INSTITUTO UNIVERSITÁRIO DE LISBOA

# 70 Years Later, a New Filter - An Update on Benjamin Graham's Stock Selection Criteria.

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Dissertation in Finance, ISCTE Business School

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Orientation by Rui Alpalhão, Invited Associate Professor,
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## Resumo

Benjamin Graham foi um dos mais icónicos e respeitados nomes no mundo dos investimentos devido às suas importantes lições relativas ao perfil do investidor inteligente e à sua abordagem ao value investment. A sua estratégia de seleção de ações com mais de 70 anos serviu de inspiração para milhares de investidores um pouco por todo o mundo e recompensou em grande escala todos aqueles que seguiram os seus princípios de investimento. Não obstante do seu sucesso no passado, os resultados pouco aliciantes obtidos por estratégias de value investing nos tempos mais recentes têm vindo a criar algum ceticismo relativamente aos princípios de Graham. Tal como muitos outros, também eu sou um seguidor ávido de Benjamin Graham e ainda que concorde com as suas filosofias, concordo também que a sua abordagem à avaliação de empresas tem vindo a tornar-se excessivamente rígida e limitativa, especialmente numa economia que é completamente diferente da que se vivia nos tempos de Graham. Nesta dissertação, proponho-me a revisitar os limites desta estratégia de investimento com o objetivo de propor uma versão atualizada e mais flexível da estratégia que possa ser utilizada por qualquer investidor com algum conhecimento em finanças e investimentos.

**Palavras-chave:** Value Investing; Benjamin Graham; O Investidor Inteligente; Seleção de Ações.

**Códigos de Classificação (JEL):** G10, G11

## Abstract

Benjamin Graham is one of the most iconic and respected names in the investment world due to his important lessons regarding the intelligent investor character and his approach to value investing. His 70 year-old strategy for screening and picking stock has inspired thousands of investors all around the world since it was first published, and it has compensated immensely to the ones who have followed his principles. However, in more recent times, the general underperformance of value investing strategies as a whole in comparison to growth strategies has led investors to question its success in today's market conditions and some disbelief in its principles has appeared. I am too a Benjamin Graham follower. Despite agreeing with most of its lessons, I agree that its approach to investing has gone too rigid and limitative in an economy that is completely different from the one of Graham's time. In this dissertation, the limits of this strategy are going to be revisited to reach an updated and more flexible strategy that can be easily applied by any investor with some level of knowledge in finance and investments.

**Keywords:** Value Investing; Benjamin Graham; The Intelligent Investor; Stock Selection

**Classification Codes (JEL):** G10, G11

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# Glossary

**Current Ratio** is a liquidity ratio that measures a company's ability to pay short-term obligations or those due within one year. It is obtained by the following formula:

$$Current\ ratio = \frac{\text{Current liabilities}}{\text{Current assets}}$$

**Debt-to-equity** is used to evaluate a company's financial leverage and is calculated by dividing a company's total liabilities by its shareholder equity. D/E ratio is an important metric in corporate finance. It is a measure of the degree to which a company is financing its operations with debt rather than its own resources.

**Defensive Investor** is a type of investor defined by Benjamin Graham as being focused on finding conservative investments that require little effort in portfolio management. Meaning they spend little time researching and selecting individual investments. The defensive investor typically doesn't expand their universe beyond the limited conservative choices available to them.

**Dividend Yield** is a financial ratio expressed in percentage that shows how much a company pays out in dividends each year relative to its stock price (dividend/price).

**Enterprising investor** or aggressive investor is defined by Benjamin Graham as one who has the time and experience in investing to expand the possible universe of opportunities beyond conservative investments. It is an active approach that requires constant attention and monitoring.

**EPS** (earnings per share) is calculated as a company's profit divided by the outstanding shares of its common stock. The resulting number serves as an indicator of a company's profitability.

**Growth Investing** is an investment style and strategy that is focused on increasing an investor's capital. Growth investors typically invest in growth stocks—that is, young or small companies whose earnings are expected to increase at an above-average rate compared to their industry sector or the overall market.

**HML** (High Minus Low) also referred to as the value premium, is one of three factors used in the Fama-French three-factor model. The Fama-French three-factor model is a system for evaluating stock returns that the economists Eugene Fama and Kenneth French developed.

**Long-short portfolio** is an investing strategy that takes long positions in stocks that are expected to appreciate and short positions in stocks that are expected to decline.

**Market-to-book ratio** is one indicator of a company's value. The ratio compares a firm's book value to its market value.

**Multiples** are measures to access some aspect of a company's financial well-being, determined by dividing one metric by another metric. Metrics are quantitative tools that measure a company's performance. Investors use multiples to quantify a company's growth, productivity, and efficiency.

**Net Current Assets or Working Capital** is the difference between a company's current assets (such as cash, accounts receivable/customers' unpaid bills, and inventories of raw materials and finished goods) and its current liabilities, such as accounts payable and debts. It's a commonly used measurement to gauge the short-term health of an organization.

**P/E Ratio** is the ratio for valuing a company that measures its current share price relative to its earnings per share (EPS). The price-to-earnings ratio is also sometimes known as the price multiple or the earnings multiple.

**Screening process** is the process of searching for companies that meet certain financial criteria. A stock screener has three components: A database of companies. A set of variables. A screening engine that finds the companies that satisfy those variables and generates a list of matches.

**Specific risk** is a hazard that applies only to a particular company, industry, or sector. It is the opposite of overall market risk or systematic risk.

# Introduction

Benjamin Graham is known in the investments field as the father of value investing due to his popular work during the ’30s and ’40s with 2 of his books, “Security Analysis”, and “The Intelligent Investor”, being claimed as the bibles of value investing. In his last-mentioned book, Graham guides the reader to what he believes true investing is and gives a helpful framework to those who want to invest following his investment principles by pointing out a set of 7 criteria for stock screening and selection.

For decades, value investing was known to be the winning strategy of the investment world. The strategy implied that the market is not fully rational, with speculative and greedy agents being responsible for short-term shifts between a company’s intrinsic value and its market price. By believing that the market price will always correct all the short-term frenzy in the long term, the patient investor could take advantage of the short-term value opportunities by investing in temporarily undervalued companies with exceptional business fundamentals.

This strategy turned out to be largely accepted in the investment world and achieved consistent above-average returns for most of the last century.

After more than 70 years since The Intelligent Investor was originally published, many investors still follow Graham’s principles today. However, value investing strategies as a whole have been losing their appeal in the last decade after the results achieved by these strategies being surprisingly disappointing for the last 15 years, with many stating that value investing is old-fashioned and doesn’t apply to today’s market conditions.

Despite the many studies made by other scholars regarding this topic, all the studies I found used single criteria value strategies to make conclusions on the inefficiency of value investing. No studies using multi-criteria and specially Grahm’s criteria were found, thus leaving unanswered the question of whether this strategy still fits today’s economy or not.

In this dissertation, I made a deeper analysis of Benjamin Graham’s strategy to understand if this underperformance phenomenon also included the well-regarded strategy. The work presented in this dissertation is divided into 5 parts: Initial back-test of the original strategy; Analysis of the initial back-test; Strategy update; Updated strategy back-test; Analysis of the final back-test and conclusions.

Using these methods, I was able to figure out an uncorrelation between the poor results found in previous studies regarding single criteria value strategies and the surprisingly good results achieved by Graham’s strategy in recent years. Nonetheless, the strategy was found to be too rigid, leading to undiversified portfolios and leaving valuable investment opportunities behind. Some rules were also found to be outdated and needed to be reformulated to capture today’s digital environment value. The

updated strategy got overall similar results to the original one but with more diversified portfolios, decreasing the overall strategy risk.

# Literature Review

## Concept of Value Investing

It is usual to assume that a value investor is one who invests in stocks that are, at the moment of the investment, priced below what they are worth, their intrinsic value. Despite this notion being easy to understand even for anyone without any knowledge of business or finance, it is indeed too broad a definition. Following that line of thinking, almost every investor could be classified as a value investor since every investor looks for opportunities in the market that he thinks are not priced accordingly, otherwise would not make sense to invest in the first place.

To understand value investing, we must begin with the proposition that the value of a firm is derived from two sources – investments that the firm has already made (assets in place) and expected future investments (growth opportunities).

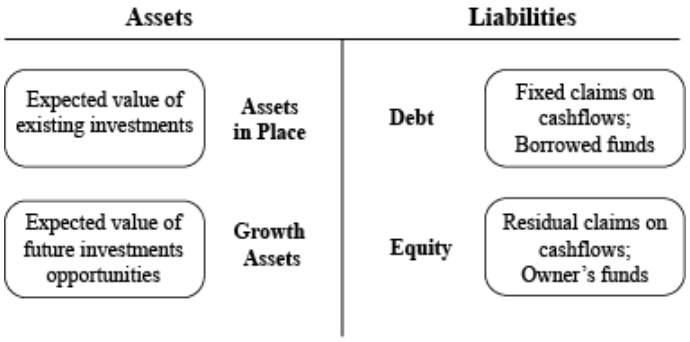


*Figure 1- Company's value sources*

What distinguishes a value investor from its peers is their desire to buy firms for less than what their assets in place are worth. Hence, value investors tend to move away from large premiums paid for growth opportunities and try to find their best bargains in more mature and tangible companies that are temporarily out of favor.

## Value Investment Strategies

Even after describing what a value investor is and what types of investments he looks for, it is still not completely apparent which opportunities might be considered valuable for these types of investors as it was not defined how to find a business's intrinsic value.

One of the most common ways to compute a business's intrinsic value is through the DCF (Discounted Cashflow) method, in which the value is nothing but the sum of the business' future cash flows, discounted to the present value by the company's discount rate. This method is widely accepted and taught in business schools all around the world, but despite being one of the best ways to achieve the company's intrinsic value, it can lead to a very subjective output value with slight changes in the model's inputs such as the assumed discount and futures growth rates.

As an alternative, it is very common to use multiples to access a company's value due to its straightforward approach.

Lakonishok et al. (1994) used the market-to-book ratio as the multiple to categorize value stocks. This strategy consists in buying the 30% of the stocks with the lowest market-to-book ratio and selling short the 30% of the stocks with the highest market-to-book ratio.

Fama & French et al. (1992) introduced a similar value strategy with the HML methodology. In this strategy long-short portfolios were determined after first, dividing the sample firms into large and small by median market capitalization (thereby adjusting for firm size), and then investing in the 30% lowest value stocks and shorting the 30% highest valued stocks, of both large and small firms, using the market-to-book ratio too as a way to define value stocks.

Using the market-to-book ratio, alongside the P/E ratio, to define value stocks is, in fact, a conventional approach, but I believe that it is too narrow of a definition of value investing and misses the essence of value investing explained previously.

## Graham criteria

Benjamin Graham introduced a different approach on how to screen stocks when looking for potential investment opportunities. In his book, The Intelligent Investor, Graham proposed only buying into a stock that fulfilled all the following criteria:

1. Price to Earnings ratio below 15;
2. The product between the PE ratio and PB ratio below 22.5;
3. Current Ratio above 1.5;
4. The company pays out dividends;
5. EPS above 0 in all last 5 years;
6. Debt below Twice Net Current Asset;
7. Historical Growth in EPS (over last 10 years) above 33%;
8. Debt to Working Capital Ratio bellow 1.1.

With these 8 rules, Graham tried to define what in his mind was a value stock worth investing in. For him, a stock could not be categorized as a value stock, only based on price attractiveness alone. If that were the case, the value investor would be doomed to buy in companies that despite being undervalued by the market, were also badly managed and represented bad businesses overall. That is the reason why its screen metrics were not only connected with the stock price but were also related to the business safety and profitability too. For him, an investment decision should only consider great businesses with favorable records over long periods that are facing a period of low popularity in the investment world.

## Recent Underperformance

Much research has been made regarding value investing and its under-performance against the market as a whole and specifically against growth investing, commonly known as the opposite investing strategy of value investing. Usually, these studies (Lakonishok et al., 1994; Fama and French, 1992 & 1993; Kok et al., 2018; Ball et al. 2019.) use the standard classification of value investing based solely on the Market-to-Book ratio. This is common practice due to the high explanatory power of excess returns provided by this ratio alone.

Lev & Srivastava et al. (2019) examined the 10-year growth of a dollar invested in the Fama-French value strategy at the beginning of each decade, from the 1970s to the present. Their conclusions, illustrated in figure 2, were that a dollar invested in the long-short portfolio on January 1, 1970, yielded

by the end of the decade $2.02 (102% return), and a dollar invested on January 1, 1980, yielded by decade-end $1.75 (75% return). These were attractive returns.

From 1989 on, the strategy faltered, mainly because of the tech bubble of the 1990s which inflated the valuations of tech companies until the end of the decade. A dollar invested in the strategy at the beginning of the 1990s would lose 10% by the end of the decade. The first few years of the 2000s saw a brief resurgence of the value strategy, driven primarily by the huge sell-off after the tech bubble.

However, since the last global financial crisis that ended in 2009 returns in this strategy have been surprisingly poor compared to the strategy's overall past performance.

