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The Modern Intelligent Investor

Simple, Algorithmic Strategies to Produce Market-Beating Returns

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Abstract

In this paper, we study Benjamin Graham's criteria for investing in common stocks, and we are interested in exploring their potential both on a theoretical and on a practical level. Specifically, we are interested in whether *"Graham companies"* exceed the market returns, and whether it would be desirable for a mutual fund to apply this strategy. Therefore, our research question is the following: "To what extent may common stocks that match Benjamin Graham's investing criteria produce market-beating returns from early 2006 to late 2016, should the criteria be adjusted to improve the excess returns further, and may a mutual fund apply such a simple, algorithmic stock selection strategy to exceed the MSCI World Index's total return?"

We conclude that there *are* simple, Graham-based strategies that produce market-beating returns. Specifically—and based upon our 2006 data set—to achieve market-beating returns, it is sufficient to apply the following simple, algorithmic strategy: to buy common stocks in companies that match Graham's criteria, but to adjust the price criterion such that $\frac{P}{E} \cdot \frac{P}{tBV}$ lies between 70 and 300, to hold the stocks indefinitely, and to reinvest dividends in the same company whenever they are paid. This strategy has, for stocks that were bought in 2006 and held until 2016, produced substantial returns compared to their reference indices—whether each company were compared against its own respective index or against a common world index—both when the portfolio were adjusted for currency fluctuations and when it was not. In short, this strategy produced between a 5.5 % and a 7.7 % annualized net return, depending on which situation one wishes to study, by punching 18 holes in our ticket to buy wonderful companies at a fair price and by following the sit-on-your-ass investing principle.

Furthermore, we highlight limitations and weaknesses concerning our paper. First, we critique the Graham criteria. We state 1) that Graham's criteria leave no room for small errors, 2) that it does not consider a company's financial leverage, 3) that it may be too concerned with dividend-paying companies instead of dividend-stable companies, 4) that the criteria are based on quantitative data only, and 5) that the price criterion does not consider the opportunity cost of risk-free investments.

Then we critique our own data. First of all, we do not analyze how well these criteria fare throughout the time domain. Instead, we invest only on January 1, 2006. Second, our revenue criterion may be somewhat inaccurate. Third, our EPS figures include extraordinary items and may therefore distort our analysis adversely. And finally, we have relied solely on the Bloomberg Terminal for financial data on each company and reference index, but have not compared them with similar data from Morningstar Direct or other alternatives.

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Introduction

In 1984, Warren Buffett wrote the article *The Superinvestors of Graham-and-Dodsville* in which he praises Benjamin Graham's views on value-based stock selection. First, he points out that "looking for values with a significant margin of safety relative to prices" has recently come under criticism from relevant authors. They state that the stock market is now efficient, and the stock prices reflect everything that is known about a company's prospects and everything about the state of the economy, meaning that value trading is no longer as viable an option as before. In response, Buffett uses a coin-flip example to illustrate why Graham's methods are still relevant. He proposes a game in which 225 million americans flip a coin every morning, and they each wager 1$ which will be paid by the losers to the winners. If this game continues for 20 days, there will be approximately 240 people left with over 1$m in earnings. This—by itself—can arguably just be random, but then you might observe that 40 of these winners come from the same university. You will find that a disproportionate number of successful coin flippers in the investment world came from a small intellectual village that could be called *Graham-and-Dodsville*. Consequently, this is a concentration of winners that simply cannot be explained by chance. These investors do not copy each other's behavior, but they are amongst the most successful investors nonetheless. The causal factor of their success, however, is that they had the same intellectual patriarchs: Benjamin Graham and David L. Dodd. (Buffett, 1984)

In this assignment, we seek to test Benjamin Graham's criteria for stock selection, which is chosen both to find profitable stocks and to reduce the risks of stock ownership. Initially, he introduced ten criteria in *Security analysis* (Graham & Dodd, 1934), and later refined them to seven criteria in *The intelligent investor* (Graham & Zweig, 2003). It is a daunting task to backtest all the companies in the world, so we have made simplifications and adaptations that will be explained fully.

