windows showing the same pattern with more cyclical variation.

As Panel A demonstrates, the cumulative annualized return stabilizes near 10% as the sample lengthens, settling between the expanding average earnings yield ($\approx 4.3\%$) and the expanding average book ROE ($\approx 13.3\%$). Using the corrected Gordon model with sample averages—$\overline{\mathrm{ROE}} = 13.3\%$, $\overline{\mathrm{P/B}} = 3.25$—and the realized return of 10.1%, we can solve for the implied sustainable growth rate: $g^* \approx 8.7\%$.[3] The key empirical finding is that the realized return sits between the earnings yield (a lower bound, since it ignores growth entirely) and the book ROE (an upper bound, since it measures returns on book rather than market capital), exactly as the theory predicts.

In the rolling 5-year window analysis (Panel B), the realized return oscillates around the book ROE more closely, with notable convergence episodes during the mid-2010s (2013–

[3]From $10.1\% = (13.3\% - g)/3.25 + g$, solving yields $g \approx 8.7\%$. This exceeds the historical nominal earnings growth rate of approximately 6%, which is expected given that the simple Gordon steady-state does not fully capture transitory valuation gains, index reconstitution effects, and share buybacks that have contributed to S&P 500 total returns over this period.

2017), when the rolling 5-year return and the rolling 5-year average ROE were within 1–2 percentage points of each other.

7.7 Cross-Sectional Predictability Across Horizons

Figure 6 presents scatter plots of the earnings yield against forward returns at the 1-year horizon (left panels), and Figure 7 extends the analysis to 1-year, 3-year, and 5-year horizons.

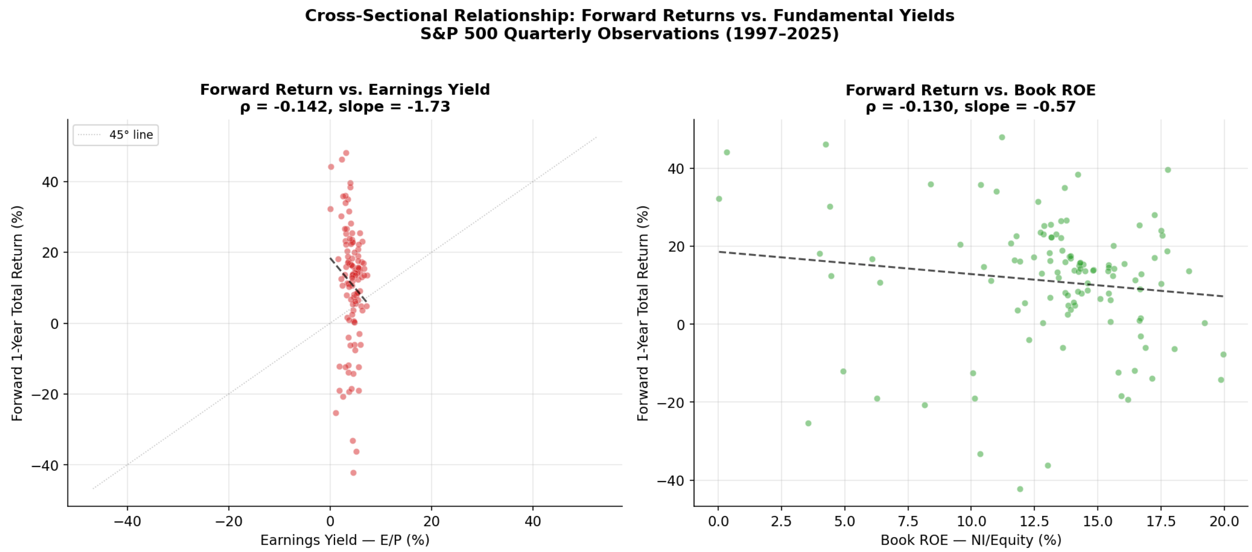

Figure 6: Scatter plots of forward 1-year total return versus the earnings yield (left) and book ROE (right). The dashed line is the OLS regression; the dotted line is the 45-degree reference. Correlations are weak at the 1-year horizon.

