

Why the P/E Ratio Becomes Irrelevant in the Valuation of High-Growth Stocks: Insights from the Potential Payback Period

By Rainsy Sam

Abstract

The Price-to-Earnings (P/E) ratio is a widely used yet fundamentally flawed valuation tool for high-growth companies. Its static nature fails to account for the time value of money and the exponential effects of earnings growth. This paper introduces the **Potential Payback Period (PPP)** as a superior, forward-looking metric that integrates both growth and discounting. Using mathematical analysis and three pivotal visual demonstrations—including the concept of the **Hidden Value Zone (HVZ)**—we show why the P/E ratio becomes increasingly irrelevant in high-growth contexts, and how PPP restores coherence and clarity in valuation.

Keywords: P/E Ratio; Potential Payback Period; PPP; PEG; High-Growth Stocks; Hidden Value Zone (HVZ); Stock Internal Rate of Return; SIRR

1. Introduction

The P/E ratio compares a stock's price to its current earnings, offering a snapshot of valuation. However, in dynamic environments—particularly for high-growth firms—this snapshot becomes misleading. Firms with reinvestment strategies and rapid earnings expansion may exhibit high P/E ratios, wrongly suggesting overvaluation. Conversely, the **Potential Payback Period (PPP)** measures how long it takes for the investor to recoup their investment through future discounted earnings, adjusting naturally for growth and risk.

2. Mathematical Foundation of the PPP : A Generalization of the P/E Ratio

2.1. General Case

The **Potential Payback Period (PPP)** estimates how long it takes for an investor to recover their initial investment through future earnings, adjusted for **growth** (g) and **discounting** (r). Its general formula is:

$$PPP = \frac{\log \left[\frac{P}{E} \cdot \frac{g-r}{1+r} + 1 \right]}{\log \left(\frac{1+g}{1+r} \right)}$$

Where:

- P/E: Price-to-Earnings ratio
- g: Expected annual earnings growth rate
- r: Discount rate (cost of capital or risk-adjusted required return)

This formula generalizes the Price-to-Earnings (P/E) ratio by accounting for both the compounding of earnings and the time value of money, including risk.

2.2. Three Special Cases

1. **When $g = 0$:** Earnings are flat. PPP reflects only the discounting effect.
2. **When $r = 0$:** No discounting is applied. PPP captures the pure effect of growth, providing a non-linear alternative to the Price-to-Earnings to Growth (PEG) ratio.
3. **When $g = 0$ and $r = 0$:** In this hypothetical static world, PPP exactly equals the P/E ratio.

These edge cases are limiting forms of PPP, applicable when **growth and/or cost of capital are ignored**. In contrast, the full PPP framework offers a more realistic and adaptable valuation model suited to dynamic economic conditions.

3. The Static World Behind the P/E Ratio

3.1. A Hypothetical Static World

When both growth and discounting are absent, the PPP formula reduces cleanly and directly to the Price-to-Earnings ratio:

$$PPP = \frac{P}{E}$$

This result follows directly from applying L'Hôpital's Rule to the general PPP formula when both g and r approach zero.

In this hypothetical static world:

- Earnings remain constant over time ($g = 0$)
- Future earnings are valued equally to present earnings ($r = 0$)

- There is **no compounding, no inflation, no risk, and no opportunity cost**.

Under these assumptions, the P/E ratio tells us exactly how many years of flat earnings it takes to recover the initial investment—**making it numerically identical to the PPP**.

3.2. Interpretation

- This case illustrates that **P/E = PPP** only in a highly idealized environment.
- It reveals the **conceptual limitation** of the P/E ratio: it is grounded in a world that lacks time sensitivity and economic realism.
- In contrast, the **PPP is designed for dynamic conditions**, where future cash flows are uncertain, vary in size, and must be discounted.

4. How PPP Evolves Relative to P/E as Growth Increases

The graph below (Figure 1) illustrates how the Potential Payback Period (PPP) diverges from the traditional Price-to-Earnings (P/E) ratio as earnings growth accelerates—while assuming a 0% discount rate to isolate the pure effect of growth. The dynamic nature of PPP captures a stock's true value more accurately than the static P/E ratio, especially in high-growth scenarios. As growth accelerates, however, the conventional P/E metric may rise dramatically, but its relevance diminishes. In contrast, PPP stabilizes and offers a more realistic reflection of value by incorporating the time required for earnings to recoup the price paid. This makes PPP a more reliable guide to valuation under varying growth conditions.

