Poor Predictive Power of PE Ratio on Market Returns

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Project Motivation

$$\text{Price-Earnings Ratio (P/E)} = \frac{\text{Stock Price}}{\text{Earnings Per Share (EPS)}}$$ [1]

nerdwallet [4]

Top 20 Most Undervalued Stocks in the S&P 500: March 2025

Seeking Alpha [3]

This May Be The Most Expensive Stock Market Ever

reddit [2]

S&P 500 P/E ratio at record high - why not wait for the dip?

SP500 Historical PE Ratio indicates market correction?

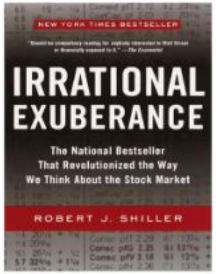
Research Questions

Research Question: How accurately can PE ratios help us predict future 3 year S&P 500 market returns?

Hypothesis: There will be a noticeable negative correlation between PE ratio and future market returns (less than -0.50).

Modeling Approach: Create several correlational matrices and a polynomial regression to assess the strength of relationship between market returns and PE ratio.

Data Acquisition



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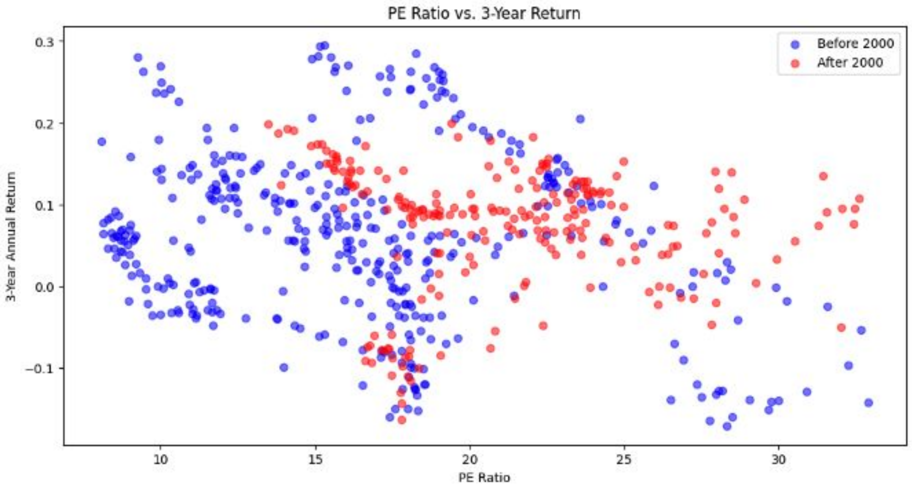
1.6 MB

Field	Explanation	Type
Date	Date when observation occurred (monthly)	Date
S&P Index Price	Price of S&P 500	Float
Earnings	Earnings of S&P 500	Float
3 Year Annual Return	The 3 year annual compound growth rate from specific date of the S&P 500	Float
5 Year Annual Return	The 5 year annual compound growth rate from specific date of the S&P 500	Float
PE Ratio	S&P Composite Price divided by the Earnings of the index	Float

Analysis Plan



Data Cleaning → Creating additional data points → Initial EDA → Constructing Polynomial Model

Data Cleaning

- Reformatting Excel File
- Checking for Missing Values
- Dropping columns with extra data
- Removed observations before 1960

Creating additional data points

- Developing algorithm to calculate annual return n years out
- Creating new PE column using existing price and earnings column

Initial EDA

- Looking at distribution of PE ratios and annual returns over time.
- Creating correlation matrices to assess initial relationship.

