

## Understanding the Legitimacy of Popular Business and Stock Prediction Formulas

The concept of the stock market is a question perplexing to most. However, any gaps in understanding are quickly brushed aside as millions of people yearly rush to invest their money in hopes of great returns yet most are often met with disappointment. Although the stock market is open to all, it seems the winners are only of the select, knowledgeable, few, but is this really true? Just a few quick google searches and you can find some useful tools and ratios that will supposedly guide you towards financial success in the market. However, do these ratios really work, or is there a reason that multi-billion dollar brokerage firms like BlackRock or Fidelity exist. In this paper, I will look at the most cited and popular ratios and assess whether they actually result in stock success or not.

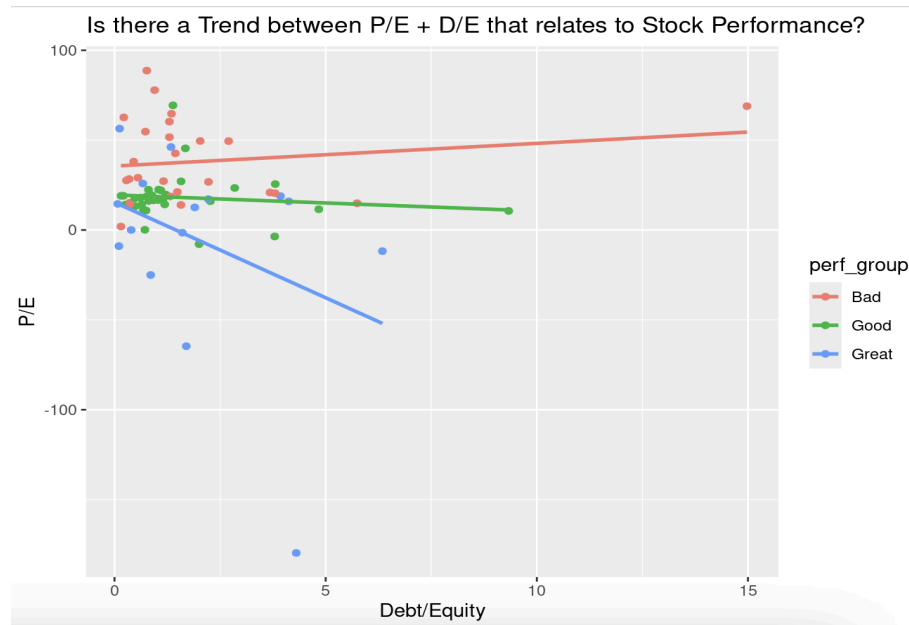
Before exploring the formulas, it is important to understand the data we are working with. A total of three datasets were used; US businesses annual income statements, US businesses annual balance sheets, and stock performance data. The income and balance sheets were taken from SimFim, a stock analytics and data API website, which offers recent historical data for free. I used an inner join to merge the two datasets which resulted in a set with around 17000 observations and 40+ variables with data spanning from 2018-2022. The stock performance dataset is much more tame, coming from a practice exercise on machine learning, the data frame contains only about 70 observations and focuses more on the stocks of certain companies.

A big reason why data is so important in the world of stocks is because much of the most popular and used formulas are common knowledge, meaning that in order to be a step above your peers, you need to have superior data. The 4 ratios I've highlighted in this paper are the price-earnings ratio (P/E), return on equity ratio (RoE), debt-equity ratio (D/E), and the current ratio.

The price to earnings ratio, calculated by dividing the market value per share by the earnings per share, is one of the most commonly used ratios to analyze stocks.

