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Why Earnings Surprises Move Stocks So Sharply: Insights from the Potential Payback Period (*PPP*) or "Dynamic *P*/*E* Ratio"

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Abstract

Equity markets often react disproportionately to quarterly earnings surprises. Small deviations from analyst expectations—sometimes just a few cents per share—can trigger sharp stock price movements. Traditional valuation tools such as the Price-to-Earnings (*P*/*E*) ratio, the Price/Earnings-to-Growth (PEG) ratio, and discounted cash flow (DCF) models fail to rationally explain this amplification effect. This article introduces the Potential Payback Period (*PPP*), conceived as the "Dynamic *P*/*E* ratio", a framework that embeds both earnings growth (*g*) and discount rates (*r*) into valuation. Because the *PPP* uses a logarithmic structure to reflect compounding effects, even minor revisions to earnings growth expectations extend over a multi-year horizon, producing amplified and measurable valuation shifts. By translating *PPP* into the Stock Internal Rate of Return (*SIRR*), the framework further connects earnings surprises to shifts in implied returns, explaining why markets react so sharply to seemingly small revisions.

Keywords

Potential Payback Period (*PPP*), Stock Internal Rate of Return (*SIRR*), Dynamic *P*/*E*, Earnings Surprises, Amplification Effect, Stock Valuation

1. Introduction

Quarterly earnings announcements consistently generate large market reactions [1] [2]. Firms missing or beating analyst expectations by just a few cents often experience multi-percent price swings, despite the seemingly trivial magnitude of

the surprises. Explaining these disproportionate responses is a longstanding challenge in finance [3].

Traditional valuation tools—*P*/*E*, PEG, Gordon Growth Model (GGM), and DCF—cannot account for the amplification. *P*/*E* is static, PEG is linear (which distorts financial realities that follow compounding dynamics), and both GGM and DCF depend on restrictive assumptions (e.g., $g < r$) that do not hold in modern markets.

The Potential Payback Period (*PPP*) framework clarifies this puzzle by embedding earnings growth (g) and discount rates (r) logarithmically, showing how small quarterly earnings revisions propagate across a multi-year horizon, leading to large valuation shifts.

2. Literature Review

The valuation of equities has evolved through several frameworks:

- **Gordon Growth Model (GGM)** (Gordon, 1962): anchors value to dividends but collapses when $g \geq r$ [4].
- ***P*/*E* ratio**: simple and intuitive but ignores growth and discounting (Damodaran, 2012) [5].
- **PEG ratio**: incorporates growth but only linearly, neglecting compounding (Easton, 2004) [6].
- **DCF models**: comprehensive but highly assumption-sensitive, especially for high-growth firms [5].

These models proved useful in more stable markets of past decades, when growth rates (g) typically remained below discount rates (r). In today's environment, with many firms sustaining growth above risk-free rates and interest rates fluctuating daily, they appear less reliable.

The *PPP* extends this trajectory [7]. It subsumes *P*/*E* as a special case (when $g = 0$ and $r = 0$) while addressing the weaknesses of PEG, GGM, and DCF. By combining growth and discounting in one dynamic metric, it better reflects modern market realities [8]-[10].

Recent studies (e.g., Haboub, Kartsaklas & Sarafidis, 2025; Xu, 2024) show that residual-income and abnormal-earnings models predict stock returns more accurately than traditional *P*/*E*-based approaches but remain sensitive to parameter instability. *PPP* aligns closely with these models' theoretical foundations while offering a simpler yet equally powerful framework: it collapses the valuation logic into a single dynamic horizon, which may explain its superior predictive power for earnings-surprise-driven price changes.

3. The Dynamic *P*/*E*: Potential Payback Period (*PPP*)

The *PPP* generalizes the static *P*/*E* ratio by asking not how many years of current earnings, but how many years of future growing and discounted earnings are needed to match today's price [7]:

***PPP* Formula:**

$$PPP = \frac{\log\left(\frac{P/E \times (g-r)}{1+r} + 1\right)}{\log\left(\frac{1+g}{1+r}\right)}$$

where:

- P/E = Price-to-Earnings ratio;
- g = expected earnings growth rate;
- r = discount rate.

Special Case: When $g = 0$ and $r = 0$, *PPP* collapses to the traditional P/E ratio. This result follows from taking the mathematical limits as both g and r approach zero, which resolves the apparent indeterminate form of the *PPP* equation and shows that P/E is a limiting case of *PPP*.