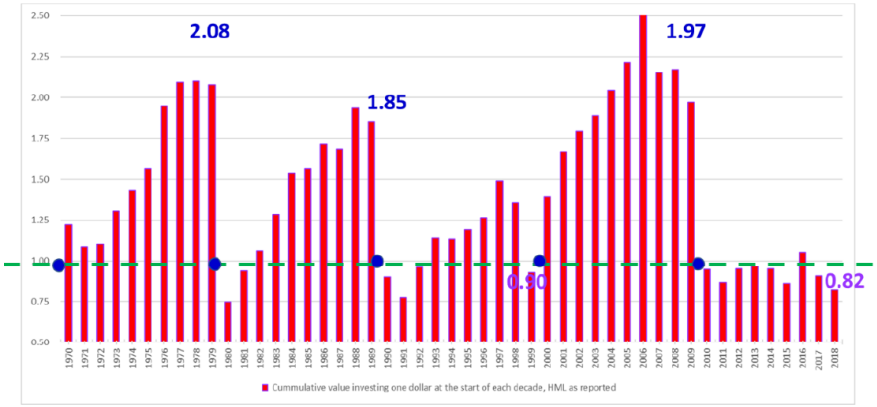


*Figure 2- 10-year growth of a dollar invested in the Fama-French value strategy*

This same pattern appears as we follow Warren Buffet's Berkshire Hathaway returns all the way back to 1965 until today (figure 3). Warren Buffet's Fund might indeed be a closer proxy to Graham's strategy since Graham was Buffet's mentor early in his career and who still applies his investment philosophy until this day.

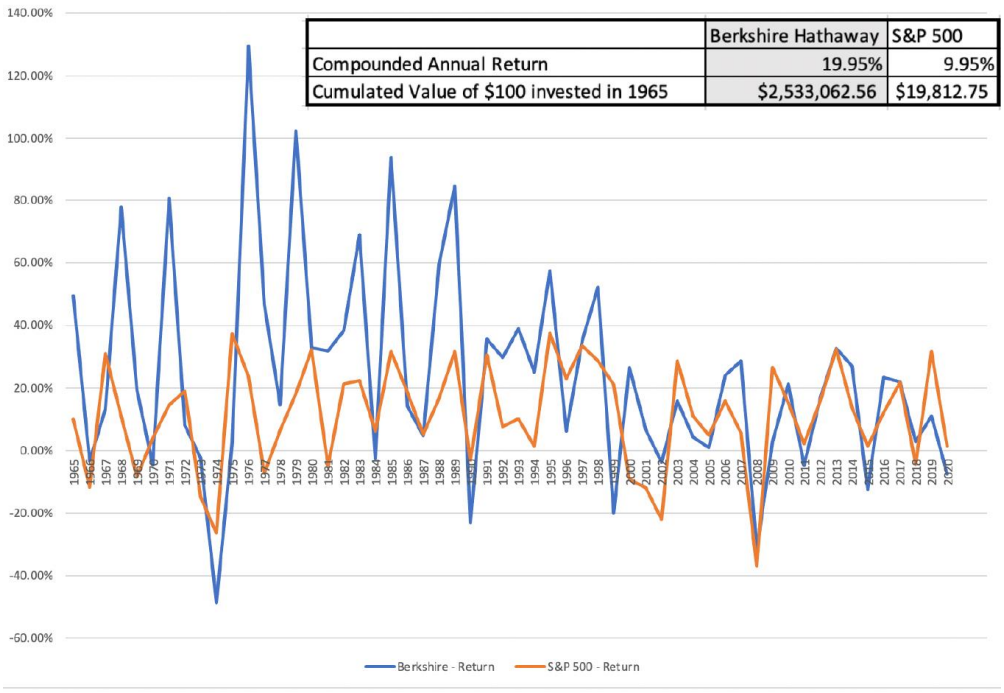


*Figure 3- Comparison between Berkshire Hathaway and S&P 500 returns*

If until the tech bubble in 2001, Berkshire recorded huge excess returns against the S&P500 index almost every year, with only a few exceptions, that upper hand seemed to have completely vanished in the last 15 years, with Berkshire's and S&P500 returns to be much closer than ever and with a larger number of years in which Berkshire underperforms the market.

## Reasons for Underperformance

Much has been said in the last few years about the vanishing of value investing and while some state that there's no room for such strategies in the modern economy, others have been trying to understand what is wrong with these types of investment approaches.

One of the most popular explanations for this recent failure among scholars is related to the incapacity of some popularly used metrics such as the Book-to-Market ratio to correctly value companies in the modern economy. This explanation argues that most value investing strategies were created more than 50 years ago, in an era when most companies had most of their investments concentrated in tangible assets, thus making sense to use book value as a proxy for a business's intrinsic value. These strategies had little or no innovation since those times while the overall economy is totally different today from what it was 50 years ago. Using old metrics in valuation techniques seems to create value mismeasurement is the immediate expensing in income statements of all investments in internally

generated, value-creating, intangibles, such as R&D, IT, brand development, and human resources. This bigger expense in intangibles, which are obvious investments intended to generate future profits, is absent in companies' book value.

This shift from tangible to intangible businesses was well documented in Lev & Srivastava et al. (2019).

In Cornell et al. (2021), metrics such as Book-to-Market, P/E ratio, and dividend yields were compared among all S&P 500 companies to understand which type of companies have performed the best in recent times, especially since the COVID-19 pandemic started. Interesting findings concerned with Dividend yields were discovered in this analysis, with companies with the lowest or no dividend yield policies having the best results.

These findings are especially relevant if related to Bulan, Subramanian & Tanlu et al. (2007) dividend policy theory that defends that a company's dividend policy should be aligned with the company's growth opportunities, only being optimal for the company to distribute dividends to its shareholders when there are no profitable investment opportunities left to take. This theory contraries the traditional signaling theory of dividends, which predicts that a firm will pay dividends to signal to the market that its growth and profitability prospects have improved. This last theory is the base for most value strategies that support investing in companies with a good record of dividends payout.

## Hypotheses

More than 70 years since "The Intelligent Investor" was originally published, many investors still follow Graham's principles today. However, value investing strategies as a whole have been losing their appeal in the last decade after the results achieved by these strategies being surprisingly disappointing for the last 15 years, with many stating that value investing is old-fashioned and doesn't apply to today's market conditions.

Despite the many studies made by other scholars regarding this topic, all the studies I found used single criteria value strategies to make conclusions on the inefficiency of value investing. No studies using multi-criteria and specially Grahm's criteria were found, leaving the question whether the strategy still delivers good results for its investors unanswered.

My purpose with this thesis is to test the strategy firstly introduced by Mr. Graham in his book "The Intelligent Investor" and revise its key rules with the goal of giving a clear answer to the 2 questions presented below.

1. **Did Benjamin Graham's value investing strategy underperform the market in the recent 15 years?**

| | |
|---|---|
| H1: Yes, indeed Graham strategy seems to underperform the market and there is no room for value investing anymore. | H2: No, still performs well when compared to the market. |

2. **Is the strategy capable of capturing the value of companies in the new economy or does it need to be revised?**

| | |
|---|---|
| H1: Yes, the strategy is timeless and works as well today as it worked 70 years ago. | H2: No, the strategy fails to capture the value of intangibles and thus needs to be updated. |

## Data

To execute the backtests for both Graham's strategy and our purposed updated version of it, I used the S&P 500 companies as samples. The reason for this sample choice is related to the easy access any investor has to these stocks in any legal broker in most countries all around the world. Being the 500 larger companies in the US, these are also one of the most liquid stocks available in the market and thus the cheapest ones to trade. This reason also makes it easier to collect the data necessary for this study, since there are plenty of data sources that can offer this type of data.

All tests were performed in the years between 2008 and 2021, 13 years in total. This timeframe will allow me to make conclusions regarding the performance of the 2 strategies in the period in which the previous literature has identified an underperformance of other value investing strategies.

The timeframe of my analysis could have been a bit larger, maybe ranging from 2021 back to 2001, giving a larger sample period and thus more reliable conclusions, however, the further back I went in time, the more difficult it was to gather the information needed regarding the sample companies. Factors such as bankruptcy, mergers, and acquisitions that occurred over the last 20 years, make it extremely complicated to have access to companies' data that were part of the S&P 500 somewhere in this timeframe but got out due to one of these mentioned reasons.

Because of the difficulty of gathering past information, I decided to only include in the analysis the companies that were part of the index in all the years of the study. The reason behind this decision comes from the misrepresentation of older years' data. This happens because of the same issue stated previously, as it is impossible to aggregate all the data needed for companies that were acquired merged or filed for bankruptcy in the meantime. If no corrections were made, the analysis would lead to a much more complete sample of the most recent years and a much smaller and incomplete sample for older years as there were much more companies being acquired in the last 13 years together than in the last year alone.

After making these corrections, the sample of my study is made of data from 284 companies that were part of the S&P 500 index in the year 2021 from a period ranging from 2008 until 2021. The sample data can be found in Annex A.

For every single company, there were 9 individual data requirements: PE ratio, PB ratio, Current ratio, Dividend Yield, EPS, EPS Growth (10Y), Shares Outstanding, Debt, and Working Capital.

The data was collected from 2 distinct data sources. Most of it was available by subscribing to the Stock Analysis database which provides historical financial data for all the S&P 500 companies and more. These individual criteria, however, were separated between 3 different excel sheets (Financial

Ratios, Balance Sheet, and Income Statement) and needed to be aggregated into a single one manually. For the few occasions in which the Stock Analysis database didn't have the Current Ratio and Working Capital data available, I relied on Macrotrends free database to collect that data.

# Methodology

## Initial Strategy Back-test

Although many scholars pointed out the downfall of value investing in the last 20 years, there is no study out there, at least that I found, which analyses the performance of Benjamin Graham's strategy. All the studies that I presented in the literature review chapter only analyzed specific single criteria strategies, such as the PE Ratio or the Market to book value. As I've discussed previously, despite these being two of the most common metrics used to screen for value stocks, I don't agree that individually these can correctly tell the investor which companies are worth investing in or not. The main reason behind that argument is that such criteria only give information regarding the gap between the price and the supposed intrinsic value of a given stock, while giving the investor little information regarding the business performance and sustainability in the long term.

As discussed in the "Intelligent Investor", a good business is one that the investor may be comfortable owning for his life, despite the overall market momentum being bullish or bearish, and thus it makes sense for this strategy to have other rules in it, responsible for adding further screen restriction related with the business quality.

The "Intelligent Investor" proposes various criteria, ones for the defensive type of investor, who is characterized as being passive and with little knowledge regarding investments and business in general, and others for the enterprising investor which takes an active role in its portfolio management and that can have more flexible screening rules due to its higher knowledge in the field.

In this study, I am assuming that I and the potential readers have enough degree of studies in finance and investments and thus can actively manage our own portfolio and assume slightly more risk as well. For that reason, the rules used are going to be more enterprising investor oriented with a few additional metrics usually concerning the defensive type-investor. Rules 3 to 7 are originally for the enterprising investor guide proposed by Graham while rules 1 and 2 are originally for the defensive investor. I decided to include these 2 last rules to substitute the pricing metric used for the enterprising investor (PB < 1.2). This decision came after making a quick stock screening following this rule and realizing that in today's market conditions this rule would make it impossible to find any available investment opportunity in most of the years. To tackle this issue, I decided to use the defensive investor pricing rules which are by norm less "harsh" on price requirements.

The metrics used in this strategy are the following:

1. PE Ratio < 15

2. PE Ratio x PB Ratio < 22.5
3. Current Ratio > 1.5
4. Dividend Yield > 0
5. EPS > 0, in the last 5 years
6. EPS Growth (last 10 years) >1/3
7. Debt/WC < 1.1

In this back-test, I assumed that the investor would equally invest in all the portfolio stocks, this is, investing the same amount in each individual stock, so that every stock in the portfolio would get the same weight.

The investment in a certain company would depend on its past year's performance. This means that the investor should invest in the stock of the company at the beginning of the year, based on the performance of the company in the year that past (i.e. invest in a certain stock in 2018 based on the company's performance in 2017).

Based on these rules I created two different portfolios, the difference between them being the approach the investor has at the end of the investment year.

For the first portfolio, named "Graham's Strategy", the portfolio composition will be reset every year. This means that at the end of the year, the investor would sell all its portfolio holdings and build a new portfolio from scratch with the new companies that meet the requirements for the new coming year. This approach will be considered with the goal of comparing the portfolio results with the ones of previous value strategies I mentioned early in the literature review since this was the approach followed by those strategies.

From an intelligent investor's point of view, however, this logic does not seem to make sense. To sell the whole portfolio every year would imply paying taxes over capital gains every single year throwing away the benefit of accumulation of capital over the years. Other than that, Graham's investing philosophy is to find sound businesses that are temporarily undervalued to then take advantage of the price correction expected in the future. This does not mean that if the stock is no longer undervalued, the stock is no longer worth keeping.

For that reason, the second portfolio, named "Buy&Hold Strategy", will follow the same rules as the previous but will only be rebalanced in the cases of new companies being eligible to be added and the existing ones no longer having solid financial positions to be considered a prospering business and should then be sold. For "solid financial positions" I mean companies that continue to comply with the rules 3 to 7 from the strategy.

## Screening the stocks

As I mentioned in the Data section of this study, there was not any database that I could find which provided all the variables I needed for every single year of the sample in just one place. Hence, by using the Stock Analysis database, I was able to manually search for the individual relevant metrics for the study.

Metrics such as PE ratio, PB ratio, Current Ratio, and Dividend Yield could be found already together in the Financial Ratios excel sheet. EPS and EPS growth was able to be calculated using the earnings data in the Income Statement excel sheet. Finally, Debt and Working Capital data were also usually together in the balance sheet excel sheet. In some cases, there was no information available for the Current Ratio and Working Capital and to overcome that lack of information, I gathered that data from Macrotrends.

The process to screen for the sample stocks was straightforward from this point on. If a stock met the 1st criteria of the strategy, I would advance to the following criteria and check its compliance. As soon as one of the rules was not met, I would abandon the possibility of investing in that stock and advance to the next stock on the sample list.

The companies that passed all the requirements needed to be invested in can be seen in figure 4.