Top Stocks by P/E Ratio		
Showing the top 6 stocks by P/E ratio and their performance		
ID	P/E Ratio	Stock Performance
	P/E	Perf
2183	276.26	0.42
6060	161.05	-0.13
8871	112.28	-0.16
12238	108.20	0.43
7670	88.69	-0.07
12017	77.81	-0.16

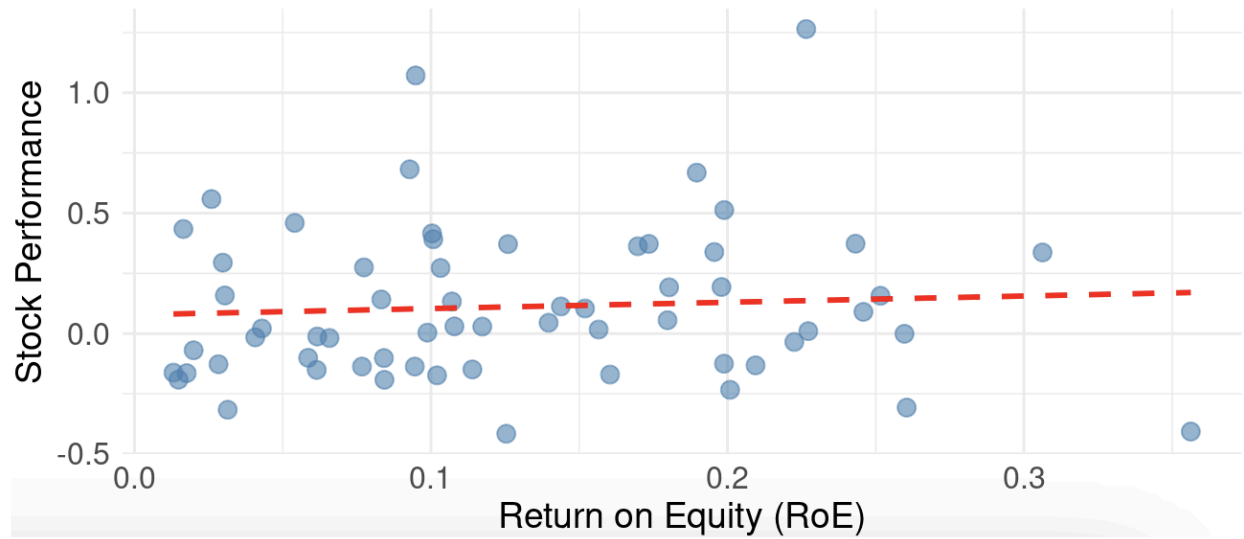
When looking at this table, which chooses the six companies with the highest P/E ratio, we would think this also means the companies would have the six best stock performances, but this is not the case. The stock performances seem totally unrelated, which means there is probably more going on. To try and dig deeper into this problem I calculated a company's debt to equity ratio, which you get by dividing total liabilities by total shareholder equity, and compared it to the P/E ratio to try and see if the combination of the two would generate a better correlation with stock performance.



Perf\_group is a category for how good the performance is ( $>0.4$  is Great, 0 to 0.4 is Good,  $<0$  is Bad). This scatter plot seems to show that companies with a negative P/E and normal D/E have great stock performance, however if I were to include outliers we see a significant change in the graph so I believe these results are caused by a small sample size from the third dataset. Even though the line of best fits for each group is probably an oversimplification due to a lack of data, it seems to hint that adding more variables in our analysis actually helps guide us towards accurately predicting stock performance.

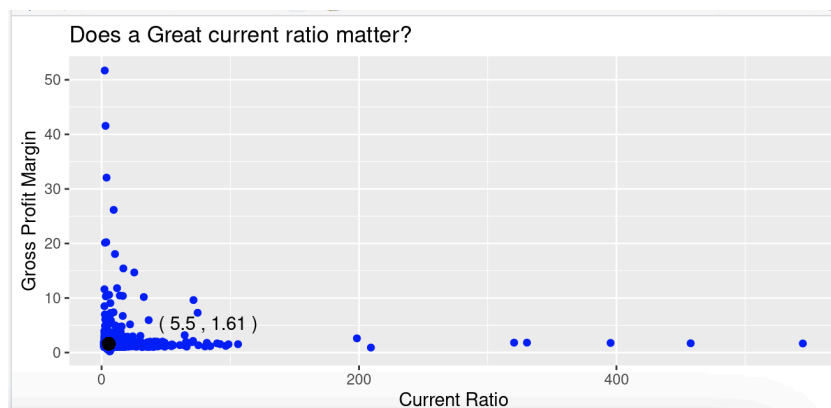
Return on equity, the next formula on the list, measures a corporation's profitability and how efficiently it generates those profits. The ratio is calculated by dividing the net income by the average shareholder equity, and when we compare this ratio to stock performance we get this graph.