Similar work has already been published. For instance, Benjamin Graham and James Rea

published a study that backtested data for 50 years to find the best criteria to pick stocks. They worked together up until Graham's death, and their methodology has therefore become known as *Graham's Last Will*. Rea published ten rules that—instead of being absolute demands—gave the companies a score based on how many criteria they satisfied, and these criteria produced market-beating results for five of the six decades they tested them on. (Croft, 2014)

Furthermore, Henry R. Oppenheimer tested Graham's ten rules from 1974 to 1981 on securities listed on the New York Stock Exchange and the American Stock exchange, and he found that companies satisfying three specific rules generated annual returns of 29 %. (Oppenheimer, 1984)

And finally, Société Générale tested the rules in 2015 and concluded that, for the last 18 years, only three companies passed all ten criteria. Stocks that scored at least seven out of ten produced on average 26 % excess returns. (Hargreaves, 2015)

To illustrate how we have conducted our analysis, we have constructed the following story. In the fall of 2005, a student named Klaus was in his final year at the University of Bremen. He was intrigued by the stock markets and the teachings of Benjamin Graham. Therefore, over lunch, his grandmother proposed to give him a small loan of one million euros to invest in the stock market. Klaus wanted to invest these money wisely, so he decided to read *The Intelligent Investor* by Benjamin Graham and then follow his sound advice for selecting common stocks. He used his access to the university's Bloomberg terminal to gather data from the entire Bloomberg universe and to determine which listed companies satisfied Graham's criteria. After identifying these companies, Klaus invested on the first day of trading in January 2006, splitting his one million euros in equal amounts spread over his selected investments. He intended to stay in the stock market until November 1, 2016, in which he would sell the stocks, repay his grandmother, and hopefully exit the market with an excess return compared to other investment alternatives, such as an index fund. However, upon graduating from the University of Bremen, Klaus lost access to the Bloomberg terminal, which both hindered him in identifying new companies that matched Graham's criteria after 2006 and made him rely on annual reports to control the portfolio he bought in early 2006. Specifically, Klaus would analyze the annual reports and determine whether the company still satisfied Graham's criteria, and then either keep the stocks or sell them. Furthermore, if he decided to sell any stocks before November 2016, he would invest all the money in the index fund that matched the stock's respective reference index. And finally, on November 1, 2016, Klaus would compare each investment made in 2006 with its respective reference index, calculate his portfolio's excess return compared to the indices, and repay his grandmother.

In this paper, we are interested in Benjamin Graham's criteria both on a theoretical and on a practical level. Specifically, we are interested in whether *"Graham companies"* exceed the

market returns, and whether it would be desirable for a mutual fund to apply this strategy. Therefore, our research question is the following:

> To what extent may common stocks that match Benjamin Graham's investing criteria produce market-beating returns from early 2006 to late 2016, should the criteria be adjusted to improve the excess returns further, and may a mutual fund apply such a simple, algorithmic stock selection strategy to exceed the MSCI World Index's total return?

Throughout this paper, we will make numerous references to Warren Buffett and Charlie Munger because Buffett is not only considered Graham's best student, but because Buffett's and Munger's Berkshire Hathaway has a solid foundation that is largely based upon Benjamin Graham's wisdom. Buffett and Munger, however, may have distributed Graham's principles and wisdom far better than he did himself, so we will enrich the paper with various Buffett and Munger statements.

2

Graham's Seven Criteria for Selecting Common Stocks

Graham claimed that potential companies must fulfill the following criteria.

Adequate size A company's size must be adequate, *revenue-wise*. Since large companies rarely experience adverse losses that the investor cannot foresee, this criterion is meant to minimize risk. (Graham & Zweig, 2003)

Strong financial conditions The company must have strong financial conditions. Specifically, it should have at least a $2:1$ *current ratio* to fulfill this criterion, meaning the company's current assets should be at least twice the size of their current liabilities. Companies passing this criterion have a sizeable cushion of working capital that, on average, should sustain them during harsh times. (ibid)

Earnings stability To ensure the company is profitable, the third criterion will only be met if the company has delivered *strictly positive earnings* each year for the last ten years. Thus, if the company had a profit loss at least once during the last ten years, then they are disqualified from the *"Graham portfolio"*. (ibid)