Determining *r*: The discount rate r is estimated using the Capital Asset Pricing Model (CAPM):

$$r = r_f + \beta \times (r_m - r_f)$$

where r_f is the risk-free rate (e.g. 10-year Treasury yield), β is the stock's beta, and r_m is the expected market return.

The logarithmic form captures compounding, making *PPP* highly sensitive to small changes in g or r. This sensitivity explains the amplification of earnings surprises and interest rate shifts [5] [6].

4. From *PPP* to *SIRR*: Interpreting Payback as Yield

The Potential Payback Period (*PPP*) expresses valuation in years, while investors typically compare opportunities in rates of return. The bridge is the Stock Internal Rate of Return (*SIRR*), defined from *PPP* as [7]:

$$SIRR = 2^{1/PPP} - 1$$

Intuition: *PPP* is the horizon at which the investment "pays back" in discounted earnings. The compounding rate that doubles capital over exactly *PPP* years is $2^{1/PPP} - 1$; that rate is *SIRR*. Thus, shorter *PPP* implies higher *SIRR*, and vice versa.

This translation allows earnings-driven valuation changes to be expressed directly in return space, making *PPP* outcomes interpretable as *SIRR* values that can be positioned alongside bond yields when comparing cross-asset opportunities.

5. Quarterly Earnings Surprises as Growth Inflexions

Earnings growth (g) can be viewed as the first derivative of corporate performance, representing the speed at which earnings expand. Quarterly earnings surprises, even when numerically small, are interpreted by markets as inflexions in this growth trajectory—accelerations or decelerations measured as second derivatives of earnings growth.

This distinction matters. A firm that slightly beats expectations signals not just higher earnings for one quarter, but a potential upward adjustment in the slope of

growth. Conversely, a small miss suggests a deceleration, prompting downward revisions.

Because the Potential Payback Period (*PPP*) compounds growth logarithmically across a multi-year horizon, such second-derivative signals propagate forward, producing disproportionately large valuation shifts. In this sense, earnings surprises act as catalysts: they trigger revisions in projected growth, which then translate into amplified changes in *PPP*.

Observation: Following earnings revisions, mature companies tend to show larger shifts in *PPP* than growth companies. This confirms why minor earnings surprises often trigger sharper corrections in mature firms than in high-growth firms.

6. Earnings Surprises, IRR Shifts, and Stock Price Changes

Quarterly earnings surprises are interpreted as revisions in forward-looking growth trajectories. In *PPP* terms, these revisions lengthen or shorten the payback horizon. In rate-of-return terms, they raise or lower the internal rate of return (*SIRR*) implied by today's price.

To illustrate, we present the following practical example:

Baseline:

- Price = \$100
- EPS (TTM) = \$5
- P/E (TTM) = 20
- g = 12% (annual)
- r = 4.00%

Baseline *PPP*: ≈ 12.57 years

Baseline *SIRR*: ≈ 5.67%

6.1. Upward Revision (Positive Surprise)

- Latest quarterly EPS rises from \$1.25 (expected) to \$1.30 (actual).
- EPS (TTM): \$5.05 vs. \$5.00.
- Growth expectation could rise from 12% (so far) to 13% (now on).
- P/E (TTM) required to maintain *PPP* at 12.57 and *SIRR* at 5.67%: ≈ 21.24 (vs. 20 baseline).
- New Price = 21.24 × 5.05 = \$107.26.
- Price change = +7.26%.

6.2. Downward Revision (Negative Surprise)

- Latest quarterly EPS falls from \$1.25 (expected) to \$1.20 (actual).
- EPS (TTM): \$4.95 vs. \$5.00.
- Growth expectation could fall from 12% (so far) to 11% (now on).
- P/E (TTM) required to maintain *PPP* at 12.57 and *SIRR* at 5.67%: ≈ 18.84 (vs. 20 baseline).
- New Price = 18.84 × 4.95 = \$93.26.

- Price change = −6.74%.

6.3. Reconciling Price Changes and *SIRR* Shifts

From the EPS-based calculations: a ± $0.05 quarterly surprise produces ≈ ±7% price swings. This occurs because the earnings surprise implies a change in the earnings growth rate (g). Normally, any change in g would also alter *PPP* and *SIRR*. In this context, however, *PPP* and *SIRR* are kept constant at 12.57 years and 5.67% to preserve valuation equilibrium. The adjustment associated with the change in g must therefore occur through the P/E ratio, which directly drives the stock price. The market P/E multiple adjusts—upward to about 21.24 in the positive case or downward to about 18.84 in the negative case. These shifts, representing market corrections to earnings surprises, reconcile the observed price moves with the unchanged payback horizon and return benchmark. This mechanism is consistent with variance decomposition analyses, which show how small shocks can account for substantial return volatility [11].