## Correlation between RoE and Stock Performance

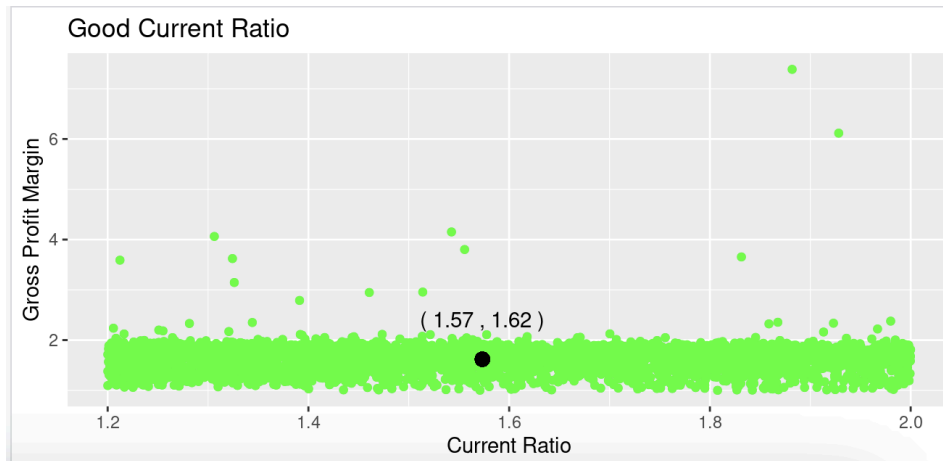


The red line depicts the line of best fit which shows a very small (if any) correlation between RoE and stock performance. Visually we also see a pretty evenly dispersed distribution, meaning as RoE increases, it doesn't necessarily mean there will be a better stock performance.

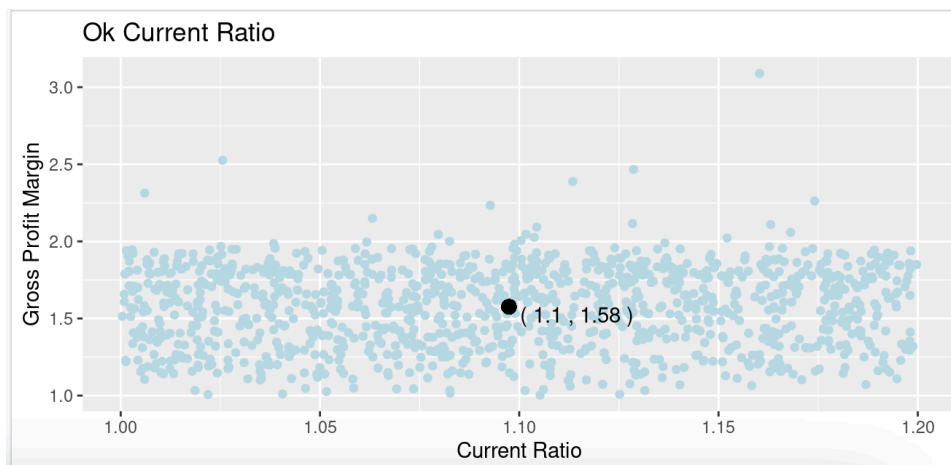
Finally, let's look at the current ratio, which is calculated by dividing the total current assets by the total current liabilities. This ratio I wanted to see how companies with a "great", "good", "ok", and "bad" current ratio compared to their gross profit margins. I plotted a black dot on each graph to represent what the average gross profit margin and current ratio for each group is.