Dividend record The company must have paid *dividends* each year for 20 consecutive years. Although this is no guarantee that the company will pay dividends forever, a solid track record is a comforting sign. This criterion is also meant to substantiate the profitability of the company. (ibid)

Earnings growth The company must have increased their *earnings per share* (EPS) by at least one third over the last 10 consecutive years. Specifically, a company passes this criterion if their average EPS from the years 1–3 surpasses their average EPS from the years 10–12 by at least 33 %. (ibid)

Moderate P/E ratio and price-to-book ratio This price criterion limits the portfolio to stocks whose price is 15 times or less the average earnings per share over the past three years. Furthermore, the price to *tangible* book value ratio should be less than or equal to 1.5. However, Graham allowed trade-offs between these two criteria, letting the company pass these two criteria if the product of the P/E and the price-to-tangible book value ratio is 22.5 or less[1]. Instead of using the regular book value in his calculations, Graham uses the tangible book value to avoid companies in which intangible assets—brand names, patents, etc.—constitute a large fraction of the company's total assets. His motivation were that these assets may not transform into real value. (ibid)

2.1 Simplifications and Adaptations

Adequate size Since Graham's monetary value for the revenue criterion is outdated in 2016, we have updated it by applying Jason Zweig's advice. In his commentary chapters in *The Intelligent Investor*, Zweig stated that a reasonable criterion was 2 billion US dollars in 2003 (Graham & Zweig, 2003). We have decided to use this criterion and then update it each year by using a US inflation calculator (Coin News, 2016).

Furthermore, we have transformed this revenue criterion into relevant local currencies, but we have simplified the filtration process. Firstly, we updated the revenue criterion using the US inflation rate instead of each currencies inflation rate. And secondly, instead of downloading the exchange rate for all the years spanning from 2006 to 2016, we downloaded *one* day's currency exchange rate—the rates given on January 1, 2006[2]—which we then applied to evaluate each year's revenue against Zweig's USD-denominated, inflation-adjusted criterion (Graham & Zweig, 2003).

We chose not to update the revenue criterion with the new exchange rates 1) to prevent companies from being discarded because of changes in the exchange rates and 2) to simplify the model

[1] $\frac{P}{E} \cdot \frac{P}{tBV} \leq 22.5 = 15 \cdot 1.5$.

[2] To calculate a precise currency rate for January 1, 2006–controlling for potential short-term fluctuations–we used the average rates of two days: the mid-market, 5 PM currency rate on December 31, 2005 and the mid-market, 5 PM currency rate on January 1, 2006 (XE Market Analysis, 2016). However, this was unnecessary because the results were no large fluctuations in this 24-hour time window.

and number crunching. Bloomberg (2016) provided us with each company's revenue, which we then adjusted for inflation and converted into local currencies in Microsoft Excel.

Strong financial conditions We used Bloomberg's current ratio criterion in the equity screener and set the value to be greater than or equal to two.

Earnings stability We set Bloomberg's equity screener to include companies with a strictly positive profit for the last ten years in which the company reported annually. Some companies that were no longer trading in 2006—but that had profits in all their final ten years of *trading*—passed Bloomberg's filters but were discarded in Excel.

Dividend record Graham's original criterion was 20 consecutive years of paying dividends. However, no companies in the Bloomberg Terminal matched all the original criteria because many of the companies had not even existed for 20 years in the Bloomberg universe. By relaxing the criterion from 20 to ten years, we eventually had a list of 41 companies that passed all of Graham's criteria, excluding the two price criteria.

Earnings growth This criterion required heavy computations. Bloomberg (2016) listed the basic earnings per share, but we could not use their screening formula to find an average of three years of data because Bloomberg did not take stock splits and stock dividends into consideration. Therefore, we exported both the annual basic earnings per share and each company's corporate action calendar. We sorted through the corporate action calendars and found all stock splits and stock dividends that occurred from 1993 to today. We then used these data to create a split adjustment factor, so that a company that reduced its earnings per share from 50 to 25 because of a 2-to-1 split, for instance, would display no growth instead of negative growth. We chose not to include equity offerings and buy-backs because we could not find good, structured data on buy-backs and none of our companies had any significant equity offerings during the years we studied them.

