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1. Introduction

The project analyses stock data and uses three different methods to detect the best portfolio containing 30 stocks each. The idea was taken from Greenblatt's "The Little Book That Beats The Market" as he introduces the Magic Formula in his book. After research two other formulas were chosen to compare with the initial Magic Formula.

The data was obtained using Yahoo finance, downloading the necessary values for 100 companies in the United States. The chosen companies were mostly selected from the S&P500 list or the NASDAQ100 as all formulas require the companies to be large and top-valued in order to outperform the market return. As a programming language Matlab is used.

The paper will introduce in the following sections each concept, explain the methods and presents the results from applying the formula to the data. Additionally a discussion section is provided where similarities and differences between the chosen portfolios are mentioned. In conclusion important points as well as a critical reflection will terminate the paper.

2. The Magic Formula

The Magic Formula was derived from Joel Greenblatt and determines an easy way to detect a portfolio to invest in. His strategy is based on two assets: The earnings yield and the return on capital. The earnings yield is calculated by dividing the earnings per share (EPS) by the share price. The EPS is obtained by taking the reciprocal of the price-earnings ratio. The formula for the return on capital (ROC) is given by the following.

$$ROC = \frac{\text{Net Income} - \text{Dividends}}{\text{Total Capital}} \quad (1)$$

For each company those two values are calculated and a separate ranking for each calculation is made. The company with the highest ROC gets the best ranking (rank 1). The same ranking technique is applied to the earnings yield. Then the two separate rankings are added up in order to get the 30 best ranked companies, the portfolio one should invest in.

Joel Greenblatt showed that his investment strategy was able to outperform the market return over a time period and that this simple formula works when choosing stocks to invest in. He suggests to only use large and top-ranked companies and to follow his investment guidelines. The investor should start buying five to seven stocks at one time and repeat the buying process during the first year every two months until the ownership of 30 stocks. Each single stock should only be held for one year (Greenblatt, 2010).

I applied the Magic Formula to the selection of stocks described in the introduction and used the return on asset (ROA) instead as the ROC. Greenblatt described in his book that the ROA is a good substitute for the ROC in the screening process. The following portfolio was obtained by following his steps:

Table 1: Portfolio suggested from the Magic Formula

Index	Company Name
63	Seagate Technology Plc
91	United Rentals Inc.
99	Western Digital Corporation
31	Intel Corporation
87	Union Pacific Corporation
94	Viacom Inc.
64	Southwest Airlines Co.
37	Kellogg Company
57	NVIDIA Corporation
93	Verizon Communications Inc.
5	Apple Inc.
85	Tyson Foods Inc.
46	Masco Corporation
62	Ross Stores Inc.
73	The Home Depot Inc.
79	The Walt Disney Company
68	Texas Instruments Inc.
26	Facebook Inc.
90	United Parcel Service Inc.
23	Dollar Tree Inc.
65	Starbucks Corporation
82	Tractor Supply Company
36	Kansas City Southern
72	The Hershey Company
86	Ulta Beauty Inc.
9	Best Buy Co. Inc.
15	CBS Corporation

42	Macy's Inc.
38	Kohl's Corporation
47	Mastercard Inc.

3. Benjamin Graham's Formula

In this section the formula from the famous investor Benjamin Graham is used to analyze the same stocks as before. I decided to use this formula as Greenblatt talks in his book about Graham and his investment strategy and it would be great to compare the portfolios that each method suggests according to similarities and differences.

The strategy starts by computing the value expected from the growth formula.

$$V = \text{EPS} * (8.5 + 2 * G) \quad (2)$$

The value V is obtained by multiplying the EPS with the sum of the price-earnings ratio of a non-growing company plus twice the reasonable expected five year growth rate. It is debatable if the 8.5 and the 2, which is used for multiplying the expected growth, are still reasonable today or if those numbers should be changed according to recent changes in the financial market such as suggested by Jun (Jun, 2017).

In the second step the relative intrinsic value is calculated (RIV), used to detect if a stock is under-or overvalued. According to Graham, one should avoid undervalued stocks with a RIV below 1.

$$\text{RIV} = \frac{V}{\text{Share Price}} \quad (3)$$

The RIV is then calculated for each company's stock and a ranking is obtained, where the most undervalued stock gets the best number. When applying this formula to the dataset the following portfolio is obtained.