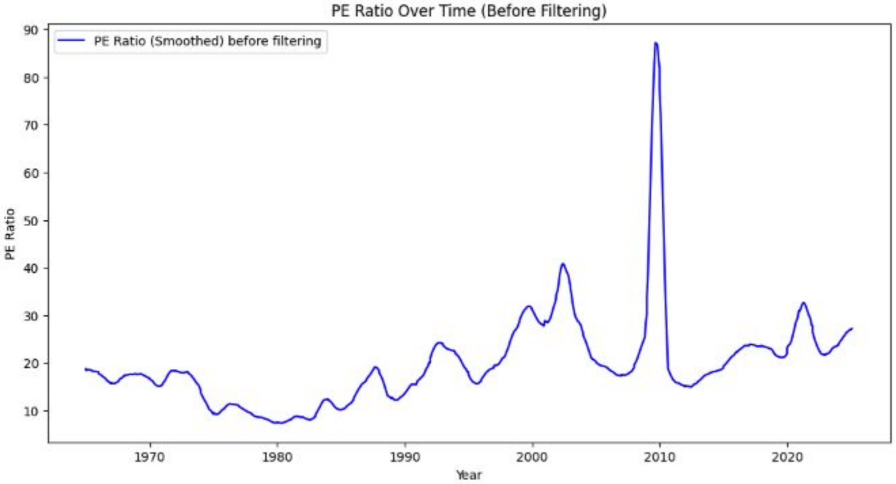
Constructing Polynomial Model

- Creating a polynomial regression model to predict 3 year return based on PE
- Assessing R-Squared performance of model

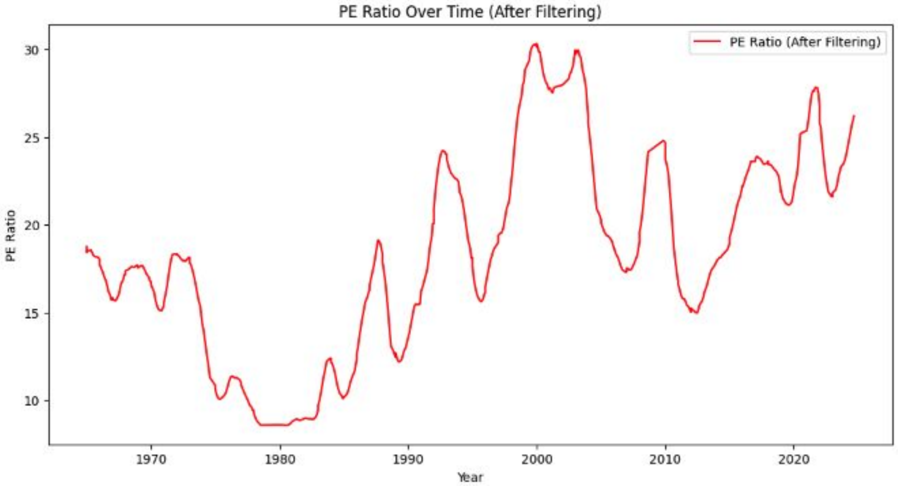
Tricky Analysis Decision 1

How to handle observations from abnormal market conditions (outliers)?

Before



After



Tricky Analysis Decision 2

<u>Best Predictive model to use?</u>

1. VAR Model
    a. Incorporated a relationship in time, but lead to overfitting with rolling cross validation
2. Polynomial Model
    a. Less emphasis on relationship in time, but did not suffer from overfitting which made it easier to assess model's true performance

Solution: Used Polynomial model. However, to still incorporate some element related to time we also segmented are eventual analysis into PRE (before 1995) and POST (after 2002) dotcom bubble.

Biases and Uncertainty

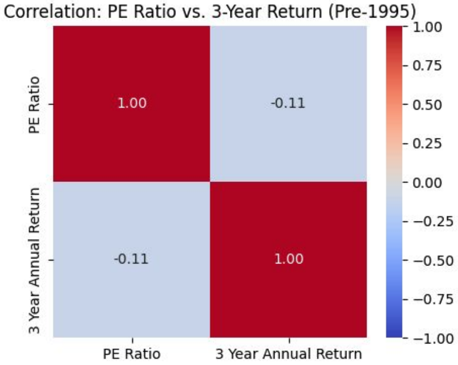
<u>Relevant Biases and Uncertainties:</u>