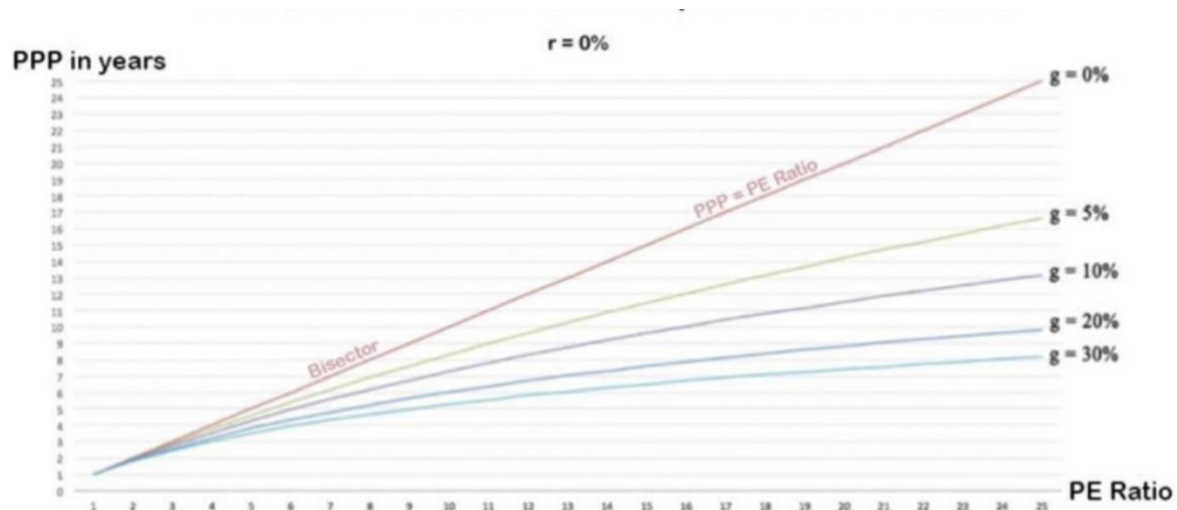


Figure 1: PPP vs. P/E for various growth rates

4.1. Key Observations

- The **red line** is the bisector ($PPP = P/E$), which holds only when earnings growth rate $g = 0$.

- As **growth increases** (e.g., from 5% to 30%), the PPP curve bends below the P/E line, indicating **faster capital recovery** despite a high P/E.

Illustrative example at P/E = 10:

- $g = 0\%$: PPP = 10 years
- $g = 10\%$: PPP ≈ 7.5 years
- $g = 30\%$: PPP ≈ 5 years

4.2. Implication

High-growth firms often appear overvalued through the lens of the P/E ratio. However, the PPP reveals that such firms may, in fact, be **fairly or even attractively valued**, once the compounding effects of earnings growth are properly accounted for.

5. PPP's Sensitivity to Earnings Growth Rates

The graph below (Figure 2) illustrates that the higher the P/E ratio, the more rapidly the PPP declines as growth accelerates. Regardless of initial P/E levels, the intrinsic value of all stocks—as reflected by their PPP—tends to converge at high growth rates. This convergence highlights the structural irrelevance of the static P/E ratio in high-growth environments.