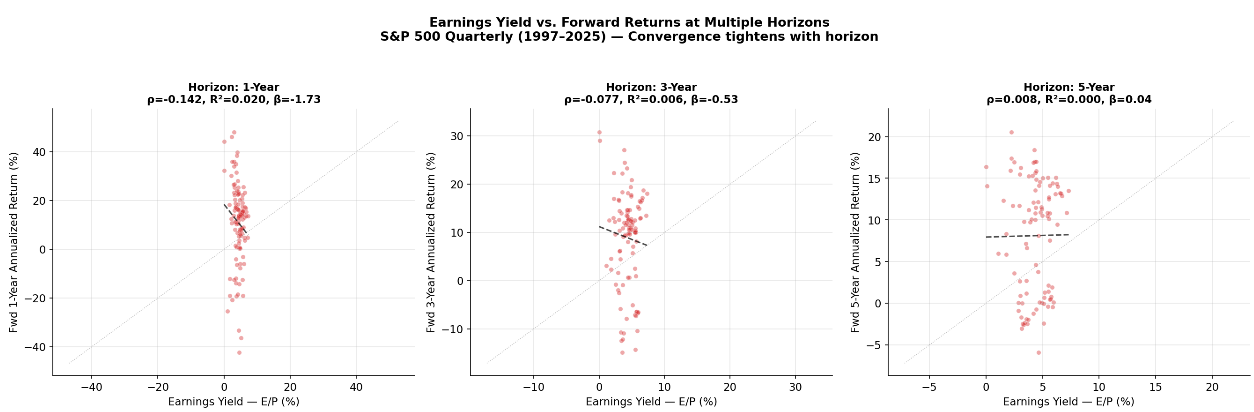

Figure 7: Earnings yield versus forward annualized returns at 1-year, 3-year, and 5-year horizons. As the horizon lengthens, the dispersion of forward returns narrows substantially, though the cross-sectional predictive power of the earnings yield remains weak ($R^2 < 0.02$ at all horizons).

At the 1-year horizon, the correlation between the earnings yield and forward returns is weakly negative ($\rho = -0.14$). This result, while perhaps counterintuitive, reflects a well-documented pattern: periods of elevated earnings yields (such as 2008–2009) coincide with recessions in which current earnings are temporarily depressed, making the contemporaneous earnings yield a noisy signal for near-term returns. As the horizon extends, the dispersion of forward returns narrows substantially—the standard deviation drops from 16.7% at 1 year to 6.8% at 5 years—and the regression slope approaches zero, consistent with mean reversion in returns over longer periods.

7.8 Annualization Methodology: TTM vs. Quarterly Times 4

Figure 8 compares the two annualization methodologies across all metrics.