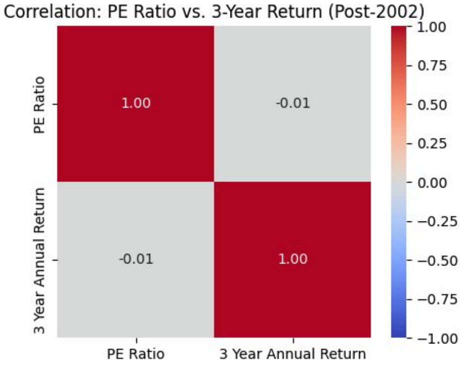
- How abnormal market conditions are handled
  - Removed the lowest and highest 5% of PE Ratios to reduce the impact of these periods.

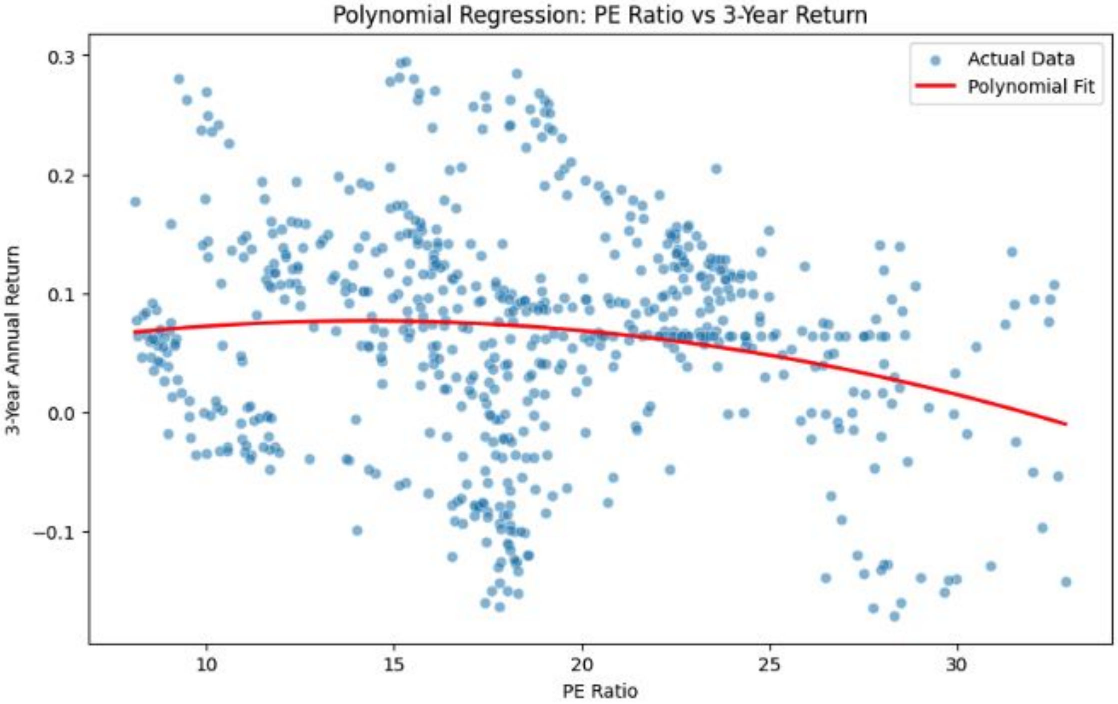
- Analysis looks did not look a lot at internal cyclicality related to presidential terms or rate cycles.
  - Did use ADF test to do a basic test which validated that PE ratio and 3 year returns were stationary.

- Changing market dynamics
  - If market has structurally changed should we have given more weight to more recent observations?

Results and Conclusions







R-Squared Score: 0.0323

Next Steps

Explore Additional Metrics:

- Incorporate Forward PE and PEG Ratios
- Consider using the CAPE Ratio

Dive Deeper into Specific Time Periods:

- Specific Market Downturns
- Presidential Cycles
- Interest Rate Cycles

New Question:

- How might forward looking metrics improve the model?