HOW PPP PLUMMETS AS EARNINGS GROWTH ACCELERATES ACROSS P/E RATIOS

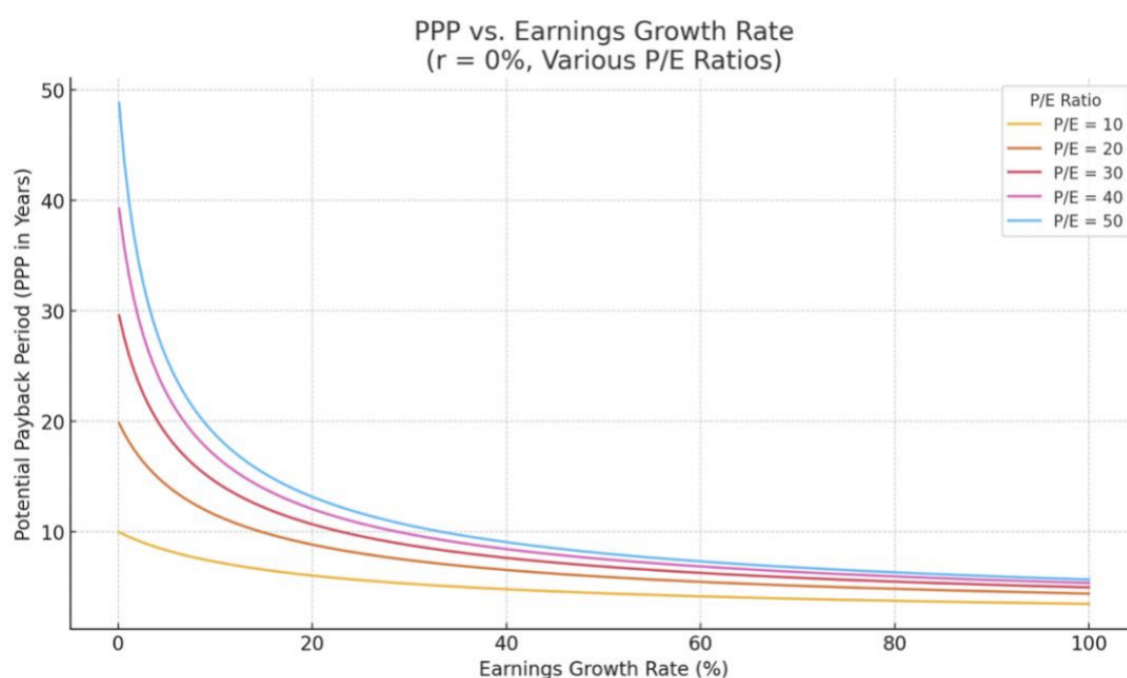


Figure 2: PPP vs. growth rate for fixed P/E levels

5.1. Key Observations

- PPP decreases sharply as earnings growth increases.
- The drop is **steeper** for higher P/E ratios.
- At high enough growth levels (e.g., 50–100%), all curves begin to converge.

5.2. Implication

The non-linear sensitivity of PPP to growth renders it a more accurate and responsive valuation tool than PEG, which naively divides P/E by growth. PEG fails to capture the accelerating effect of compounding earnings on capital recovery time—an effect that PPP internalizes by design.

6. Revealing Mispriced Growth through the Hidden Value Zone (HVZ)

A key advantage of the PPP framework is its ability to uncover undervalued high-growth companies that are misclassified as overvalued by traditional metrics such as PEG or P/E. This leads to the concept of the **Hidden Value Zone (HVZ)**.

6.1. The Hidden Value Zone (HVZ)

THE HIDDEN VALUE ZONE (HVZ)

The HVZ (in yellow) is defined by both PPP and PEG approaches.
It represents the range of P/E ratios and earnings growth rates (g) where:
PEG ratio > 1 and PPP < 10

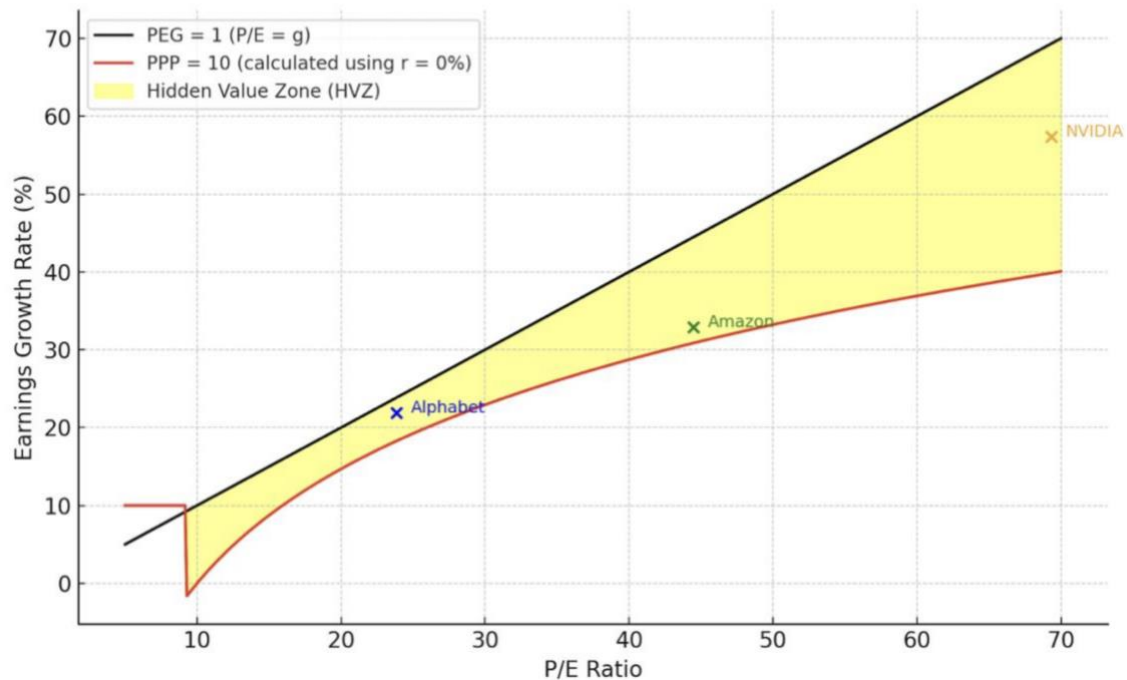


Figure 3: The HVZ is the yellow area bounded by the PEG = 1 line and the PPP = 10 years curve

6.2 Key Observations

- **Black Line (Bisector):** Represents **PEG = 1**, where the Price-to-Earnings (P/E) ratio equals the earnings growth rate (g). This is a traditional benchmark suggesting *fair value* under the PEG approach; stocks falling **below this line (PEG > 1)** are typically deemed *overvalued* by PEG standards.
- **Red Curve (Isocline):** Represents the set of combinations where **PPP = 10 years**, assuming a discount rate $r = 0$ to align with the PEG framework, which likewise ignores discounting. This curve corresponds to a **Stock Internal Rate of Return (SIRR)** of approximately **7.18%**, derived using the Doubling Formula:

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

This expression represents the annualized return required to recoup—meaning to effectively double—the initial investment through cumulative earnings over a 10-year payback period, as defined in the PPP framework.