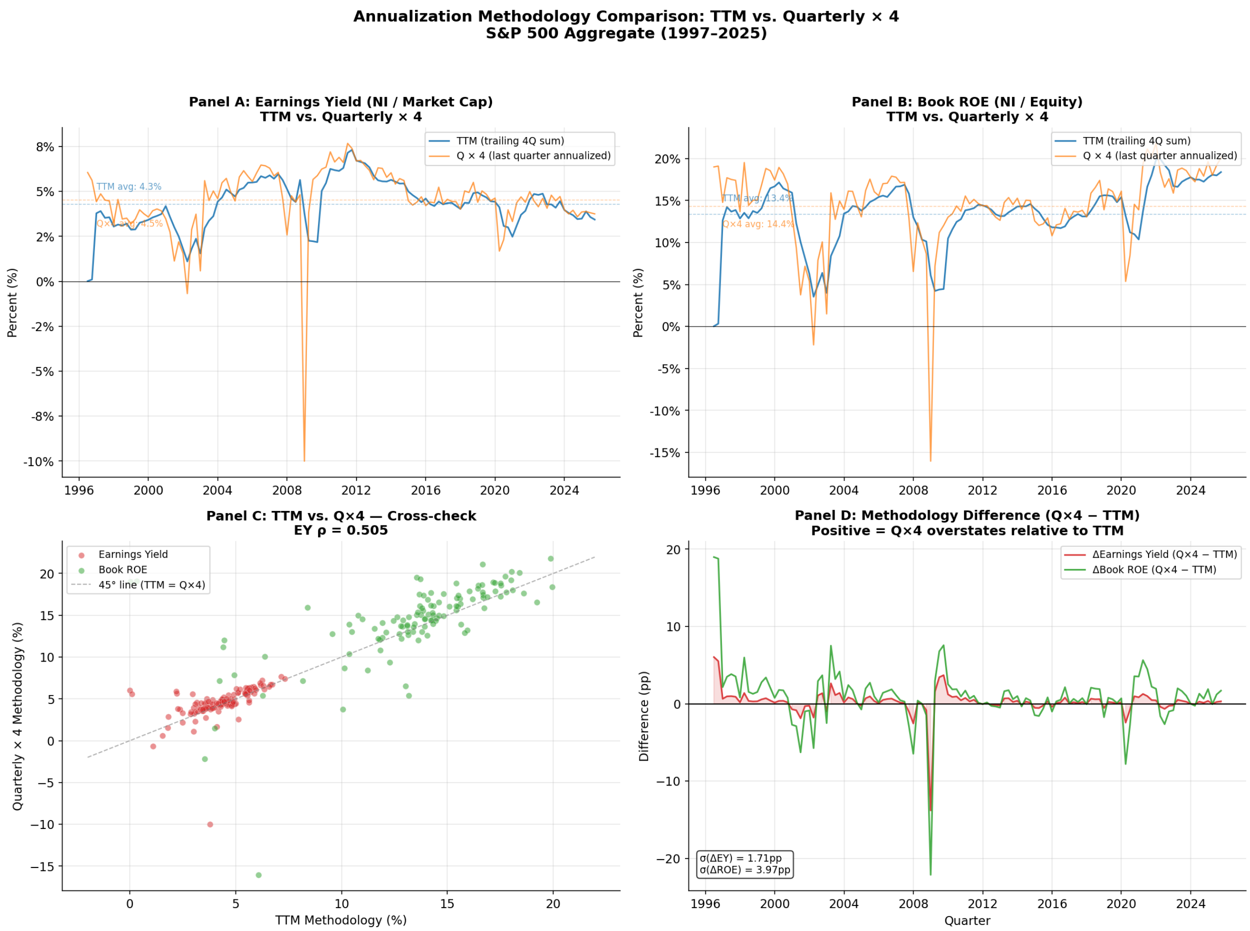

Figure 8: Comparison of TTM and Q×4 annualization methodologies. Panel A: Earnings Yield; Panel B: Book ROE; Panel C: scatter cross-check (TTM vs. Q×4); Panel D: methodology difference over time. The Q×4 approach produces substantially higher volatility, particularly around the 2008–2009 crisis.

The two methodologies yield similar long-run averages (4.28% vs. 4.54% for the earnings yield; 13.39% vs. 14.36% for book ROE) but differ markedly in their volatility profiles. The standard deviation of the difference between Q×4 and TTM is 1.71 percentage points for the earnings yield and 3.97 percentage points for book ROE. The divergence is most acute during the Global Financial Crisis, when the Q×4 methodology produced sharply negative readings (ROE as low as −16%, earnings yield as low as −10%) that overstated the deterioration by extrapolating a single catastrophic quarter to an annual rate.

Figure 9 extends the comparison to forward return prediction.