Justification of Constant Horizon Assumption (Methodological Simplification):

In our scenario analysis, we hold the *PPP* horizon constant to isolate the pure effect of growth revisions. This is a modeling simplification rather than a literal description of market behavior. In reality, growth shocks alter the effective payback horizon, but fixing it in the scenario design allows us to highlight the valuation impact that comes directly from growth revisions. The constant horizon thus serves as a long-term maturity benchmark tied to the firm's business model, while in practice *PPP* does adjust dynamically to growth changes.

7. Why Markets React So Sharply

What appears as 'irrational overreaction' is rational under *PPP*. A ±1pp change in growth expectations, though trivial in quarterly terms, alters intrinsic value—as reflected in the period of time required to recoup the initial investment—by several months across a multi-year horizon. Investors immediately price this adjustment, producing sharp stock price moves.

Traditional metrics cannot account for this dynamic. The P/E ratio is static, while the PEG ratio is simplistically and misleadingly linear. By embedding compounding effects through a logarithmic structure, the *PPP* aligns valuation more closely with observed market behavior.

Sensitivity: Because of its logarithmic structure, *PPP* is highly sensitive to small forecast errors in g and r. A ±1pp error in g can shift *PPP* by several months, while the same error in r shifts it by a comparable magnitude. This strong sensitivity explains why valuation responses appear disproportionate, but it also represents a limitation of the model, since inaccurate inputs may amplify estimation errors in practice. For this reason, conducting sensitivity analysis on g and r is crucial in any prevision based on *PPP*, as it helps investors assess the robustness of valuation outcomes under different scenarios.

8. Conclusions

Quarterly earnings surprises may appear small in absolute terms but, when reframed through *PPP* and translated into *SIRR*, they represent significant valuation adjustments. *PPP* helps clarify why the market's reaction is not irrational: minor earnings revisions alter intrinsic value not just by pennies, but by percentage points of expected return and multi-year payback horizons.

By integrating growth and discounting logarithmically, *PPP* explains how minor revisions compound over time, producing amplified and measurable valuation shifts. It subsumes P/E as a special case (when $g = 0$ and $r = 0$), corrects PEG's linearity, and avoids GGM/DCF instability when $g \geq r$.

The conclusion is clear: *PPP* resolves the puzzle of why earnings surprises move stock prices so sharply. What looks like overreaction is, in fact, consistent with rational valuation dynamics.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Ball, R. and Brown, P. (1968) An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research*, **6**, 159-178. https://doi.org/10.2307/2490232

[2] Bernard, V.L. and Thomas, J.K. (1989) Post-Earnings-Announcement Drift: Delayed Price Response or Risk Premium? *Journal of Accounting Research*, **27**, 1-48. https://doi.org/10.2307/2491062

[3] Shiller, R.J. (1981) Do Stock Prices Move Too Much to Be Justified by Subsequent Changes in Dividends? *American Economic Review*, **71**, 421-436.

[4] Gordon, M.J. (1962) The Investment, Financing, and Valuation of the Corporation. Irwin.

[5] Damodaran, A. (2012) Investment Valuation: Tools and Techniques for Determining the Value of Any Asset. Wiley.

[6] Easton, P.D. (2004) PE Ratios, PEG Ratios, and Estimating the Implied Expected Rate of Return on Equity Capital. *The Accounting Review*, **79**, 73-95. https://doi.org/10.2308/accr.2004.79.1.73

[7] Sam, R. (2025) Mathematics of Stock Valuation: Why the Potential Payback Period (PPP) Outperforms the P/E and PEG Ratios. *Journal of Mathematical Finance*, **15**, 687-695. https://doi.org/10.4236/jmf.2025.153027

[8] Liu, J., Nissim, D. and Thomas, J. (2002) Equity Valuation Using Multiples. *Journal of Accounting Research*, **40**, 135-172. https://doi.org/10.1111/1475-679x.00042

[9] Modigliani, F. and Miller, M.H. (1961) Dividend Policy, Growth, and the Valuation of Shares. *Journal of Business*, **34**, 411-433.

[10] Fama, E.F. and French, K.R. (1992) The Cross-Section of Expected Stock Returns. *The Journal of Finance*, **47**, 427-465. https://doi.org/10.1111/j.1540-6261.1992.tb04398.x

[11] Campbell, J.Y. (1991) A Variance Decomposition for Stock Returns. *The Economic Journal*, **101**, 157-179. https://doi.org/10.2307/2233809