**Graham's Strategy**

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | ADM | AXP | ADM | ADM | ANTM | ANTM | ANTM | GLW | ADM | AFL | | DHI | LEN | LEN |
| | | ADI | BMY | CVX | ADM | ADM | GLW | HAL | GLW | BAX | | LEN | NUE | |
| | | ADM | NOV | GLW | CVX | CVX | FDX | VLO | BEN | GLW | | | | |
| | | CMI | | WBA | GLW | CSCO | HUM | NOV | NLOK | BEN | | | | |
| | | GPS | | | HUM | GLW | NOV | | VLO | | | | | |
| | | NUE | | | SNA | HUM | | | | | | | | |
| | | RL | | | | INTC | | | | | | | | |
| | | SNA | | | | NOV | | | | | | | | |
| | | VFC | | | | | | | | | | | | |
| | | FLS | | | | | | | | | | | | |

*Figure 4- Portfolio composition for Graham's original strategy*

For the "Buy&Hold" strategy, the portfolio composition is also straightforward. All stocks in the previous portfolio would automatically be part of this new portfolio as well. In addition, the stocks that made it for the previous year but couldn't make it to the current one would be screened again, but this time only according to the rules from 3 to 7 of Graham's strategy.

By executing this process, the "Buy&Hold" portfolio got the composition displayed in figure 5.

**Buy&Hold Strategy**

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | ADM | AXP | ADM | ADM | ANTM | ANTM | ANTM | GLW | ADM | AFL | BAX | DHI | LEN | LEN |
| | | ADI | BMY | CVX | ADM | ADM | GLW | HAL | GLW | BAX | BEN | LEN | NUE | NUE |
| | | ADM | NOV | GLW | CVX | CVX | FDX | VLO | BEN | GLW | CSCO | BAX | DHI | DHI |
| | | CMI | CMI | WBA | GLW | CSCO | HUM | NOV | NLOK | BEN | HUM | HUM | HUM | HUM |
| | | GPS | RL | BMY | HUM | GLW | NOV | ADM | VLO | CSCO | CMI | CMI | CMI | CMI |
| | | NUE | VFC | NOV | SNA | HUM | ADM | CSCO | CSCO | HUM | | | | |
| | | RL | FLS | CMI | WBA | INTC | CSCO | HUM | HUM | CMI | | | | |
| | | SNA | | RL | NOV | NOV | INTC | SNA | SNA | | | | | |
| | | VFC | | FLS | CMI | SNA | SNA | CMI | CMI | | | | | |
| | | FLS | | | RL | CMI | CMI | RL | RL | | | | | |
| | | | | | FLS | RL | RL | FLS | | | | | | |
| | | | | | | FLS | FLS | | | | | | | |

*Figure 5- Portfolio composition for "Buy&Hold" strategy*

Once I already had the portfolio composition for every single year of the study's sample, the only step left was to search for the stock returns of each security on the list and to calculate the mean return for each year. To obtain the stock returns, I relied on the Yahoo Finance database to get the stock price at the beginning and end of the year. With those prices, I could use the simple mean formula $\frac{End\ of\ Year}{Beginning\ of\ Year} - 1$. In this study it wouldn't make sense to calculate the returns using the Log Returns formula because the portfolio would only be rebalanced once a year and not at every single moment of time.

**Graham's Strategy**

| Year | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| | ADM | -37.62% | AXP | 119.76% | ADM | -3.46% | ADM | -3.95% | ANTM | -9.56% | ANTM | 50.62% | ANTM | 37.66% |
| | **Total** | **-37.62%** | ADI | 67.32% | BMY | 4.88% | CVX | 18.63% | ADM | -3.60% | ADM | 53.59% | GLW | 29.82% |
| | | | ADM | 8.81% | NOV | 51.70% | GLW | -31.76% | CVX | 1.41% | CVX | 12.87% | FDX | 21.61% |
| | | | CMI | 72.82% | **Total** | **17.71%** | WBA | -14.54% | GLW | -2.49% | CSCO | 10.19% | HUM | 41.06% |
| | | | GPS | 51.20% | | | **Total** | **-7.90%** | HUM | -21.82% | GLW | 37.20% | NOV | -9.26% |
| | | | NUE | 0.92% | | | | | SNA | 56.01% | HUM | 47.35% | **Total** | **24.18%** |
| | | | RL | 75.43% | | | | | **Total** | **3.32%** | INTC | 21.89% | | |
| | | | SNA | 9.59% | | | | | | | NOV | 13.31% | | |
| | | | VFC | 33.38% | | | | | | | **Total** | **30.88%** | | |
| | | | FLS | 81.94% | | | | | | | | | | |
| | | | **Total** | **52.12%** | | | | | | | | | | |

| | 2015 | | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| | GLW | -22.06% | ADM | 26.53% | AFL | 26.08% | **Total** | **0.00%** | DHI | 55.05% | LEN | 49.44% | LEN | 38.25% |
| | HAL | -13.56% | GLW | 35.93% | BAX | 48.92% | | | LEN | 45.41% | NUE | -4.66% | **Total** | **38.25%** |
| | VLO | 42.04% | BEN | 12.91% | GLW | 32.46% | | | **Total** | **50.23%** | **Total** | **22.39%** | | |
| | NOV | -48.42% | NLOK | 16.50% | BEN | 8.77% | | | | | | | | |
| | **Total** | **-10.50%** | VLO | -1.18% | **Total** | **29.06%** | | | | | | | | |
| | | | **Total** | **18.14%** | | | | | | | | | | |

*Figure 6- Graham's strategy returns by year*

**Buy&Hold Strategy**

| Year | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| | ADM | -37.62% | AXP | 119.76% | ADM | -3.46% | ADM | -3.95% | ANTM | -9.56% | ANTM | 50.62% | ANTM | 37.66% |
| | **Total** | **-37.62%** | ADI | 67.32% | BMY | 4.88% | CVX | 18.63% | ADM | -3.60% | ADM | 53.59% | GLW | 29.82% |
| | | | ADM | 8.81% | NOV | 51.70% | GLW | -31.76% | CVX | 1.41% | CVX | 12.87% | FDX | 21.61% |
| | | | CMI | 72.82% | CMI | 139.65% | WBA | -14.54% | GLW | -2.49% | CSCO | 10.19% | HUM | 41.06% |
| | | | GPS | 51.20% | RL | 36.95% | BMY | 32.57% | HUM | -21.82% | GLW | 37.20% | NOV | -9.26% |
| | | | NUE | 0.92% | VFC | 17.05% | NOV | 2.65% | SNA | 56.01% | HUM | 47.35% | ADM | 20.78% |
| | | | RL | 75.43% | FLS | 24.49% | CMI | -18.57% | WBA | 13.18% | INTC | 21.89% | CSCO | 25.67% |
| | | | SNA | 9.59% | **Total** | **38.75%** | RL | 25.66% | NOV | 0.19% | NOV | 13.31% | INTC | 42.24% |
| | | | VFC | 33.38% | | | FLS | -14.60% | CMI | 23.27% | SNA | 35.38% | SNA | 25.23% |
| | | | FLS | 81.94% | | | **Total** | **-0.43%** | RL | 8.46% | CMI | 25.95% | CMI | 3.41% |
| | | | **Total** | **52.12%** | | | | | FLS | 46.46% | RL | 14.85% | RL | 6.01% |
| | | | | | | | | | **Total** | **10.14%** | FLS | 56.25% | FLS | -22.94% |
| | | | | | | | | | | | **Total** | **31.62%** | **Total** | **18.44%** |

| 2015 | | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| GLW | -22.06% | ADM | 26.53% | AFL | 26.08% | BAX | -0.14% | DHI | 55.05% | LEN | 49.44% | LEN | 38.25% |
| HAL | -13.56% | GLW | 35.93% | BAX | 48.92% | BEN | -32.92% | LEN | 45.41% | NUE | -4.66% | NUE | 112.05% |
| VLO | 42.04% | BEN | 12.91% | GLW | 32.46% | CSCO | 9.34% | BAX | 28.79% | DHI | 30.76% | DHI | 55.85% |
| NOV | -48.42% | NLOK | 16.50% | BEN | 8.77% | HUM | 13.61% | HUM | 29.60% | HUM | 13.80% | HUM | 10.43% |
| ADM | -30.82% | VLO | -1.18% | CSCO | 27.33% | CMI | -26.08% | CMI | 37.19% | CMI | 26.47% | CMI | -3.94% |
| CSCO | -5.28% | CSCO | 15.08% | HUM | 22.92% | **Total** | **-7.24%** | **Total** | **39.21%** | **Total** | **23.16%** | **Total** | **42.53%** |
| HUM | 16.54% | HUM | 20.10% | CMI | 28.40% | | | | | | | | |
| SNA | 23.34% | SNA | 1.77% | **Total** | **27.84%** | | | | | | | | |
| CMI | -40.26% | CMI | 59.37% | | | | | | | | | | |
| RL | -40.86% | RL | -17.02% | | | | | | | | | | |
| FLS | -31.27% | **Total** | **17.00%** | | | | | | | | | | |
| **Total** | **-13.69%** | | | | | | | | | | | | |

*Figure 7- "Buy&Hold" strategy returns by year*

## Original Strategy Results

Contrary to what my initial beliefs were and to what public opinion usually argues, the portfolio created using Mr. Graham's value strategy delivered surprisingly good results in most of the years under analysis. Following the results obtained in figure 8, the effective annual return for the period was 13.6415% meaning that if an investor invested 1000€ at the beginning of 2008, at this annual rate, would get to the end of 2021 with a total portfolio value of 5991€, an increase of 499%.

The second portfolio created based on this strategy achieved even more impressive results. With an effective annual return of 14.4123%, the "Buy&Hold" strategy delivered a compound return rate of 559%, meaning that 1000€ invested at the beginning of 2008 would be valued at 6585€ at the end of the study period.

| Graham's Strategy | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -37.62% | -37.62% |
| 2009 | 52.12% | -5.12% |
| 2010 | 17.71% | 11.69% |
| 2011 | -7.90% | 2.86% |
| 2012 | 3.32% | 6.28% |
| 2013 | 30.88% | 39.10% |
| 2014 | 24.18% | 72.73% |
| 2015 | -10.50% | 54.59% |
| 2016 | 18.14% | 82.63% |
| 2017 | 29.06% | 135.70% |
| 2018 | 0.00% | 135.70% |
| 2019 | 50.23% | 254.09% |
| 2020 | 22.39% | 333.36% |
| 2021 | 38.25% | 499.13% |
| **Effective anual Rate** | | **13.6415%** |
| **St. Deviation** | | **24.87%** |

| Graham's Buy&Hold Strategy | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -37.62% | -37.62% |
| 2009 | 52.12% | -5.12% |
| 2010 | 38.75% | 31.66% |
| 2011 | -0.43% | 31.09% |
| 2012 | 10.14% | 44.37% |
| 2013 | 31.62% | 90.02% |
| 2014 | 18.44% | 125.07% |
| 2015 | -13.69% | 94.25% |
| 2016 | 17.00% | 127.27% |
| 2017 | 27.84% | 190.54% |
| 2018 | -7.24% | 169.51% |
| 2019 | 39.21% | 275.18% |
| 2020 | 23.16% | 362.08% |
| 2021 | 42.53% | 558.59% |
| **Effective anual Rate** | | **14.4123%** |
| **St. Deviation** | | **24.94%** |

| S&P 500 | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -38.49% | -38.49% |
| 2009 | 23.45% | -24.07% |
| 2010 | 12.78% | -14.36% |
| 2011 | 0.00% | -14.36% |
| 2012 | 13.41% | -2.88% |
| 2013 | 29.60% | 25.87% |
| 2014 | 11.39% | 40.21% |
| 2015 | -0.73% | 39.18% |
| 2016 | 9.54% | 52.46% |
| 2017 | 19.42% | 82.07% |
| 2018 | -6.24% | 70.71% |
| 2019 | 28.88% | 120.01% |
| 2020 | 16.26% | 155.78% |
| 2021 | 26.89% | 224.56% |
| **Effective anual Rate** | | **8.7731%** |
| **St. Deviation** | | **17.94%** |

*Figure 8- Graham's strategy results and comparisons*

In the finance world, we should never analyze obtained returns without looking at what the market is returning on average as well. Returns, by themselves, give us very little information regarding the good or bad performance of a given investment strategy. If we compare the returns achieved by Graham's Strategy with the ones the investor would obtain if he decided to invest in an index replicating the S&P 500 instead, it is straightforward to conclude that both strategies overperformed the "market" portfolio on the timeframe of the study. Not only did the strategies achieve more than double the returns of the S&P 500 index (which delivered an annual effective rate of 8.77%), but also outperformed the index in 11 of the 14 years and 10 of the 14 years of the analysis respectively. Annex B gives a more complete outlook of the comparison between the two strategies and the S&P 500 index.

The main drivers for this overperformance were the especially good returns achieved during the years the market advanced the most. During years such as 2009 and 2019 in which the S&P 500 returned

23.45% and 28.88% respectively, making these the two best years of our sample, Graham strategy led to a portfolio growth of 51.49% and 50.23%. On the other hand, the poorest years for the market were usually even worse for the strategy, although the gap between the two was not so large as in the best market years. In the years of 2011 and 2015, the market returned 0% and -0.73% whereas the strategy returned -10.66% and -6.66% respectively.

The excess returns can also be explained by the increased risk involved in this strategy when compared to an index fund such as the S&P 500. During the sample period, the S&P 500 had a standard deviation of 17.94, while the strategy on the other hand had a 25.32% standard deviation.