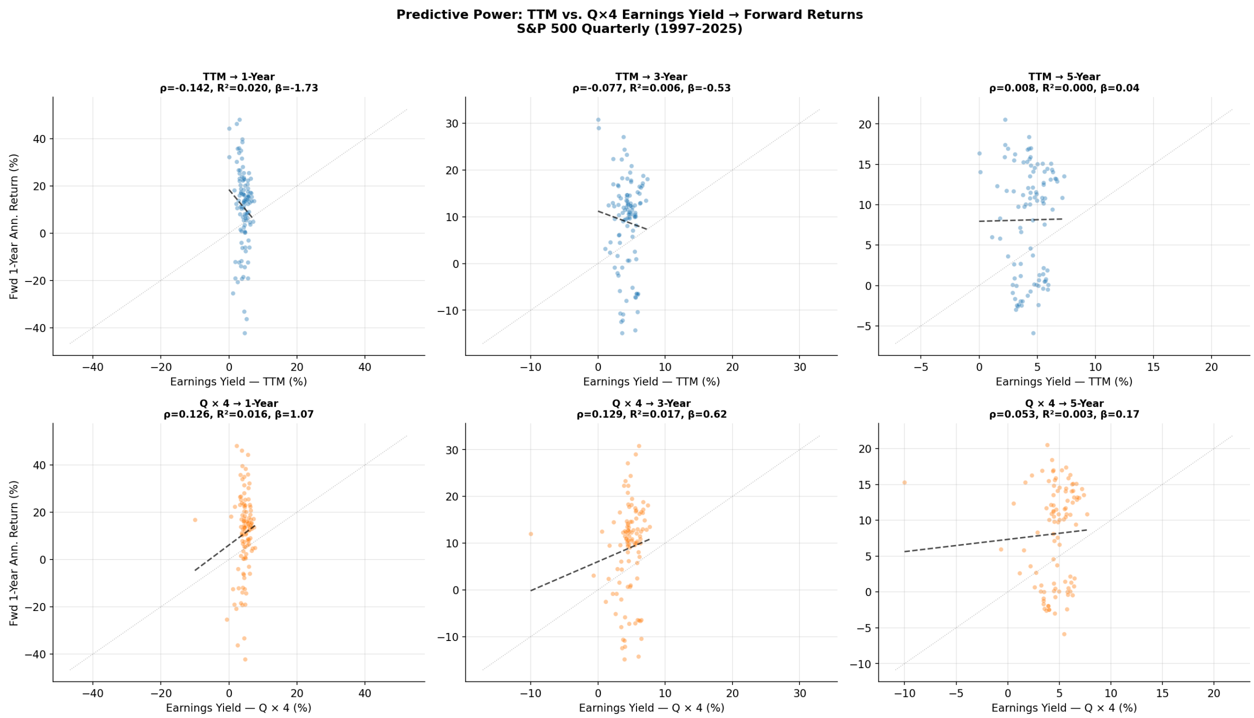

Figure 9: Predictive power of TTM vs. Q×4 earnings yield for forward returns at 1-year, 3-year, and 5-year horizons. The Q×4 methodology shows weakly positive correlations with 1-year forward returns ($\rho = 0.13$), in contrast to the weakly negative correlation of the TTM approach ($\rho = -0.14$).

Interestingly, the Q×4 methodology exhibits a weakly positive correlation ($\rho = 0.13$) with forward 1-year returns, while the TTM approach shows a weakly negative one ($\rho = -0.14$). The intuition is that Q×4 captures recent earnings momentum more rapidly—a strong last quarter may signal the beginning of a recovery—while TTM is still weighed down by the prior weak quarters. However, both R^2 values remain below 2%, precluding any practical forecasting use at the individual-quarter level.

Based on these findings, we adopt TTM as the primary methodology for the remainder of the analysis, consistent with the convention in the academic literature (Shiller, 2000; Fama and French, 1993). The Q×4 approach serves as a robustness check.

8 Extension: Valuations, Profitability, and the Cost of Equity

The analysis so far has used the accounting identity EY = ROE/P/B and the Gordon decomposition as relationships that hold by construction at each observation. A natural extension is to ask: does the *variation over time* in valuations behave as the same identity implies? If the Price-to-Book ratio is the exchange rate that converts a book return into a market return, then movements in P/B should track movements in profitability and in the cost of equity with the signs the identity requires.

We refer to these two arms of the identity as the *profitability*, or cash-flow, channel and the *cost-of-equity*, or discount-rate, channel, following the standard decomposition of variation in valuation ratios into cash-flow and discount-rate components (Campbell and Shiller, 1988). The terms denote the numerator and the denominator of Equation (18) respectively; no dynamic transmission is implied.