A SIRR of 7.18% is appreciable compared with a risk-free rate of around 4%—a benchmark based on the yield of 10-year U.S. Treasury securities as of late 2024—indicating that **stocks**

lying just above this curve (i.e., offering a SIRR greater than 7.18%) possess intrinsic value and investment appeal despite being misclassified by PEG.

- **Yellow Zone (HVZ):** The **Hidden Value Zone** captures stocks where $PEG > 1$ but $PPP < 10$. These stocks appear overvalued by PEG but are revealed to be *undervalued* by *PPP*, uncovering hidden value overlooked by traditional metrics.

6.3. Interpretation

- PEG penalizes growth disproportionately because it fails to account for time-based compounding.
- PPP corrects this by showing that companies with high growth and high P/E can still return capital quickly and offer good value.

Table 1: Examples of Stocks in the Hidden Value Zone (as of Nov. 2024)

Company	P/E	Growth (g)	PPP	PEG
NVIDIA	69.31	57.8%	8.18	1.21
Alphabet	23.85	21.91%	9.23	1.09
Amazon	44.48	32.90%	9.67	1.35

All three stocks appear overvalued via PEG ($PEG > 1$), but PPP reveals a less than 10-year payback period, classifying them as **Hidden Value Stocks** under the PPP framework.

7. Conclusion: From Static Multiples to Dynamic Valuation

The P/E ratio, though historically central to equity valuation, fails in the very situations where growth matters most. It cannot distinguish between productive reinvestment and deteriorating margins. The **Potential Payback Period (PPP)** corrects this by integrating growth, risk, and time into a coherent framework.

The three graphs—showing PPP vs. P/E, PPP vs. growth, and the **HVZ**—collectively reveal the limitations of static ratios like P/E and PEG. They also illustrate how PPP:

- Adjusts non-linearly to compounding growth,
- Identifies hidden value where PEG fails,
- Maintains interpretability when P/E explodes.

As equity markets increasingly revolve around technology, innovation, and exponential earnings growth, PPP emerges not as an alternative to P/E—but as its **natural evolution**.

That said, it is important to acknowledge three limiting considerations:

- Even though the PPP represents a conceptual shift in valuation methodology, **no single metric can fully capture all aspects of equity valuation.**
 - The **reliability of any valuation model—including PPP—depends fundamentally on the accuracy and quality of the input data**, particularly projected earnings and growth assumptions.
 - **Further empirical research and application across diverse market conditions** will be essential to reinforce the practical usefulness of PPP and to refine its role in modern equity analysis.
-

References

1. Bodie, Z., Kane, A., & Marcus, A. J. (2018). *Investments* (11th ed.). McGraw-Hill Education.
2. Damodaran, A. (2012). *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* (3rd ed.). Wiley.
3. Gordon, M. J. (1959). Dividends, Earnings, and Stock Prices. *The Review of Economics and Statistics*, **41**(2), 99–105.
4. Penman, S. H. (2013). *Financial Statement Analysis and Security Valuation* (5th ed.). McGraw-Hill.
5. Sam, Rainsy. (2025). *Extending the P/E and PEG Ratios: The Role of the Potential Payback Period (PPP) in Modern Equity Valuation*. Preprints. <https://doi.org/10.20944/preprints202505.0213.v1>
6. Sam, Rainsy. (2025). *How to Adjust the P/E Ratio for Earnings Growth in Equity Valuation: PEG or PPP?* SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5241650
7. Sam, Rainsy. (2025). *A Quantitative Revelation in Equity Valuation: The P/E Ratio is a Degenerate Case of the Potential Payback Period (PPP)*. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5268285
8. Sam, Rainsy. (2025). *Proving that the P/E Ratio is Just a Limiting Case of the Potential Payback Period (PPP) When Earnings Growth and Interest Rate are Ignored*. Preprints. <https://doi.org/10.20944/preprints202505.1236.v1>
9. Sam, Rainsy. (2025). *Generalizing the P/E Ratio Through the Potential Payback Period (PPP): A Dynamic Approach to Stock Valuation*. SSRN.

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5261816

10. Stewart, J. (2015). *Calculus: Early Transcendentals* (8th ed.). Cengage Learning.
-