Table 2: Portfolio suggested from Graham's Formula

Index	Company Name
91	United Rentals Inc.
27	Ford Motor Company
99	Western Digital Corporation
22	Devon Energy Corporation
7	Avis Budget Group Inc.
74	The Kraft Heinz Company
40	Lincoln National Corporation
6	At&T Inc.
42	Macy's Inc.
94	Viacom Inc.
75	The Kroger Co.
97	Walker & Dunlop Inc.
85	Tyson Foods Inc.
44	Marathon Petroleum Corporation
1	Adobe Inc.
93	Verizon Communications Inc.
64	Southwest Airlines Co.
88	United Continental Holdings Inc.
63	Seagate Technology Plc
49	MetLife Inc.
87	Union Pacific Corporation
39	Lennar Corporation
36	Kansas City Southern
21	Delta Air Lines INC
31	Intel Corporation
66	Symantec Corporation
12	Capital One Financial Corporation
100	Wells Fargo & Company
38	Kohl's Corporation
67	Target Corporation

The formula is at the upper end of the valuation range and works best in outperforming the market when the market is depressed. For our results it would be best to invest only in the first 20 chosen companies as the RIV for the remaining 10 is below 1, meaning the companies are overvalued and one should not invest in them.

4. ERP-Method

The third method examined is modified from the ERP5-method to fit the data constraints. I decided to use three measures to get an investable portfolio (Quant Investing, 2014).

1. Earnings Yield
2. Return on Equity (ROE)
3. Price-to-Book Ratio

Each measure is calculated and ranked separately. The earnings yield as well as the ROE are ordered from highest to lowest, giving the highest number the best rank. When ranking the price-to-book ratio lower numbers are preferred as they indicate an undervalued stock. In order to make a portfolio decision we add up the separate ranks of the three measures for each company. The lowest combined rank then gives again the portfolio decision. Table 3 displays the choice made.

Table 3: Portfolio suggested from the ERP-Method

Index	Company Name
7	Avis Budget Group Inc.
91	United Rentals Inc.
63	Seagate Technology Plc
93	Verizon Communications Inc.
75	The Kroger Co.
87	Union Pacific Corporation
37	Kellogg Company
46	Masco Corporation
90	United Parcel Service Inc.
73	The Home Depot Inc.
42	Macy's Inc.
65	Starbucks Corporation
64	Southwest Airlines Co.
57	NVIDIA Corporation

72	The Hershey Company
15	CBS Corporation
78	The Sherwin-Williams Company
5	Apple Inc.
56	Nordstrom Inc.
62	Ross Stores Inc.
97	Walker & Dunlop Inc.
67	Target Corporation
85	Tyson Foods Inc.
58	Omnicom Group Inc.
82	Tractor Supply Company
9	Best Buy Co. Inc.
94	Viacom Inc.
68	Texas Instruments Inc.
77	The Progressive Corporation
21	Delta Air Lines Inc.

5. Discussion

In this section similarities and differences between the obtained portfolios are made. The highest ranked company from the Magic Formula is Seagate Technology, the Graham formula puts United Rentals as the number one investment choice. The last method values Avis Budget Group the best. Even though the first place of each ranking is different, the chosen companies are similar and occur throughout the three rankings altered in order. United Rentals Inc., which is one of the eight companies that are listed in each of the three portfolios, is in the top two choices throughout the rankings. Table 4 provides a list of the companies listed in all portfolios.

Table 4: Companies ranked in each portfolio

Index	Company Name
91	United Rentals Inc.
63	Seagate Technology Plc
87	Union Pacific Corporation
94	Viacom Inc.
64	Southwest Airlines Co.
93	Verizon Communications Inc.

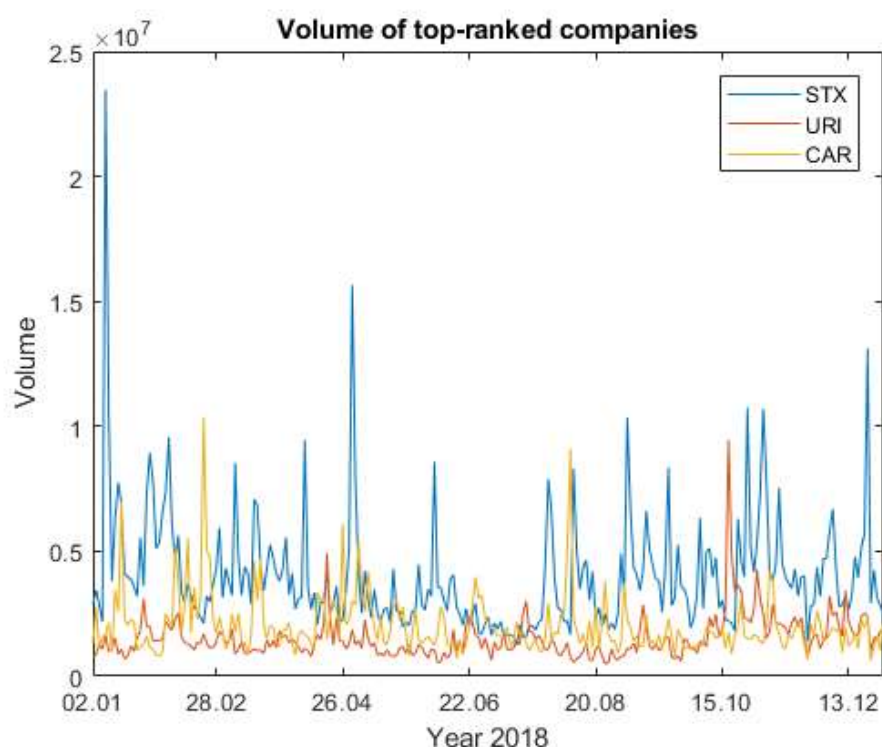
85	Tyson Foods Inc.
42	Macy's Inc.