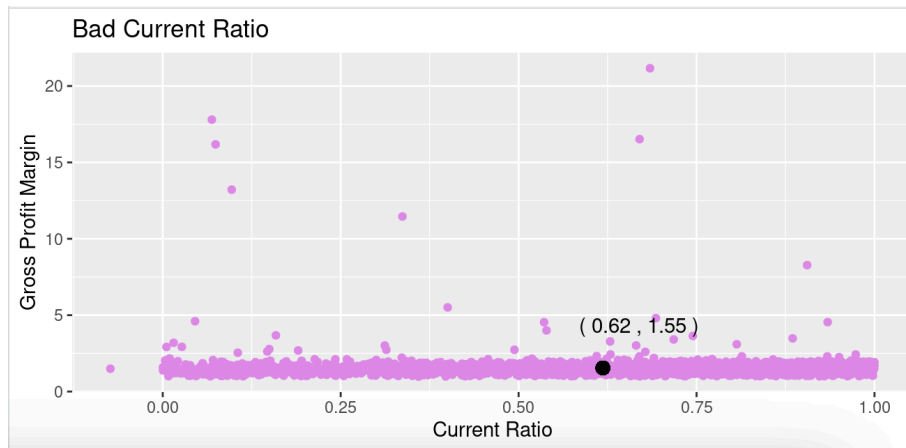
This first graph shows companies with a great current ratio ( $\geq 2.0$  current ratio) had a current ratio average of 5.5 and a gross profit margin of 1.61.



The second graph shows companies with a good current ratio (from 1.2 to 2.0 current ratio) had a current ratio average of 1.57 and a gross profit margin of 1.62.



The third graph shows companies with an ok current ratio (from 1.0 to 1.2 current ratio, in my research I found discrepancies as to what a good current ratio was so I wanted to include this category) had a current ratio average of 1.1 and a gross profit margin of 1.58.



The final graph shows companies with a bad current ratio ( $<1.0$  current ratio) had a current ratio average of 0.62 and a gross profit margin of 1.55. Despite the great changes in current ratio average, each group's profit margin does not change substantially, meaning the current ratio does not correlate with gross profit margin.

Before we break down the results it's important to recognize potential problems with the conclusions. One major issue I had was actually defining what it meant for a business to be successful. I ended up using the gross profit margin as a signifier of success, but this is not a definitive way of showing this and it is possible successful companies don't have a particularly high gross profit margin. Another potential problem was that in the dataset taken from the exercise about machine learning, it has a variable called 'performance' which is a value representing the stock performance of a company. I wasn't able to actually find what this value meant, although considering the value can be negative and positive one good assumption is that the variable measured stocks of the companies over time and looked at the difference. Another possibility is that it uses other resources or statistics to know how good a stat is. This dataset was also fairly small, only having 78 observations. Another oversight was that in this paper I chose to view each ratio at face value and compared them directly to a company's stock performance or

their gross profit margin. However each of these formulas has a story behind them and a context in which they should be used, so it is possible that these comparisons are an unfair assessment.

The goal of this paper was to assess whether commonly used ratios such as P/E, Debt to Equity, and the Current Ratio could be used at face value to determine stock or business success. Throughout each comparison, we found no signs that they actually relate to the success of a stock. The only case which showed promise was when we graphed P/E and D/E compared to a stocks performance, in which we saw some separation between the lines of best fits. Although these results were probably faulty, theoretically, if we continue to add more and more variables (dimensions) to our graph we should be able to find an accurate way to predict performance.

It is a tough pill to swallow that finding success in the market takes more than just a few calculations, but this really shouldn't come as a surprise. It is a nearly impossible task, how can you use past data to predict a future that has never happened? Although much more complicated, there are still many methods for an individual to research and beat out the corporations, the most promising in my opinion is the use of AI. When given large amounts of data, AI can find patterns humans can't. The multi-dimensional analysis I previously mentioned is the exact strategy machine learning algorithms use, and in the past few years there have been numerous cases of AI stock predictors performing better than the S&P 500 (<https://valueinvestingai.com/> one I just recently found). As AI continues to perpetuate our lives at a rapid rate, it is inevitable that the tools for analyzing the market will become mainstream fast. However the big corporations shouldn't be worried just yet. The market grows and morphs as we do, so the drastic changes AI will undoubtedly cause will also be reflected in the market. When all is said and done the market will still remain a mystery, a problem that data cannot yet solve.