8.1 From the identity to an estimable form

Setting $E(R) = K_e$ in Equation (6) and rearranging for the steady state gives

$$\mathrm{P/B} = \frac{\mathrm{ROE} - g}{K_e - g}, \tag{18}$$

which requires $K_e > g$ for a finite and positive valuation. In the no-growth case $g = 0$, Equation (18) is exactly log-linear:

$$\ln \mathrm{P/B} = \ln \mathrm{ROE} - \ln K_e. \tag{19}$$

This motivates an index-level regression of the form

$$\ln \mathrm{P/B}_t = \beta_0 + \beta_1 \ln \mathrm{ROE}_t + \beta_2 \ln K_{e,t} + \varepsilon_t, \tag{20}$$

with the no-growth benchmark $(\beta_1, \beta_2) = (+1, -1)$.

We stress at the outset that this benchmark is a *reference point* rather than a null the data should be expected to satisfy. Our sample implies a sustainable growth rate of $g^* \approx 8.7\%$

(Section 7), and for $g > 0$ the elasticities implied by Equation (18) are

$$\frac{\partial \ln \mathrm{P/B}}{\partial \ln \mathrm{ROE}} = \frac{\mathrm{ROE}}{\mathrm{ROE} - g}, \qquad \frac{\partial \ln \mathrm{P/B}}{\partial \ln K_e} = \frac{-K_e}{K_e - g}, \tag{21}$$

both of which diverge sharply from unity as g approaches either rate. Equation (20) is therefore best read as a test of *direction*—whether valuations rise with profitability and fall with the required return—rather than as a structural estimate of the identity's parameters.

8.2 Variable construction

We measure the three series at the index level over the full sample. Book ROE and the P/B ratio are the aggregate TTM series constructed in Section 6. For the cost of equity we follow the logic of Section 2: with $\beta = 1$ for the index, K_e equals the expected market return, which is proxied empirically by the realized total return measured over an extended horizon. We therefore set $K_{e,t}$ equal to the trailing ten-year (40-quarter) annualized total return,

$$K_{e,t} = \left(\prod_{k=0}^{39} \left(1 + R_{t-k}^{\mathrm{total}}\right) \right)^{4/40} - 1, \tag{22}$$

and, in the baseline specification, smooth ROE_t and $\mathrm{P/B}_t$ with a matching 40-quarter trailing mean so that all three regressors are measured over a common horizon. The ten-year requirement means the estimation sample begins in Q1 2006 and comprises 71 quarterly observations.

Because the trailing windows overlap, adjacent observations share up to 39 of their 40 quarters, and conventional standard errors would be severely understated. All specifications are therefore estimated with Newey–West heteroskedasticity- and autocorrelation-consistent (HAC) standard errors using 39 lags, the overlap length implied by the window. Even so, the effective information content of the smoothed sample is closer to three independent decades than to 71 independent quarters, and the results below should be read with that in mind.

8.3 Results

Table 3 reports four specifications. Column (1) is the baseline described above. Column (2) removes the smoothing from ROE and P/B, retaining the trailing K_e. Columns (3) and (4) estimate the corresponding relationships in first differences.

Two findings emerge, and they point in opposite directions.

Table 3: Valuation-Consistency Regressions: $\ln \mathrm{P/B}$ on $\ln \mathrm{ROE}$ and $\ln K_e$

	Levels		First differences	
	(1) Smoothed	(2) Unsmoothed	(3) Smoothed	(4) Unsmoothed
$\ln \mathrm{ROE}$	1.681	0.575	1.008	0.105
	(0.452)	(0.183)	(0.174)	(0.078)
$\ln K_e$	−0.060	0.208	0.010	0.043
	(0.026)	(0.066)	(0.004)	(0.005)
Constant	4.297	2.772	−0.003	0.009
	(0.830)	(0.374)	(0.007)	(0.005)
R^2	0.410	0.584	0.689	0.195
N	71	71	70	70
$H_0: (\beta_1, \beta_2) = (+1, -1)$	reject	reject	reject	reject

Notes. Quarterly index-level data, Q1 2006–Q3 2025. Newey–West HAC standard errors with 39 lags in parentheses. "Smoothed" denotes a 40-quarter trailing mean of ROE and P/B; K_e is the trailing ten-year annualized total return in every column. The Wald row tests the no-growth benchmark of Equation (19); all four specifications reject it at $p < 0.001$.