By comparing the Graham formula and the ERP-method with the Magic Formula, many consensuses can be seen. Benjamin Graham's way of choosing an investment portfolio resembles Greenblatt in twelve out of the thirty companies. An indicative and promising results for investing even though the order is different. When comparing the ERP-method with the Magic Formula even more companies are similar. Around 73% of the portfolios coincide when looking at the companies listed and not their proposed portfolio order.

On the other side, especially the order of the companies listed differs quite throughout the portfolio. A demonstrative example would be the company Union Pacific Corporation (Index: 87), which is ranked at sixth or seventh place for the Magic Formula and the ERP-method. Contrary to those good ranks, the Graham's formula ranks this corporation at the 22nd place with a RIV value below one, meaning an overvaluation and a suggested investment avoidance.

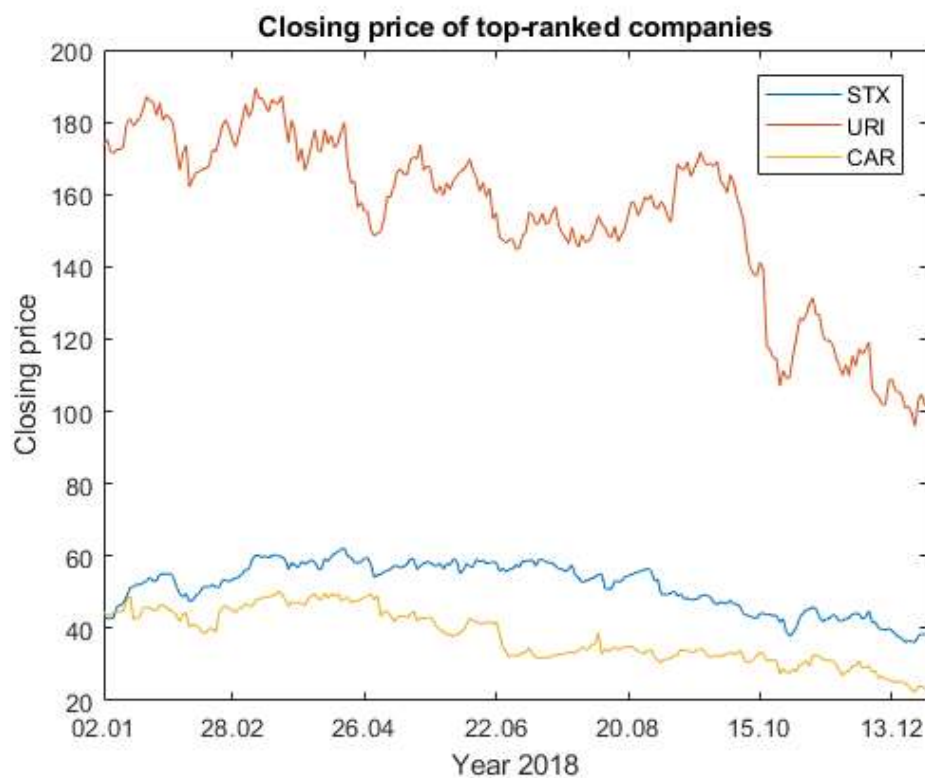
Finally, the top three ranked companies are closer looked at. The volume and the closing price of 2018 are examined. Figure 1 display the volume and figure 2 plots the closing price for Seagate Technology (STX), United Rentals (URI) and Avis Budget Group (CAR).

Figure 1: Volume of top-ranked companies



STX has the highest volume of the three stocks with extreme peaks. The volume is fluctuating around a stationary mean. From figure 2 we see a clear negative trend for URI during 2018, the share price dropped by around 70 to 80 in one year. The closing price of STX shows a far less negative trend, whereas the negative development of CAR is a little more distinctive.

Figure 2: Closing price of top-ranked companies



6. Conclusion

The analysis of the data with three different methods to determine the best portfolio provided alike results in the company choices. This is due to the fact that the used techniques are quite similar and have same data requirements. The largest difference lies in the distinct ranking order. An investment should be made, if the stock is clearly undervalued. A decision, which formula works best to outperform the market cannot be made. Each investors needs to consider its own risk.

From the simple analysis the performance of each portfolio is not quite clear and one should further research around this topic before making any investment decisions. Further research could contain the examination of past performance; the decisions on how much to invest and to what proportion the investment should be divided between each company in the portfolio.

7. List of literature

Greenblatt, J. (2010). *The Little Book that Beats the Market*. John Wiley & Sons.

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