## Criticisms of the Strategy

Although the results obtained in the original strategy back-test were a good surprise, given the reading I previously made regarding the decay of value investing in general, a few remarks must be taken into account regarding the ability of the strategy, as it is nowadays, to find sound investment opportunities. Although the overall returns over the period between 2008 and 2021 would be exceptional for every investor that invested following Graham's rules, it is important to understand how these returns were obtained.

In the years 2008, 2018, 2019, 2020, and 2021, the portfolio obtained by Graham's strategy was composed of less than 3 stocks, and in 2018 not even 1. This means that it gets harder for this strategy to find sound investment opportunities as the market advance for long periods of time, ultimately leading to poor portfolio diversification during these years and subsequently increasing the risk of investing in such a portfolio. Because there was very little diversification and the market conditions were at their peak, large returns such as the ones we have seen in 2019 were made possible. However, if bad market conditions were to happen during those years, the contrary might have happened, wiping all the good results achieved during the rest of the sample years away.

This same pattern is not so evident for the "Buy&Hold" strategy, however. Because this second strategy encourages holding the portfolio stocks for longer periods of time, the diversification problems faced by the previous strategy were not a problem anymore. The minimum number of stocks the portfolio had over the study period occurred between the years of 2018 and 2020 with a total of 5 stocks in each of these years' portfolios. With this improvement, the portfolio' specific risk for these years decreases a lot, making it safer for the investor to invest following this strategy.

More portfolio diversification usually comes at the expense of less expected returns, since the potential exceptional returns provided by a given stock would get diluted in between other more average

stock returns. In this case, though, the power of holding undervalued stocks for longer periods gave more time to price increases in the portfolio holdings, exploiting the benefits of holding quality businesses and improving the returns of the portfolio in most of the years of the analysis. That was the case in the years 2010, 2011, 2012, 2013, 2020, and 2021.

Another problem concerning the inability of Graham's strategy to find investment opportunities is that during good business and market conditions, the strategy might let the good momentum of the market slip away by not taking advantage of it.

Although it was not the case, in this sample period, there could have been a large negative gap between the market returns and the strategy returns in 2018 if the market had advanced a lot, since there were no investments made in that year. Luckily, the market returns were poor in that year but that could have not been the case.

This decrease in the opportunities available as the market rallies is visible in the variation in the number of stocks composing the portfolio over time. In 2008, before the financial crisis, there was only one stock in the portfolio. In 2009 after the recession started, many opportunities were found in the market. However, as market prices advanced throughout the last decade, the list of available companies shrank and in 2021 there was, once again, a single stock available for selection.

It is also important to take close attention to the sectors of the companies making part of this strategy portfolio, as illustrated in the table in figure 9. By making such an analysis it is possible to realize that companies in sectors such as Health Care, Consumer Discretionary, Industrials, and Energy together represent 64.5% of all the companies in the portfolio whereas, in the S&P 500, companies in these sectors only represent 36.8% of the total. On the other hand, the sectors of Information and Technology, and Communications and Services represent in this portfolio only 19.4% of all the companies, while the same sectors have a combined weight of 37.7% in the S&P 500. This proves to us that, indeed, this strategy is biased towards traditional businesses with simpler accounting breakdowns and more tangible assets.

| Sectors | Graham Strategy | S&P 500 |
|---|---|---|
| Information Technology | 18% | 28% |
| Health Care | 18% | 13% |
| Financials | 11% | 12% |
| Consumer Discretionary | 18% | 12% |
| Communication Services | 0% | 10% |
| Industrials | 14% | 8% |
| Consumer Staples | 4% | 6% |
| Energy | 14% | 4% |
| Utilities | 0% | 3% |
| Real Estate | 0% | 3% |
| Materials | 4% | 3% |

*Figure 9- Sectors representation in Graham's Strategy*

I can conclude that although market returns were unexpectedly high for Graham's strategy, the risks involved with poor diversification and the difficulty in finding investment opportunities during market booms, makes it necessary to adopt changes regarding the flexibility of this strategy. I believe that although the market seemed to be overpriced in the last decade, there were still good businesses out there with decent prices available, but couldn't get captured because 1) Prices multiples such as PE and PB ratios are too rigid in this strategy, leaving the majority of the companies out of the portfolio scope; 2) The way both Earnings and Book value are calculated should be revised so that investments in intangible assets are taken into account and companies with intensive R&D expenses can be correctly valued.

## Criteria Evaluation

Although proven to be a success even in today's times, the fact that the strategy remained the same since its original creation sounds a bit crazy to me. Mr. Graham wrote his "Intelligent Investor" strategy in the 40's when the economy was completely different from today and if the businesses are in their essence different, so the way of evaluating them should be different as well. Of course, the value investing philosophy must be preserved when making such adjustments to the strategy, but I believe that if Mr. Graham was living in today's times, the way he would look at value would have probably changed as well.

With this being said, in the next section, I will evaluate each and single one of the strategy criteria by explaining the original reason for its inclusion and accessing its relevance in today's economic environment taking into account the literature, to then conclude whereas maintain, adjust or remove the criteria from the strategy.

### Value Ratios

#### PE Ratio < 15

The PE Ratio is one of the most popular (if not the most) investment ratios among investors. This ratio gives the investor a clue of how much he/her is investing to get $1 value of the company's past year's earnings. The PE ratio serves most of the time as a benchmark to assess whether a stock is overvalued or undervalued by the market since it permits the investor to compare it to other stocks or the broader market.

The PE ratio is a relative metric that changes with time as the company's earnings and price relation varies. Usually, during long periods of bull markets and especially during "bubbles", the PE ratio tends to be much higher meaning the investor is willing to pay more for the same $1 of earnings. The opposite is also true, with companies' PE ratios tending to lower levels during recession times. The P/E ratio of the S&P 500 has fluctuated from a low of around 5x (in 1917) to over 120x (in 2009 right before the financial crisis).

In the "Intelligent investor", the PE ratio is usually the first multiple to be used in any screening process, mainly because it helps to quickly shorten the potential stock list. The value set by Graham to make this shortlist is 15 or for more conservative investors 9.

The reason behind the value of 15 for the PE ratio is not clearly explained in the book but I believe that this was the average value for the historical PE ratio at the time the book was written. This makes

sense when compared to the data we have access to today with the 200-year average PE ratio from the SP500 companies varying between 14 and 16 depending on the last year of analysis. Today the value is close to 16 and so, although the difference not being substantial, I believe that this value should be updated.

The logic behind having the historical average value as the benchmark for the fair value of a company is sound for any value investor. The equity markets if assumed to work freely tend to price equities fairly in the long term. Short-term deviances from the average values are to be expected due to the investor's overreaction to bad and good fundamental news but ultimately the value predicament only works if the market is able to make corrections in equities prices so that equities revert to the mean prices over time.

Despite agreeing with the argument behind using the PE ratio as a screening rule, this ratio can be misleading as was reported by Lev & Srivastava et al. (2019). In a world like the one Mr. Graham lived in 1940, in which companies' investments were mostly related to tangible assets, the PE ratio as we know is a completely reasonable metric. However, in today's business environment in which intangibles are a huge part of companies' investments, the earnings of such companies are going to be smaller due to the fact that R&D expenses are accounted for as an expense instead of an investment. This leads to an overstated PE ratio for this type of company.

In Ben Graham's time and up to the late 1980s, corporate investments were primarily in tangible (physical) assets (property, plant, equipment, structures, airplanes, etc.), which are capitalized (considered assets) by accounting rules and, therefore, fully reflected (net of depreciation) in companies' book values (equity). This inclusion of most corporate investments in book values was reflected, among other things, by the median market-to-book ratio of public companies which hovered around 1.0 until the mid-1980s. Accordingly, market values, being lower or higher than the book values, often reflected the under- or overvaluation of stocks. From then on, however, a far-reaching transformation of corporate business models took place: Investment in tangible resources increasingly gave way to intangible assets, as demonstrated in figure 10, presenting the U.S. private sector's annual rates of tangible and intangible investment, relative to gross value added.5 Currently in the U.S., the intangible investment rate of the corporate sector is roughly twice that of the tangible investment rate, and the gap keeps growing. In absolute terms, the U.S. annual intangible investment surpassed $2 trillion in 2017.

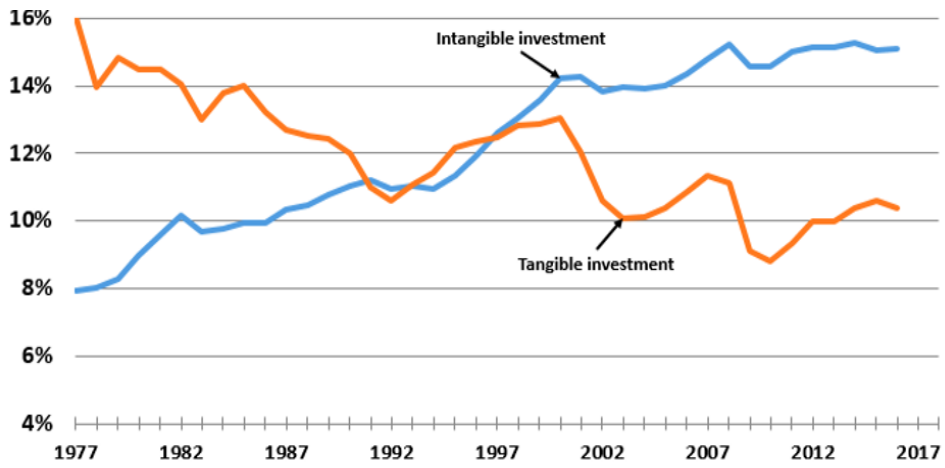


*Figure 10- U.S. annual corporate investment rate*

As suggested by Lev & Srivastava et al. (2019), a solution for this miscalculation of a company value is by adding back the annual R&D expenses to the year's earnings while the cumulative R&D capital (the sum of the capitalized past annual R&D expenses) should be amortized according to industry-specific R&D amortization rates reported in Li and Hall (2018).

**PE Ratio x PB Ratio < 22.5**

In the "Intelligent Investor", Graham holds that the investor should only buy into stocks with a value close to the company's book value. The reason behind this argument is that the book value is a safe valuation method for a company and unless the company is in distress, its intrinsic value should never be below the value reported in the accounting statements. The closer the market value is to the book value, the bigger the probability of the company being undervalued. Initially, the purposed rule by Graham is that the current price of a stock should never be more than 1.5 times the book value last reported. However, a multiplier of earnings below 15 might justify a higher multiplier of assets (PB ratio) and because of that, he suggests that the product between the 2 multipliers should never exceed 22.5 (which corresponds to a PE ratio of 15 and a PB ratio of 1.5).

From the observations made during the screening process for the initial strategy back-test, the PB ratio was the criteria that contributed more to the cut of stocks from the portfolio. In fact, if we take a look at the historic PB ratio average of the S&P 500 companies, the average for the period of my analysis is around 2.84 and the minimum value was 2.00 in the 2008 financial crisis. This means that even the majority of under-average companies will not be eligible for the portfolio according to this strategy. This average PB ratio values are not, however, the same as the ones of the last century. Before the late '80s, the average PB ratio for the S&P 500 had never gotten to a value above 2. In the other direction,

since that time never a year was closed with a PB ratio value below 2 for the S&P 500. This show that since that point in time, the average value for the PB seems to have increased, and that can easily be explained by the shift from companies investing purely in tangible assets to a new have of investments in intangibles as well.

For that reason, seems to me that continuing to have 1.5 as the maximum possible PB ratio for a company is in a way irrational and for that reason, I will increase the boundary to a value of 2, which seems to be around the average for the lower quartile companies in the most recent years.

By increasing the accepted PB ratio value to 2, the rule originally proposed by Graham of PE Ratio x PB Ratio will now increase from 22.5 to 32 (PE ratio of 16 and PB ratio of 2).

In addition to this change, the way of calculating the book value should also get some adjustments as it was the pace for the PE multiplier. In the case of the book value, we should add the R&D expenses to the newly adjusted book value to count these intangible investments in the same way as an investment in tangible assets. By making these changes, companies from the new economy, especially tech ones with intensive R&D investments, that on the original strategy would be left out of the portfolio for having a small book value compared to its price, will now have a chance to make it to the final portfolio.

## Financial Strength Indicators

### Debt/WC < 1.1

This rule is used in this strategy regarding the company's financial strength. For Graham, it made all sense to prefer a business with a cash surplus and mainly funded by equity to one with a large number of debt obligations to pay when assuming both have the same PE ratio. Although both companies could achieve the same results, one of the first types would be better off in case of an economic meltdown. In case sales and earnings figures decrease, its capital structure and liquidity would allow the company to easily go through the temporary bad economic conditions whereas a company of the second type would struggle to find liquid means to pay back to its debt owners.

Usually, the typical metric used to ensure a company's capital structure is adequate is the Debt-to-equity ratio. By setting a limit to this ratio, of let's say 1, the investor is guaranteeing the company assets are half owned by the investor while the rest half is financed by lenders who expect the debt to be paid back. Although you can easily tell if a company has too much debt if its debt-to-equity ratio is over 2 or the opposite if the ratio is below 0.5, values in the middle can be misleading regarding the company's capacity to pay its debt back. A company might have more equity than debt in its capital structure, but if most parts of its assets are illiquid, the company might still struggle financially in the short term.

Of course, the debt-to-equity ratio is a good indicator of a company's financial strength but defining a limit value for this ratio might be too subjective depending on the company's industry and the way the company runs its business. Debt per se can be valuable for a company until its tax benefits are greater than the risks associated with that debt as was explained by Modigliani & Miller et al. (1958), thus being possible that a company's optimal value for the debt-to-equity ratio is greater than 1.