References

[1] “Price-to-Earnings (P/E) Ratio” Definition, Formula, and Examples” *Investopedia*, July 30, 2024. [Online] Available: https://www.investopedia.com/terms/p/price-earningsratio.asp

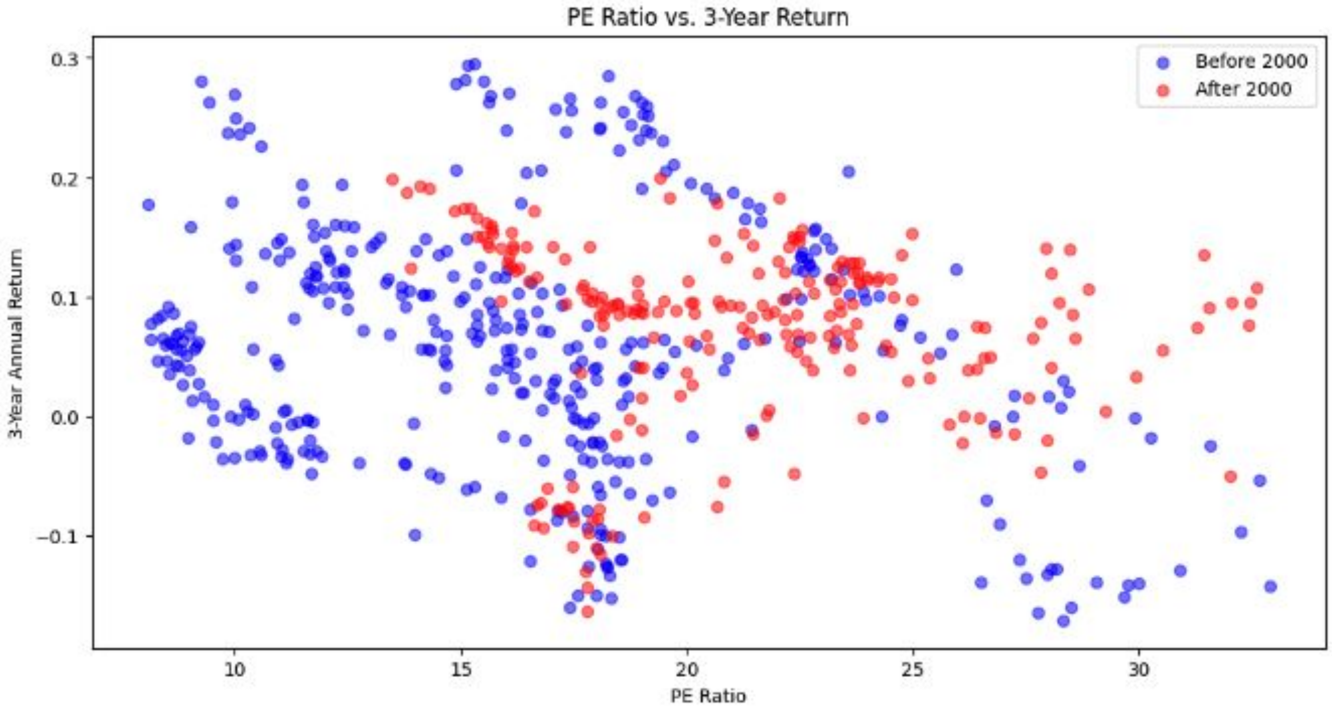
[2] “S&P 500 P/E Ratio at record high- why not wait for this dip?” *Reddit*, Feb. 2025. [Online] Available: https://www.reddit.com/r/investing/comments/1ipj5sy/sp_500_pe_ratio_at_record_high_why_not_wait_for/?rdt=36010

[3] “This May Be The Most Expensive Stock Market Ever” *Seeking Alpha*, Dec. 5, 2024. [Online] Available: https://seekingalpha.com/article/4742300-most-expensive-stock-market-ever

[4] “Top 20 Most Undervalued Stocks in the S&P 500: March 2025” *Nerdwallet*, Mar. 3, 2025. [Online] Available: https://www.nerdwallet.com/article/investing/undervalued-stocks

Thanks!

Any questions?



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