The profitability channel is robust. The coefficient on $\ln \mathrm{ROE}$ is positive in all four specifications and statistically significant in three of them. In the baseline it is 1.681, reproducing the magnitude we have reported elsewhere, and in the differenced smoothed specification of column (3) it is 1.008 with a standard error of 0.174—statistically indistinguishable from the unit elasticity of Equation (19). That valuations move one-for-one with profitability in logs, and that this survives differencing, is the clearest evidence in this paper that the identity has content beyond its construction.

The cost-of-equity channel is not. The negative coefficient on $\ln K_e$ that the identity requires appears only in column (1). It is −0.060 there, statistically significant but two orders of magnitude smaller than the benchmark of −1; and in columns (2), (3) and (4) the estimate is *positive*, significantly so in each. The sign is thus an artifact of the smoothing choice rather than a feature of the data. We do not regard the cost-of-equity channel as supported.

8.4 Why the cost-of-equity channel cannot be detected

Three considerations bear on why the second channel fails, and we report them rather than treat the baseline as decisive.

First, the level specifications carry genuine spurious-regression risk. Augmented Dickey–Fuller tests fail to reject a unit root in all three smoothed log series ($p = 0.89$, 0.99 and

0.54 for $\ln \mathrm{P/B}$, $\ln \mathrm{ROE}$ and $\ln K_e$ respectively), and an Engle–Granger test of the baseline residuals does not reject the null of no cointegration (stat $= -3.28$ against a 5% critical value of -3.87; $p = 0.14$). The long-run relationship in column (1) is therefore not established, which is one reason we place more weight on the differenced specifications.

Second, and more fundamentally, the realized-return proxy for K_e is inconsistent with the steady state it is meant to represent. Equation (18) requires $K_e > g$, but the mean trailing ten-year return over the estimation window is 7.98%, *below* the implied $g^* \approx 8.7\%$. The condition fails in 46 of 79 quarters, and this is not an artifact of the window length: the violation rate is 58%, 59%, 59% and 57% for ten-, fifteen-, twenty-year trailing and expanding-window measures of K_e respectively. Where $K_e < g$, the elasticity in Equation (21) is not merely attenuated but changes sign, which is sufficient on its own to destroy any stable negative relationship in the estimation.

Third, the rejection of $(\beta_1, \beta_2) = (+1, -1)$ in every column is expected rather than informative, precisely because g^* is far from zero. At the sample means the exact elasticities of Equation (21) are $+2.84$ for $\ln \mathrm{ROE}$ and, because $K_e < g^*$, positive rather than negative for $\ln K_e$. The baseline estimate of 1.681 sits between the no-growth benchmark of $+1$ and this exact value, which is what a linearization error of the expected direction and magnitude would produce.

8.5 Assessment and next steps

The extension supports the profitability half of the identity and fails to support the cost-of-equity half. Valuations do rise with book profitability, robustly and with an elasticity close to the predicted unit value once the series are differenced. Whether they fall with the required return cannot be determined from index-level realized returns, because over this sample that proxy is not a usable measure of K_e: it sits below the implied growth rate for most of the period, which places the data outside the region in which the steady-state identity is defined.

This is a measurement problem rather than evidence against the framework, but it is not one we can resolve with the data assembled here. Testing the second channel properly requires a measure of the required return that is forward-looking and independent of realized index returns—a CAPM-constructed K_e from contemporaneous risk-free rates and an equity risk premium, or a firm-level cross-section in which rolling betas generate genuine variation in K_e across units at a point in time. We regard that as the most valuable extension of this work, and we return to it in Section 9.

9 Conclusions

Price is about cash flows (dividends) for the shareholder, and they arise from earnings. We divide and reconcile realized earnings with expected earnings, trying to get rid of time to see whether they are consistent. To that end, this paper reconciles two fundamental measures of return on shareholders' capital—the CAPM expected return and the accounting Return on Equity—using nearly three decades of quarterly data for the S&P 500 index.