For this reason, the decision to include this metric to access the company's financial strength still seems valid today to me. By comparing the total value of debt with the business's Working Capital (the best proxy for the numeric value of a company's liquidity) the investor can have a sense of how capable the company is of payback all its holding debt with only the liquidity reserves it has. If the Debt/WC value is 1, the company is in a position in which it can pay its debt back to its debt holder in the short term, if necessary, with only its working capital. If this value is below 1, the company remains with a liquidity surplus after paying all its debt back if it is above one, the company will not be able to pay all its debt with only its working capital. Of course, a company under 99% circumstances will not be required to pay back its total debt, especially its long-term debt. But the closer this ratio is to one, the more comfortable a company will be in case of some temporary instability in the business.

**Current Ratio > 1.5**

The current ratio is also used in this strategy as a financial strength metric. A valuable company should be able to subsist during tough economic times and given that economic cycles are unpredictable, a company of this type must be ready to comply with its short-term obligations even if a recession kicks in for the next year.

This ratio gives the investor the relation between a company's current assets and its current liabilities and, following this logic, a current ratio of 1 indicates that a company could cover the totality of its short-term obligation due in 1 year (such as debts and payables) with only its current assets (cash, inventories, and receivables).

If this ratio was below 1, that might indicate the company is in distress and possibly will enter default soon, however, a higher ratio might also indicate that the company is not investing its excess assets efficiently. It is important then to sustain a current ratio bigger than one but not excessively high, and that's the reason why 1.5 is usually the number most investors accept as a lower boundary.

This rule, however, seems redundant when combined with the Debt/WC one.

Firstly, these are both liquidity and financial strength ratios, with both having the purpose of testing a company's capacity to meet its obligations.

Secondly, by using WC in the second metric, the investor is already ensuring that the WC value must be positive and thus the Current ratio to be over 1 as well. With this second metric, the investor is not only ensuring the short-term liquidity of the company but also guaranteeing that a company has enough liquidity to pay almost all its debt back in the short term if necessary, giving a hint that the decision of using debt in the capital structure is only to optimize the benefits of holding debt from a tax point of view.

For this reason, this second financial strength ratio seems redundant to me and may lead to an increase in strategy complexity unnecessarily.

**Dividend Yield > 0**

Mr. Graham was a strong supporter of a consistent dividend payment policy as in his view, that meant a company would take its shareholder's interests into account and that its ability to interruptedly pay dividends during a large period of time was directly related to the company's ability to generate profits.

In his point of view for a defensive investor, this consistent dividend payment should go back as far as 20 years. In his book, there is a chapter solely dedicated to dividend policy and its analysis of that time's trends. In this chapter, Graham defends that there was a trend surging at the time arguing that companies should make liberal dividend payments instead of constant ones, depending on the investment opportunities available to them. This argument assumes that by retaining earnings instead of distributing them to the shareholders, companies could generate larger earnings in the future. Although Graham agrees with this argument, in theory, he also assumes that the investor by accepting a liberal dividend payment would open the doors for mediocre companies and managers to take advantage of this acceptance by the investors to reinvest the earnings poorly.

Following Mr. Graham's logic, many complications in the real world might indeed confound the expected inverse relationship between current payouts and future earnings growth. For instance, dividends might signal managers' private information about future earnings prospects, with low payout ratios indicating fear that the current earnings may not be sustainable. Alternatively, earnings might be retained for the purpose of "empire-building", which itself can negatively impact future earnings growth. Theoretically, there are solid arguments for both sides of the question and then the most important thing is to understand the past relation between dividend payouts and future earnings growth.

In Arnott & Asness et al. (2002) the relation between these two variables was studied for the historical period from 1950 until 2001, and the conclusions went against what modern dividend policy theories usually defend. In this study, it was found for the S&P 500 companies in the sample period,

low payout ratios (high retention rates) historically precede low earnings growth (figure 11). Furthermore, the relationship studied was statistically strong and quite robust.

First, they created a regression of the growth based on the company's payout ratio and plotted the results. The average earnings growth increased with a rising payout ratio.

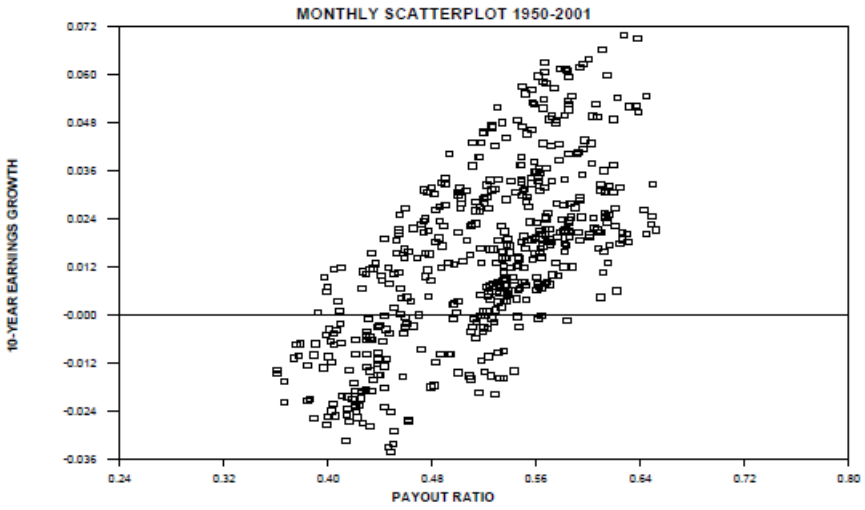


*Figure 11- Earnings growth and Payout ratio relation*

Next, they divided the companies into 4 quartiles based on payout ratio. In this test illustrated in figure 12, not only the same pattern was achieved, as it was expected, but the average subsequent real earnings growth in the 1st quartile companies was negative. The worst and best ten-year spans also show the same monotonic relationship with the starting payout ratio: the higher the payout ratio, the better the average subsequent ten-year earnings growth, and the better the best and the worst outcome, over the past fifty years. To give an extreme example, the worst ten-year growth, when starting in the highest payout ratio quartile, is considerably better than the average earnings growth, when starting in the lowest payout ratio quartile. Likewise, the best ten-year growth, starting in the lowest payout quartile, is not as good as the average growth, when starting in the highest quartile.

| Starting Payout Quartile | **Average** Subsequent Ten-year Earnings Growth | **Worst** Subsequent Ten-Year Earnings Growth | **Best** Subsequent Ten-Year Earnings Growth |
|---|---|---|---|
| One (low) | -0.7% | -3.4% | +2.6% |
| Two | +1.3% | -2.7% | +4.7% |
| Three | +2.1% | -1.6% | +6.3% |
| Four (high) | +3.2% | -0.1% | +7.0% |

*Figure 12- Earnings growth and Payout ratio relation by quartile*

The conclusion found points toward the hypothesis that managers possess private information that causes them to pay out a large share of the earnings when they are optimistic, and a small share when they are pessimistic so that they can be confident that they can maintain these payouts. Alternatively, the facts also fit a world in which low payout ratios lead to inefficient empire-building, and the funding of less-than-ideal projects and investments, leading to poor subsequent growth, while high payout ratios lead to more carefully chosen projects with relatively high returns.

**EPS > 0, in the last 5 years & EPS Growth (last 10 years) >1/3**

These two metrics are both going to be evaluated at once because they are both related to the company's EPS (Earnings per share).

Benjamin Graham added these two rules regarding earnings to ensure that the companies he was investing in were not only profitable but also continuously so. This logic goes against some modern investment strategies that look for still unprofitable companies that were recently formed with hopes that when these companies reach breakeven, their competitive advantages make them the biggest player in the market. Some recent cases of companies of this type are Uber, Tesla, and Airbnb.

The investors that support these strategies are willing to sacrifice the present value of the companies in which they invest to get a larger upside potential for the investment in the future. Although I am not against that type of approach, because that potential value is still considered value indeed, the level of uncertainty in this future value is too high to be acceptable in a strategy like the Intelligent Investor strategy.

In these companies which are still in the early phases of their business life cycle, it is impossible to predict the ones which will be successful from the ones which won't, and this unpredictability derives from the uncountable number of internal and external forces that might affect a business in its early stages. Of course, in case of good luck picking one of these stocks, the returns might be huge, but a bad call can also compromise the long-term prosperity of the portfolio as well.

For this reason, I agree with Mr. Graham on the need for business profitability in the years prior to the investment as a way of ensuring some face value for our portfolio and protecting it from high volatility.

The other rule regarding EPS purposed in this strategy is the need for a 1/3 growth rate for the past 10 years. This rule is used to protect us not from the uncertain and speculative companies as the latest, but to protect us from the decadent companies on the other hand. It is not because a company has a record of consistent profits in the past that the investor should be pleased to invest in it. If the company's growth is negative or near zero, that means that the investor would be better off if he deployed his capital into companies that have the capacity to invest their funds more efficiently due to better expansion opportunities or management quality.

This type of rule is sound to any clever investor, no matter the investment strategy and philosophy he/she might follow. However, the value used to define the boundary between eligible and not, might not be the best.

By accepting 1/3 return's growth in 10 years, the investor is agreeing in investing in a company with an average 2.92% earnings growth a year. These numbers might be a little too soft since most of the companies in the S&P500 would pass this test. If the investor decides to be more aggressive and requires a 100% earnings growth in 10 years, that means the company's earnings would grow at an annual 7.18% pace during 10 consecutive years. Although this kind of growth rate might have been normalized in the past decade, in which speculative assets returning triple digits a year seems like a norm to many, it is important to understand that during a 10 years time span a recession may occur, and the comeback to previous recession levels may take time. For that reason, I agree that the expectations for earnings growth should not be set either too low or too high, but in the middle. For that reason, I agree that it is a good policy to update this growth figure to 50% in 10 years (or an average of 4.14% a year during 10 years).

## Updated Strategy Back-test

Now that all screening rules are revised it is important to test how these changes affect the portfolio composition of this strategy as well as its returns.

To summarize the work developed in the last section, the updated strategy rules that I have used to screen stocks for the new portfolios are the ones that follow:

1. PE Ratio < 16
2. PE Ratio x PB Ratio < 32
3. Dividend Yield > 0
4. EPS > 0, in the last 5 years
5. EPS Growth (last 10 years) >1/2
6. Debt/WC < 1.1

It is important to remind that the changes made to the original strategy are not restricted to the rules themselves but also to the way both PE and PB ratios are calculated.

### Screening for Stocks

The screening process this time will be slightly different from the original one. In the previous screening, I would pick a stock from the list and test the company to the strategy rules one after another. If the first rule was met, I would advance to the next one, if not I would rule out that stock from the list and follow to the next stock in line.

This time, however, I divided the rules into 2 different categories to turn the process more time efficient. Because calculating the new values for PE and PB ratio took more time this time owing to the fact that adjustments needed to be made first, I followed the previous process only for the rules 3 to 6, until ending up with a shortlist with all the companies that met all those 4 rules.

After having the shortlist in place, I moved on to identify the companies' specific industries. This task was key to understanding which businesses needed their Earnings and Book Values to be reevaluated following the new method.

This new reevaluation would not be needed for all companies on the list though since part of these are traditional businesses that do not invest intensively in R&D. For those traditional businesses, the rules 1 and 2 were applied with the business's actual PE and PB ratios, with no changes to it.

The companies I considered that, by their nature, needed to have Book and Earnings recalculated so that R&D expenses would be considered as investments were the ones part of the following industries: Chemicals; Industrial machinery; Medical equipment; Electrical equipment; Computers and peripheral equipment; Software; Pharmaceutical; Semiconductors; Aerospace products and parts; Communication equipment; Scientific research and development.

## Calculating the new Earnings and Book Values

To value intangible investments the same way tangible investments are valued in accounting, I first needed the R&D expenses figures for each company and year of my work sample.

For the yearly earnings of a company, considering R&D as an investment has two direct implications: First, R&D expenses are no longer viewed as expenses and need to be added back to the original earnings figures; Second, as all tangible assets, these investments now need to be depreciated annually, thus creating the need to deduct from the original earnings the correspondent depreciations. It is also important to remember that, in this case, the depreciation expense for a given a year takes into account the depreciation of that year's investments as well as the previous year's for as long as the investment is not fully depreciated.

From the perspective of the book value, the exercise is also similar: 1) The value of R&D expenses is now registered as part of the company's assets, and those assets lose their value gradually over time according to the respective depreciation rate.

Since both earnings, book value, and R&D expenses were available on the "Stock Analysis" database, the only component missing was the depreciation rate for each specific industry. For that matter, I decided to use the estimated depreciation rates obtained from Li and Hall (2018), which can be found bellow in figure 13.

| Industry | Depreciation rates |
|---|---|
| Chemicals | 14.00% |
| Industrial machinery | 14.00% |
| Medical equipment | 37.00% |
| Electrical equipment | 14.00% |
| Computers and peripheral equipment | 36.30% |
| Software | 30.80% |
| Pharmaceutical | 11.20% |
| Semiconductors | 22.60% |
| Aerospace products and parts | 33.90% |
| Communication equipment | 19.20% |
| Scientific research and development | 29.50% |

*Figure 13- Estimated intangible depreciation rates by industry*

With all the information now set, I was able to test the stocks remaining on the initial shortlist with rules 1 and 2 from the updated strategy.

Based on that, the following two updated portfolios were created.