Our empirical findings support the following conclusions:

First, the long-run annualized S&P 500 total return (10.1%) lies between the average aggregate earnings yield (4.3%) and the average book ROE (13.3%). The wedge is fully and precisely explained by the Price-to-Book ratio through the identity EY = ROE/P/B, which holds exactly at each observation point.

Second, the reconciliation of these metrics with realized returns operates through the Gordon Growth Model decomposition $E(R) = (\mathrm{ROE} - g)/\mathrm{P/B} + g$. The earnings yield alone (ROE/P/B) represents the total earnings generated per unit of market capital, but only a fraction of this is distributed to shareholders—the remainder is retained and reinvested to generate growth. Thus the realized return reflects both the dividend yield $(\mathrm{ROE}-g)/\mathrm{P/B}$ and the capital appreciation g funded by retained earnings. The book ROE, in turn, overstates the return available to shareholders who purchased equity at market prices, since $\mathrm{P/B} > 1$ for the typical S&P 500 firm.

Third, the convergence between realized returns and the fundamental metrics tightens as the observation horizon lengthens, consistent with Hypothesis 1. Over rolling 5-year windows, realized returns and book ROE periodically align closely, particularly during periods of stable valuations.

Fourth, the choice of annualization methodology (TTM vs. Q$\times$4) affects volatility substantially but not long-run means, supporting the use of TTM as the more robust measure for academic analysis.

Fifth, in terms of valuation, the beta arising from the CAPM may overstate risk when extrapolated to corporate finance and project valuation, given the volatility of expectations embedded in market prices with respect to the stability of earnings and ROE. Stock prices, from where the CAPM is calculated, are comprised of constantly changing guesses about future earnings, and therefore are much more volatile than required for investment projects.

Sixth, extending the framework from an accounting identity to a testable statement about valuations (Section 8) supports one of its two channels. In logs, the Price-to-Book ratio moves with book profitability at close to the predicted unit elasticity (1.008, HAC standard error 0.174, in first differences), and this holds across specifications. The offsetting cost-of-equity channel is not supported: the negative loading the identity requires survives only under one smoothing choice and reverses sign otherwise. The reason appears to be measurement rather than theory—the realized index return, our only available proxy for K_e, lies *below* the implied sustainable growth rate in 58% of quarters, placing the data outside the region in which the steady-state relationship is defined.

These results have practical implications for equity valuation and investment analysis. When analysts or portfolio managers compare a company's ROE against its CAPM-derived cost of capital to assess value creation, they should be cognizant that the relevant comparison accounts for the reinvestment dynamic: the expected shareholder return is $(\mathrm{ROE}-g)/\mathrm{P/B}+g$, not simply $\mathrm{ROE/P/B}+g$. A firm creates value when this expected return exceeds K_e, which requires that the ROE be sufficiently high relative to both the P/B multiple and the growth rate. For a diversified index like the S&P 500, our evidence suggests that this relationship holds on average over long horizons, as the theory predicts.

We acknowledge several limitations of this study. Our empirical analysis covers a single market (the U.S.) and a single index (the S&P 500) over approximately three decades (1996–2025). While the sample is sufficiently long to observe meaningful convergence patterns and spans multiple business cycles—including the dot-com bust, the Global Financial Crisis, and the COVID-19 shock—it remains a specific historical episode that may not generalize across all market regimes. In particular, this period has been characterized by declining interest rates, rising profit margins, and an expanding role of share buybacks, all of which may have influenced the observed relationship between accounting returns and market returns in ways that are not fully captured by the steady-state Gordon model. Any empirical conclusions drawn from this analysis should therefore be tested further on broader datasets, including international equity indices, longer historical samples where available, and different market environments, before being considered robust stylized facts.

The most valuable next step, in our view, is to construct a measure of the required return that is independent of realized index returns—either a CAPM-built K_e from contemporaneous risk-free rates and an equity risk premium, or a firm-level cross-section in which rolling betas generate genuine variation in K_e at a point in time—so that the valuation channel of Section 8 can be tested on a proxy that satisfies $K_e > g$. Beyond that, future work could extend this analysis to individual sectors, international indices, or decompose the aggregate results using the DuPont framework to identify which components of ROE (margin, turnover, leverage) drive the convergence or divergence with CAPM expected returns.

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