**Updated Strategy**

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | ADM | ADM | ADM | ADM | AMGN | A | ANTM | ADM | ADM | BAX | BEN | AMAT | CMI | DHI |
| | DFS | GLW | BMY | BMY | ADI | CVX | CSCO | GLW | AMAT | GLW | | CMI | DHI | LEN |
| | BEN | CMI | CVX | CVX | ANTM | CSCO | GLW | HAL | CMI | BEN | | DHI | LEN | MTB |
| | GPS | DFS | DFS | GLW | ADM | GLW | FDX | NVDA | BEN | | | GPS | MTB | PHM |
| | NVDA | JNJ | JNJ | GPS | CVX | CMI | HUM | VLO | INTC | | | GILD | NUE | |
| | VFC | NUE | | GD | CSCO | FDX | INTC | NOV | VLO | | | PHM | PHM | |
| | | PFE | | JNJ | GLW | HAL | PFE | | NLOK | | | | | |
| | | RL | | WBA | CMI | HUM | NOV | | | | | | | |
| | | ROK | | NOV | BEN | ITW | | | | | | | | |
| | | SLB | | | GD | INTC | | | | | | | | |
| | | SNA | | | HAL | NOV | | | | | | | | |
| | | TXN | | | HUM | | | | | | | | | |
| | | NOV | | | ITW | | | | | | | | | |
| | | FLS | | | INTC | | | | | | | | | |
| | | | | | MDT | | | | | | | | | |
| | | | | | SNA | | | | | | | | | |
| | | | | | WBA | | | | | | | | | |

*Figure 14- Updated strategy portfolio composition*

**Updated Buy&Hold Strategy**

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | ADM | ADM | ADM | ADM | AMGN | A | ANTM | ADM | ADM | BAX | BEN | AMAT | CMI | DHI |
| | DFS | GLW | BMY | BMY | ADI | CVX | CSCO | GLW | AMAT | GLW | BAX | CMI | DHI | LEN |
| | BEN | CMI | CVX | CVX | ANTM | CSCO | GLW | HAL | CMI | BEN | AMAT | DHI | LEN | MTB |
| | GPS | DFS | DFS | GLW | ADM | GLW | FDX | NVDA | BEN | AMAT | CMI | GPS | MTB | PHM |
| | NVDA | JNJ | JNJ | GPS | CVX | CMI | HUM | VLO | INTC | CMI | NVDA | GILD | NUE | CMI |
| | VFC | NUE | GLW | GD | CSCO | FDX | INTC | NOV | VLO | NVDA | CSCO | PHM | PHM | NUE |
| | | PFE | CMI | JNJ | GLW | HAL | PFE | CSCO | NLOK | CSCO | HUM | BAX | AMAT | AMAT |
| | | RL | RL | WBA | CMI | HUM | NOV | HUM | GLW | HUM | A | NVDA | NVDA | NVDA |
| | | ROK | ROK | NOV | BEN | ITW | A | PFE | NVDA | A | | HUM | HUM | HUM |
| | | SLB | SLB | CMI | GD | INTC | CMI | A | CSCO | ADI | | A | | |
| | | SNA | TXN | RL | HAL | NOV | HAL | CMI | HUM | | | | | |
| | | TXN | NOV | ROK | HUM | ADI | ADI | ADI | A | | | | | |
| | | NOV | FLS | TXN | ITW | ANTM | ADM | BEN | ADI | | | | | |
| | | FLS | VFC | FLS | INTC | ADM | BEN | SNA | SNA | | | | | |
| | | GPS | | | MDT | BEN | MDT | GPS | RL | | | | | |
| | | VFC | | | SNA | MDT | SNA | RL | | | | | | |
| | | | | | WBA | SNA | GPS | FLS | | | | | | |
| | | | | | NOV | GPS | JNJ | | | | | | | |
| | | | | | GPS | JNJ | RL | | | | | | | |
| | | | | | JNJ | RL | FLS | | | | | | | |
| | | | | | RL | FLS | | | | | | | | |
| | | | | | FLS | | | | | | | | | |

*Figure 15- Updated "Buy&Hold" portfolio composition*

## Updated Strategy Results

With the new strategy rules in place, my main expectations were that the number of companies available for investing would substantially increase, leading to better portfolio diversification both in quantity and sectors, without decreasing or at least not substantially the portfolio returns.

**Updated Graham's Startegy**

| Year | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| | ADM | -37.62% | ADM | 8.81% | ADM | -3.46% | ADM | -3.95% | AMGN | 34.50% | A | 35.41% | ANTM | 37.66% |
| | DFS | -35.83% | GLW | 102.81% | BMY | 4.88% | BMY | 32.57% | ADI | 17.39% | CVX | 12.87% | CSCO | 25.67% |
| | BEN | -44.00% | CMI | 72.82% | CVX | 17.21% | CVX | 18.63% | ANTM | -9.56% | CSCO | 10.19% | GLW | 29.82% |
| | GPS | -35.42% | DFS | 53.46% | DFS | 26.09% | GLW | -31.76% | ADM | -3.60% | GLW | 37.20% | FDX | 21.61% |
| | NVDA | -76.32% | JNJ | 7.62% | JNJ | -3.21% | GPS | -15.77% | CVX | 1.41% | CMI | 25.95% | HUM | 41.06% |
| | VFC | -19.03% | NUE | 0.92% | **Total** | **8.30%** | GD | -3.26% | CSCO | 8.46% | FDX | 52.90% | INTC | 42.24% |
| | **Total** | **-41.37%** | PFE | 2.18% | | | JNJ | 4.73% | GLW | -2.49% | HAL | 42.25% | PFE | 2.63% |
| | | | RL | 75.43% | | | WBA | -14.54% | CMI | 23.27% | HUM | 47.35% | NOV | -9.26% |
| | | | ROK | 44.27% | | | NOV | 2.65% | BEN | 30.22% | ITW | 34.70% | **Total** | **23.93%** |
| | | | SLB | 55.30% | | | **Total** | **-1.19%** | GD | 3.97% | INTC | 21.89% | | |
| | | | SNA | 9.59% | | | | | HAL | 4.72% | NOV | 13.31% | | |
| | | | TXN | 69.03% | | | | | HUM | -21.82% | **Total** | **30.36%** | | |
| | | | NOV | 83.01% | | | | | ITW | 30.20% | | | | |
| | | | FLS | 81.94% | | | | | INTC | -14.09% | | | | |
| | | | **Total** | **47.66%** | | | | | MDT | 6.50% | | | | |
| | | | | | | | | | SNA | 56.01% | | | | |
| | | | | | | | | | WBA | 13.18% | | | | |
| | | | | | | | | | NOV | 0.19% | | | | |
| | | | | | | | | | **Total** | **9.92%** | | | | |

| | 2015 | | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| | ADM | -30.82% | ADM | 26.53% | BAX | 48.92% | BEN | -32.92% | AMAT | 93.51% | CMI | 26.47% | DHI | 55.85% |
| | GLW | -22.06% | AMAT | 76.73% | GLW | 32.46% | **Total** | **-32.92%** | CMI | 37.19% | DHI | 30.76% | LEN | 51.07% |
| | HAL | -13.56% | CMI | 59.37% | BEN | 8.77% | | | DHI | 55.05% | LEN | 36.76% | MTB | 21.10% |
| | NVDA | 60.44% | BEN | 12.91% | **Total** | **30.05%** | | | GPS | -30.04% | MTB | -24.50% | PHM | 32.43% |
| | VLO | 42.04% | INTC | 8.06% | | | | | GILD | -10.47% | NUE | -4.66% | **Total** | **40.11%** |
| | NOV | -48.42% | VLO | -1.18% | | | | | PHM | 51.84% | PHM | 11.37% | | |
| | **Total** | **-2.06%** | NLOK | 16.50% | | | | | **Total** | **32.85%** | **Total** | **12.70%** | | |
| | | | **Total** | **28.42%** | | | | | | | | | | |

*Figure 16- Updated Graham's Strategy returns by year*

Indeed, in general, this expectation was met. The total amount of companies invested in increased from 28 in Graham's original strategy to 42 in the updated version which translates into a 50% increase. In the years 2008, 2019, 2020, and 2021 which previously were identified as the ones with more specific risk due to lack of diversification, the portfolio was now composed of at least 4 companies in the updated strategy. Contrary though, the year 2017 registered one less company than previously, and the year 2018 was now left exposed to only one company.

Having a single company dictating the total returns of a portfolio turned out to be a huge problem, especially because 2018 was a poor year for the whole market. If previously, the incapacity of finding good business led to luckily having 0% returns in a negative year, this time a near 33% fall on the price of the single stock composing the portfolio in 2018, made the long-term annual effective rate to be compromised a lot.

In the table presented in the figure 17 it is possible to see that the yoy returns didn't differ a lot overall. Graham's original strategy outperformed the updated strategy in 8 of the 14 years while the updated version outperformed the former in the remaining 6 years.

| Graham's Strategy | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -37.62% | -37.62% |
| 2009 | 52.12% | -5.12% |
| 2010 | 17.71% | 11.69% |
| 2011 | -7.90% | 2.86% |
| 2012 | 3.32% | 6.28% |
| 2013 | 30.88% | 39.10% |
| 2014 | 24.18% | 72.73% |
| 2015 | -10.50% | 54.59% |
| 2016 | 18.14% | 82.63% |
| 2017 | 29.06% | 135.70% |
| 2018 | 0.00% | 135.70% |
| 2019 | 50.23% | 254.09% |
| 2020 | 22.39% | 333.36% |
| 2021 | 38.25% | 499.13% |
| **Effective anual Rate** | | **13.6415%** |
| **St. Deviation** | | **24.87%** |

| Updated Strategy | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -41.37% | -41.37% |
| 2009 | 47.66% | -13.43% |
| 2010 | 8.30% | -6.24% |
| 2011 | -1.19% | -7.36% |
| 2012 | 9.92% | 1.83% |
| 2013 | 30.36% | 32.75% |
| 2014 | 23.93% | 64.51% |
| 2015 | -2.06% | 61.12% |
| 2016 | 28.42% | 106.90% |
| 2017 | 30.05% | 169.07% |
| 2018 | -32.92% | 80.49% |
| 2019 | 32.85% | 139.77% |
| 2020 | 12.70% | 170.22% |
| 2021 | 40.11% | 278.62% |
| **Effective anual Rate** | | **9.9766%** |
| **St. Deviation** | | **26.02%** |

*Figure 17- Original and updated strategy returns comparison*

What appears to be more strikingly shocking at first is the huge gap between the effective annual return between the two strategies and as consequence, the cumulative return as well. While the former managed to deliver a 13.6415% effective annual return over the 14 years of the analysis, the updated version only returned 9.9766%. If we look closer, however, it is easy to identify the year 2018 as the main reason for this discrepancy, for the reason already pointed out before. In fact, heading for 2018, the cumulative return of the updated strategy was leading the battle between the 2 strategies by almost 34% overall. If we decide to remove the 2018 year from the scope of our analysis the figures would be way different. Although Graham's strategy would still get the upper hand, the updated strategy would instead achieve an annual effective rate of 13.1585% with a smaller standard deviation as well, around 22.81%.

These achievements come to reinforce the idea that a strategy consisting in selling the full portfolio and rebuilding it from starch every year is not a good idea, even if we manage to turn the strategy into a more flexible one. What we observed was that the larger increases in investment opportunities occurred in already well-diversified years, as were the case after correction years of 2009, 2012, and 2019. For the remaining years, the overall quantity of stocks also increased significantly but for those years when

the market seems to be way overpriced, this increase in flexibility proves to be ineffective anyway. That was the case in 2017 and 2018 and it seemed to be starting to happen again in 2021.

Regarding the economy sectors' representation on the portfolios, there were a few deviations from the original one to the updated version, as it is observable in figure 18. If sectors such as Information and Technology and commutation services were the most misrepresented when compared to the S&P 500 companies, the same pattern still was observed after the changes took. Although there were 3 new companies presented in the portfolio from the Information and Technology sector, that 1 basis point increase in representation wasn't enough to shorten the gap now of still 7 percentual points to the S&P 500. The Communication Services sector remained completely unrepresented in the portfolio. In this case, the reason behind it was due to the sector traditionally having negative working capital figures and by having so, all companies from the sector were cut off the list by rule 6 from the updated strategy.

Sectors that are usually underpriced by the market such as Industrials and energy, continued to have an overrepresentation on the portfolio, with special notes to the first one which also increased its representation after benefiting from the new adjusted PE and PB ratios.

Another sector that also largely benefited from the newly adjusted PE and PB ratios was the Healthcare sector. By having a low depreciation rate and growing investments in R&D over time companies in this sector end up getting their earnings and book value increasing the most. This happens because depreciation of present-time R&D investments is smaller with lower depreciation rates and there is a large amount of depreciation coming from past years with lower R&D investments.

In healthcare specifically, the lower depreciation rates are a direct consequence of patents which usually give the creator the exclusivity to produce its newly created drugs for a specific period. This is the perfect example of intangible value that was previously not captured by traditional multipliers.

| Sectors | Graham Strategy | Upadated Strategy | S&P500 |
|---|---|---|---|
| Information Technology | 18% | 19% | 28% |
| HealthCare | 18% | 26% | 13% |
| Financials | 11% | 7% | 12% |
| Consumer Discretionary | 18% | 14% | 12% |
| Communication Services | 0% | 0% | 10% |
| Industrials | 14% | 17% | 8% |
| Consumer Staples | 4% | 2% | 6% |
| Energy | 14% | 12% | 4% |
| Utilities | 0% | 0% | 3% |
| Real Estate | 0% | 0% | 3% |
| Materials | 4% | 2% | 3% |

*Figure 18- Sectors representation in Graham's and Updated strategies*

Until now, what we saw from the updated strategy was difficulty in directly answering the main problems from the original strategy. The attempt to diversify the original portfolio was achieved but with limitations especially in overpriced years which ended up being costly to the long-term returns of the strategy.

However, the same way I proposed a "Buy and Hold" portfolio for the original strategy which proved to be a success to tackle this last mention issue, I also tried the same approach for the updated strategy as well.

**Updated Buy&Hold Strategy**

| Year | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| | ADM | -37.62% | ADM | 8.81% | ADM | -3.46% | ADM | -3.95% | AMGN | 34.50% | A | 35.41% | ANTM | 37.66% |
| | DFS | -35.83% | GLW | 102.81% | BMY | 4.88% | BMY | 32.57% | ADI | 17.39% | CVX | 12.87% | CSCO | 25.67% |
| | BEN | -44.00% | CMI | 72.82% | CVX | 17.21% | CVX | 18.63% | ANTM | -9.56% | CSCO | 10.19% | GLW | 29.82% |
| | GPS | -35.42% | DFS | 53.46% | DFS | 26.09% | GLW | -31.76% | ADM | -3.60% | GLW | 37.20% | FDX | 21.61% |
| | NVDA | -76.32% | JNJ | 7.62% | JNJ | -3.21% | GPS | -15.77% | CVX | 1.41% | CMI | 25.95% | HUM | 41.06% |
| | VFC | -19.03% | NUE | 0.92% | GLW | -0.21% | GD | -3.26% | CSCO | 8.46% | FDX | 52.90% | INTC | 42.24% |
| | **Total** | **-41.37%** | PFE | 2.18% | CMI | 139.65% | JNJ | 4.73% | GLW | -2.49% | HAL | 42.25% | PFE | 2.63% |
| | | | RL | 75.43% | RL | 36.95% | WBA | -14.54% | CMI | 23.27% | HUM | 47.35% | NOV | -9.26% |
| | | | ROK | 44.27% | ROK | 52.09% | NOV | 2.65% | BEN | 30.22% | ITW | 34.70% | A | 0.83% |
| | | | SLB | 55.30% | SLB | 26.53% | CMI | -18.57% | GD | 3.97% | INTC | 21.89% | CMI | 3.41% |
| | | | SNA | 9.59% | TXN | 24.77% | RL | 25.66% | HAL | 4.72% | NOV | 13.31% | HAL | -22.39% |
| | | | TXN | 69.03% | NOV | 65.06% | ROK | 3.87% | HUM | -21.82% | ADI | 15.70% | ADI | 12.44% |
| | | | NOV | 83.01% | FLS | 24.49% | TXN | -9.45% | ITW | 30.20% | ANTM | 50.62% | ADM | 20.78% |
| | | | FLS | 81.94% | VFC | 17.05% | FLS | -14.60% | INTC | -14.09% | ADM | 53.59% | BEN | -2.63% |
| | | | GPS | 51.20% | **Total** | **30.56%** | **Total** | **-1.70%** | MDT | 6.50% | BEN | 33.80% | MDT | 26.08% |
| | | | VFC | 33.38% | | | | | SNA | 56.01% | MDT | 38.02% | SNA | 25.23% |
| | | | **Total** | **46.99%** | | | | | WBA | 13.18% | SNA | 35.38% | GPS | 8.39% |
| | | | | | | | | | NOV | 0.19% | GPS | 23.82% | JNJ | 15.26% |
| | | | | | | | | | GPS | 67.93% | JNJ | 28.33% | RL | 6.01% |
| | | | | | | | | | JNJ | 8.28% | RL | 14.85% | FLS | -22.94% |
| | | | | | | | | | RL | 8.46% | FLS | 56.25% | **Total** | **13.09%** |
| | | | | | | | | | FLS | 46.46% | **Total** | **32.59%** | | |
| | | | | | | | | | **Total** | **14.07%** | | | | |

| 2015 | | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns | Stocks | Returns |
| ADM | -30.82% | ADM | 26.53% | BAX | 48.92% | BEN | -32.92% | AMAT | 93.51% | CMI | 26.47% | DHI | 55.85% |
| GLW | -22.06% | AMAT | 76.73% | GLW | 32.46% | BAX | -0.14% | CMI | 37.19% | DHI | 30.76% | LEN | 51.07% |
| HAL | -13.56% | CMI | 59.37% | BEN | 8.77% | AMAT | -38.00% | DHI | 55.05% | LEN | 36.76% | MTB | 21.10% |
| NVDA | 60.44% | BEN | 12.91% | AMAT | 59.70% | CMI | -26.08% | GPS | -30.04% | MTB | -24.50% | PHM | 32.43% |
| VLO | 42.04% | INTC | 8.06% | CMI | 28.40% | NVDA | -33.27% | GILD | -10.47% | NUE | -4.66% | CMI | -3.94% |
| NOV | -48.42% | VLO | -1.18% | NVDA | 87.51% | CSCO | 9.34% | PHM | 51.84% | PHM | 11.37% | NUE | 112.05% |
| CSCO | -5.28% | NLOK | 16.50% | CSCO | 27.33% | HUM | 13.61% | BAX | 28.79% | AMAT | 40.71% | AMAT | 80.81% |
| HUM | 16.54% | GLW | 46.46% | HUM | 22.92% | A | -1.36% | NVDA | 82.76% | NVDA | 119.53% | NVDA | 127.53% |
| PFE | 1.85% | NVDA | 223.42% | A | 46.79% | **Total** | **-13.60%** | HUM | 29.60% | HUM | 13.80% | HUM | 10.43% |
| A | -0.29% | CSCO | 15.08% | ADI | 22.92% | | | A | 29.17% | **Total** | **27.81%** | **Total** | **54.15%** |
| CMI | -40.26% | HUM | 20.10% | **Total** | **38.57%** | | | **Total** | **36.74%** | | | | |
| ADI | -2.59% | A | 11.86% | | | | | | | | | | |
| BEN | -36.19% | ADI | 33.85% | | | | | | | | | | |
| SNA | 23.34% | SNA | 1.77% | | | | | | | | | | |
| GPS | -43.07% | RL | -17.02% | | | | | | | | | | |
| RL | -40.86% | **Total** | **35.63%** | | | | | | | | | | |
| FLS | -31.27% | | | | | | | | | | | | |
| **Total** | **-10.03%** | | | | | | | | | | | | |

*Figure 19- Updated "Buy&Hold" portfolio returns by year*

As it was expected, the total amount of companies in the portfolio increased a lot due to holding the stocks for as long as the business financials are sound. This led to a much more diversified portfolio in every single year of my work sample with the year with fewer companies continuing to be 2008 and

2018 but this time with a total of 7 and 8 companies respectively. Although being way more diversified and with much less specific risk in our portfolio, the benefit of holding to value stocks over time creates an even higher rate of return.

The case of Nvidia (NVDA) is a very interesting one, for example. After the share price plummeted more than 80% after the 2008 crisis the company didn't manage to come back for several years. Not only did the market capitalization of the company shrink but the business fundamentals such as the earnings were heavily affected in the years that followed as well. The company, however, showed resilience and as earnings were already at record highs in 2014, the stock price remained around 50% below its 2008 price. For a business such as Nvidia that otherwise would not make it to the final portfolio, now with the new adjusted metrics valuing its strong intangible core, the company passed all the tests to be in the updated portfolio, and there remained from 2015 until 2021.

Despite the correction of around 30% in 2018, the company achieved returns above 60% in all the remaining years, with half of them being over the 3 digits mark.

If in the comparison between Graham's original strategy and my updated version of it, the rate of return seemed to be much more favorable for the original piece, even if much due to the reasons pointed out before, the same pattern is not present in the comparison between the original and updated "Buy&Hold strategies". As it is possible to see in figure 20, the updated strategy outperformed the former in half of the years under analysis and achieved a 15.42% annual effective rate of return, 1 basis point above Graham's strategy.

The two strategies, even if the updated version with the slightly upper hand, seem to have achieved very similar results. It is not statistically legitimate based on only one sample period to argue that one is better than the other and it lays more as an investor preference. Annex C gives a more complete outlook over the comparison between the two Buy&Hold strategies and the S&P 500.

| Graham's Buy&Hold Strategy | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -37.62% | -37.62% |
| 2009 | 52.12% | -5.12% |
| 2010 | 38.75% | 31.66% |
| 2011 | -0.43% | 31.09% |
| 2012 | 10.14% | 44.37% |
| 2013 | 31.62% | 90.02% |
| 2014 | 18.44% | 125.07% |
| 2015 | -13.69% | 94.25% |
| 2016 | 17.00% | 127.27% |
| 2017 | 27.84% | 190.54% |
| 2018 | -7.24% | 169.51% |
| 2019 | 39.21% | 275.18% |
| 2020 | 23.16% | 362.08% |
| 2021 | 42.53% | 558.59% |
| **Effective anual Rate** | | **14.4123%** |
| **St. Deviation** | | **24.94%** |

| Updated Buy&Hold Strategy | | |
|---|---|---|
| Year | Returns | Cumulative Returns |
| 2008 | -41.37% | -41.37% |
| 2009 | 46.99% | -13.82% |
| 2010 | 30.56% | 12.51% |
| 2011 | -1.70% | 10.60% |
| 2012 | 14.07% | 26.17% |
| 2013 | 32.59% | 67.28% |
| 2014 | 13.09% | 89.19% |
| 2015 | -10.03% | 70.22% |
| 2016 | 35.63% | 130.87% |
| 2017 | 38.57% | 219.92% |
| 2018 | -13.60% | 176.40% |
| 2019 | 36.74% | 277.95% |
| 2020 | 27.81% | 383.04% |
| 2021 | 54.15% | 644.59% |
| **Effective anual Rate** | | **15.4197%** |
| **St. Deviation** | | **26.93%** |

*Figure 20- Original and Updated "Buy&Hold" strategy returns comparison*

## Conclusions

At the begging of the study, I started by questioning whether the strategy introduced in the book "Intelligent Investor" would still deliver above market returns today. After developing a portfolio following the book's guidelines and testing the portfolio performance, I concluded that my initial H2 hypothesis was the correct answer for that question, and in fact the strategy seems to still has a lot of potential today.

The follow up question of whether the strategy was still able to fully capture company's value in the new economy, however, does not have such a straightforward answer. In fact, some metrics used by Graham seem to be outdated and of course, there is space for followers of his investment philosophy to create their own strategies by making a more actual interpretation of its beliefs and rules. In despite of that, what I found with my study was that although very rigid and biased towards super traditional businesses, the strategy is still very efficient in finding exceptional undervalued businesses.

The goal then was to put in place changes to the strategy that could overcome these limitations while significantly improving the strategy returns. However, based on the results achieved I do not stand by the fact that the changes in place were enough to do so.

Despite my efforts, the argument that the framework developed by Benjamin Graham is too rigid and might limit the investor's choices as the market advances, was not totally overcome by the changes I decided to implement. However, the best solution to this problem was to opt by holding to previously acquired stocks for as long as the underlying business maintains a healthy financial position. This applies to both the original and the updated version of the strategy.

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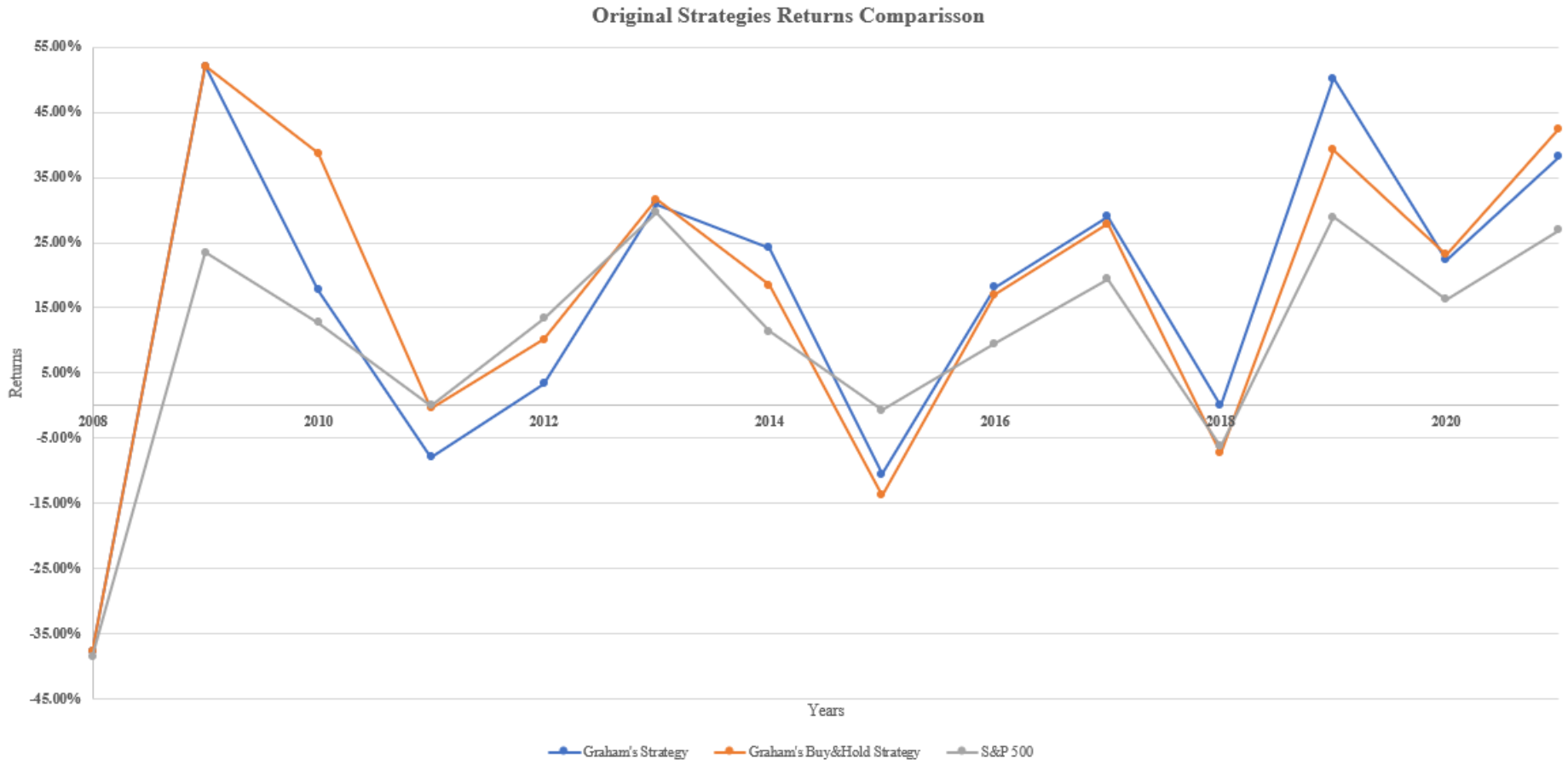
# Annexes

## Annex A

**Sample Stocks List**

| Symbol | Security | Symbol | Security | Symbol | Security | Symbol | Security | Symbol | Security | Symbol | Security | Symbol | Security | Symbol | Security |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MMM | 3M | BDX | Becton Dickinson | COST | Costco | FISV | Fiserv | KMB | Kimberly-Clark | NTRS | Northern Trust | SBNY | Signature Bank | WFC | Wells Fargo |
| ABT | Abbott | BBY | Best Buy | CTRA | Coterra | F | Ford | KIM | Kimco Realty | NOC | Northrop Grumman | SPG | Simon Property Group | WRK | WestRock |
| ADBE | Adobe | BIIB | Biogen | CSX | CSX | BEN | Franklin Resources | KLAC | KLA Corporation | NLOK | NortonLifeLock | SNA | Snap-on | WY | Weyerhaeuser |
| AES | AES | BK | BNY Mellon | CMI | Cummins | FCX | Freeport-McMoRan | KR | Kroger | NUE | Nucor | SEDG | SolarEdge | WHR | Whirlpool Corporation |
| AFL | Aflac | BA | Boeing | CVS | CVS Health | GPS | Gap | LH | LabCorp | NVDA | Nvidia | SO | Southern Company | WMB | Williams Companies |
| A | Agilent Technologies | BXP | Boston Properties | DHI | D. R. Horton | GD | General Dynamics | LEN | Lennar | OXY | Occidental Petroleum | LUV | Southwest Airlines | XEL | Xcel Energy |
| AIG | AIG | BSX | Boston Scientific | DHR | Danaher | GE | General Electric | LLY | Eli Lilly | OMC | Omnicom Group | SWK | Stanley Black & Decker | XLNX | Xilinx |
| APD | Air Products | BMY | Bristol Myers Squibb | DRI | Darden Restaurants | GIS | General Mills | LNC | Lincoln National | ORCL | Oracle | SBUX | Starbucks | YUM | Yum! Brands |
| AKAM | Akamai | BF.B | Brownâ€"Forman | DE | Deere & Co. | GPC | Genuine Parts | LIN | Linde | PCAR | Paccar | STT | State Street Corporation | ZBH | Zimmer Biomet |
| ALL | Allstate | CHRW | C. H. Robinson | DVN | Devon Energy | GILD | Gilead Sciences | LMT | Lockheed Martin | PH | Parker-Hannifin | SYK | Stryker Corporation | ZION | Zions Bancorp |
| GOOG | Alphabet | CPB | Campbell Soup | DFS | Discover Financial Services | GL | Globe Life | L | Loews Corporation | PAYX | Paychex | SYY | Sysco | NOV | Nov |
| MO | Altria | COF | Capital One | D | Dominion Energy | GS | Goldman Sachs | LOW | Lowe's | PEP | PepsiCo | TROW | T. Rowe Price | UNM | Unum |
| AMZN | Amazon | CAH | Cardinal Health | DOV | Dover Corporation | GWW | W. W. Grainger | LUMN | Lumen Technologies | PKI | PerkinElmer | TPR | Tapestry | FLIR | FLIR Systems |
| AEE | Ameren | CCL | Carnival Corporation | DTE | DTE Energy | HAL | Halliburton | MTB | M&T Bank | PFE | Pfizer | TGT | Target | FLS | Flowserve |
| AEP | American Electric Power | CAT | Caterpillar | DUK | Duke Energy | HIG | The Hartford | MRO | Marathon Oil | PNW | Pinnacle West Capital | TXN | Texas Instruments | XRX | Xerox |
| AXP | American Express | CBRE | CBRE | EMN | Eastman Chemical | HAS | Hasbro | MAR | Marriott International | PNC | PNC Financial Services | TXT | Textron | TIF | Tiffany & Co |
| AMT | American Tower | CNP | CenterPoint Energy | ETN | Eaton | HSY | The Hershey Company | MMC | Marsh & McLennan | PPG | PPG Industries | TMO | Thermo Fisher Scientific | FTI | TechnipFMC |
| AMP | Ameriprise Financial | SCHW | Charles Schwab | EBAY | eBay | HES | Hess Corporation | MAS | Masco | PPL | PPL | TJX | TJX Companies | VAR | Varian Medical Systems |
| ABC | AmerisourceBergen | CVX | Chevron | ECL | Ecolab | HD | Home Depot | MKC | McCormick & Company | PFG | Principal Financial Group | TRV | The Travelers Companies | | |
| AMGN | Amgen | CI | Cigna | EIX | Edison International | HON | Honeywell | MCD | McDonald's | PG | Procter & Gamble | TFC | Truist Financial | | |
| ADI | Analog Devices | CINF | Cincinnati Financial | EA | Electronic Arts | HST | Host Hotels & Resorts | MCK | McKesson Corporation | PGR | Progressive Corporation | TSN | Tyson Foods | | |
| ANTM | Anthem | CTAS | Cintas | EMR | Emerson | HPQ | HP | MDT | Medtronic | PLD | Prologis | USB | U.S. Bancorp | | |
| AON | Aon | CSCO | Cisco | ETR | Entergy | HUM | Humana | MRK | Merck | PRU | Prudential Financial | UNP | Union Pacific | | |
| APA | APA Corporation | C | Citigroup | EOG | EOG Resources | HBAN | Huntington Bancshares | MET | MetLife | PEG | PSEG | UNH | UnitedHealth Group | | |
| AAPL | Apple | CTXS | Citrix | EPAM | EPAM Systems | ITW | Illinois Tool Works | MCHP | Microchip Technology | PSA | Public Storage | UPS | United Parcel Service | | |
| AMAT | Applied Materials | CLX | Clorox | EFX | Equifax | INTC | Intel | MU | Micron Technology | PHM | PulteGroup | VLO | Valero Energy | | |
| ADM | ADM | CME | CME Group | EQR | Equity Residential | ICE | Intercontinental Exchange | MSFT | Microsoft | QCOM | Qualcomm | VRSN | Verisign | | |
| AIZ | Assurant | CMS | CMS Energy | EL | EstÃ©e Lauder Companies | IBM | IBM | TAP | Molson Coors | DGX | Quest Diagnostics | VZ | Verizon Communications | | |
| T | AT&T | KO | Coca-Cola | ES | Eversource Energy | IP | International Paper | MCO | Moody's | RL | Ralph Lauren Corporation | VFC | VF Corporation | | |
| ADSK | Autodesk | CTSH | Cognizant Technology Solutions | EXC | Exelon | IPG | Interpublic Group | MS | Morgan Stanley | RTX | Raytheon Technologies | VIAC | ViacomCBS | | |
| ADP | Automatic Data Processing | CL | Colgate-Palmolive | EXPE | Expedia Group | IFF | International Flavors & Fragrances | MSI | Motorola Solutions | RF | Regions Financial Corporation | VTRS | Viatris | | |
| AZO | AutoZone | CMCSA | Comcast | EXPD | Expeditors | INTU | Intuit | NTAP | NetApp | RHI | Robert Half International | VNO | Vornado Realty Trust | | |
| AVB | AvalonBay Communities | CMA | Comerica | XOM | ExxonMobil | J | Jacobs Engineering Group | NWL | Newell Brands | ROK | Rockwell Automation | VMC | Vulcan Materials | | |
| AVY | Avery Dennison | CAG | Conagra Brands | FDS | FactSet | JNJ | Johnson & Johnson | NEM | Newmont | SPGI | S&P Global | WMT | Walmart | | |
| BLL | Ball | COP | ConocoPhillips | FDX | FedEx | JPM | JPMorgan Chase | NEE | NextEra Energy | SLB | Schlumberger | WBA | Walgreens Boots Alliance | | |
| BAC | Bank of America | ED | Con Edison | FIS | Fidelity National Information Services | JNPR | Juniper Networks | NKE | Nike | SEE | Sealed Air | DIS | The Walt Disney Company | | |
| BBWI | Bath & Body Works | STZ | Constellation Brands | FITB | Fifth Third Bancorp | K | Kellogg's | NI | NiSource | SRE | Sempra Energy | WM | Waste Management | | |
| BAX | Baxter International | GLW | Corning | FE | FirstEnergy | KEY | KeyCorp | NSC | Norfolk Southern | SHW | Sherwin-Williams | WAT | Waters Corporation | | |

**Annex B**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Returns
2008
2010
2012
2014
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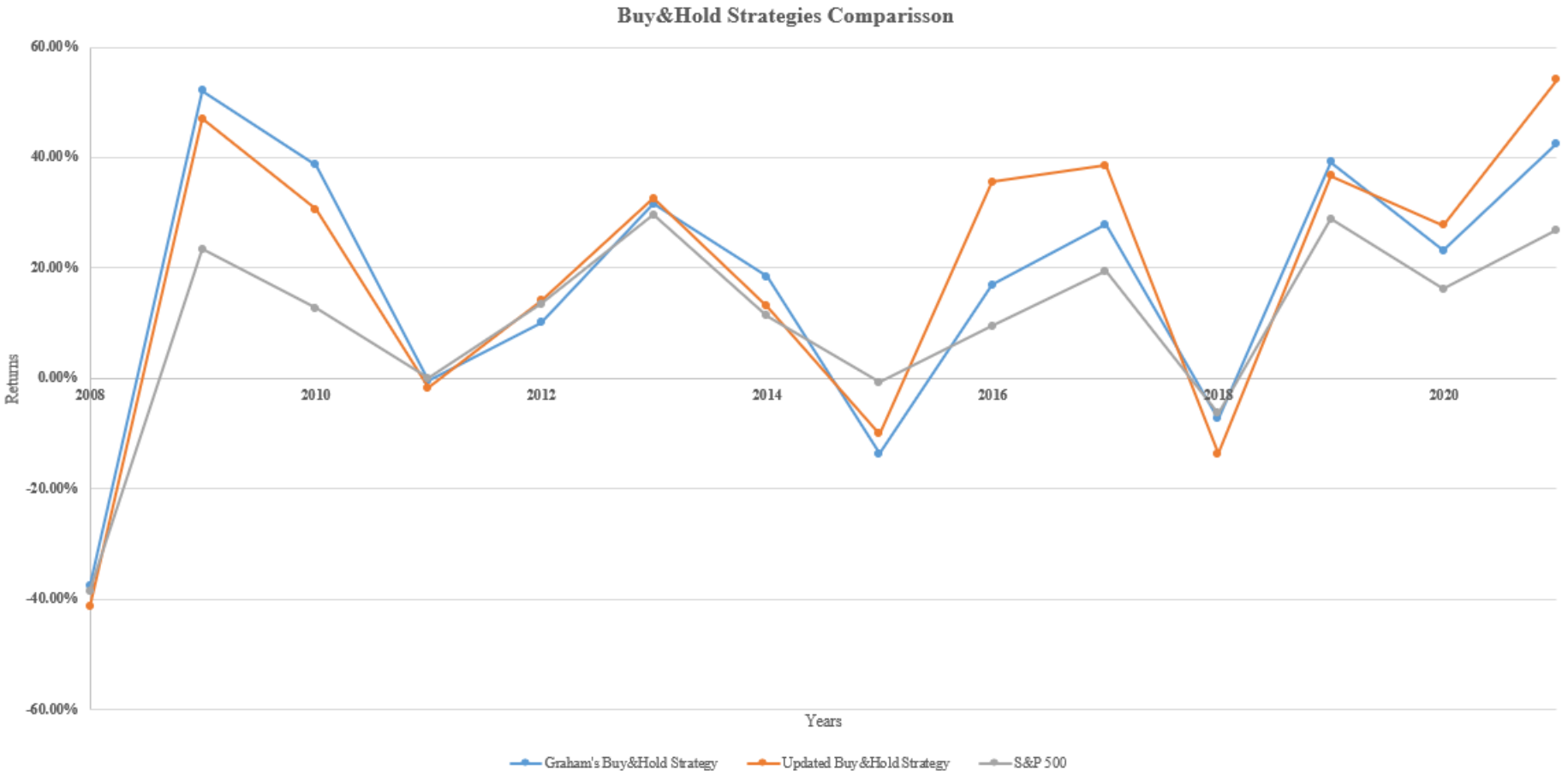
Years
Graham's Strategy
Graham's Buy&Hold Strategy
S&P 500

**Annex C**


Buy&Hold Strategies Comparisson
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40.00%
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0.00%
-20.00%
-40.00%
-60.00%
Returns
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2014
2016
2018
2020
Years
Graham's Buy&Hold Strategy
Updated Buy&Hold Strategy
S&P 500