Moderate P/E ratio and price-to-book ratio To know whether a company passed Graham's price criterion, we applied the same split adjustment factor method described in the previous paragraph. We identified the closing price on the final day of trading in 2005—which we simplified and assumed were somewhat the same as the opening price on the first day of trading in 2006—and calculated each company's P/E ratio. Furthermore, Bloomberg (2016) offered a tangible book value criterion in the equity screener, but it was inadequate. Therefore, we used their formula builder and subtracted the company's intangible assets from the company's

total book value. And finally, we exported the values to Excel and formalized the price criteria trade-off between the P/E and price to tangible book value ratios .

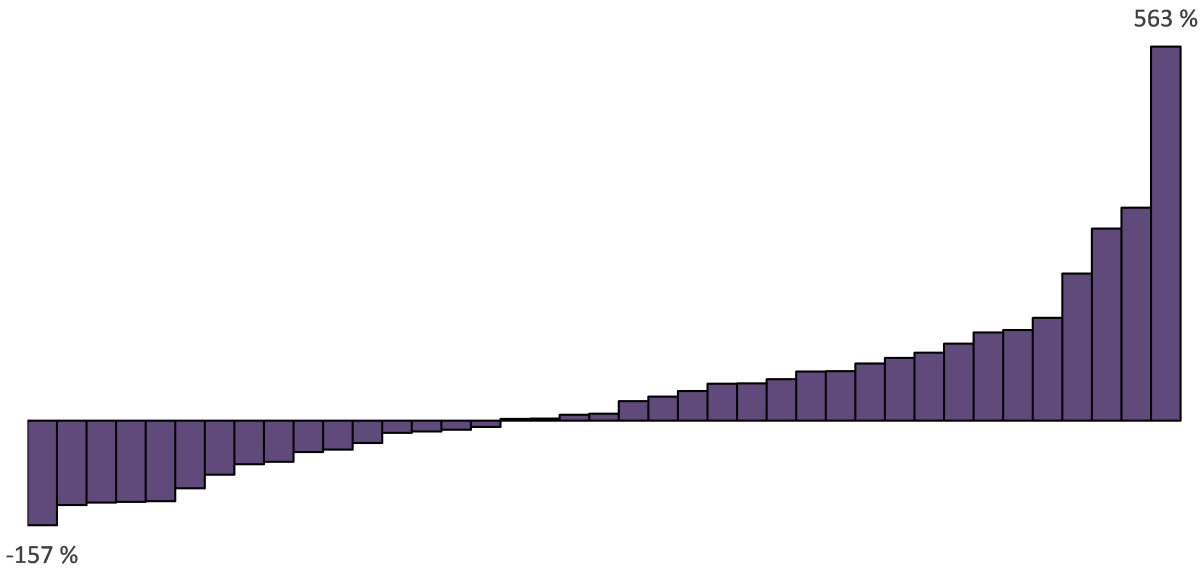


Figure 2.1: Excess market returns for all 41 companies in the Bloomberg universe that fulfill every criteria, excluding Graham's price criterion. The average excess return—the company's total return from January 1, 2006 to November 1, 2016, less its respective reference index's total return in the same time period—is 39 % and the population standard deviation is 137 %. The lowest excess return is –157 % and the highest excess return is +563 %. Throughout the analysis, we will study various subsets of this population.

3

Analysis

In this section, we show the results for various strategies. The work has been completed in Microsoft Excel, and our measure of success is the annualized excess return compared to each company's related index. Furthermore, to match the index, all cash dividends are reinvested in the stock on the payment date. And finally, we have allowed ownership of stock fractions for analytical purposes.

We consider the population of Graham companies in a given year as a kind of sample from a *superpopulation* because the number and members of the Graham companies that constitutes our population changes somewhat year-over-year. However, because we study the entire Bloomberg universe, we can not treat our companies as a normal sample because the number of Graham companies each year is not randomly chosen. Therefore, some descriptive statistics are relevant—such as the ones described in figure 2.1, but we will not use hypothesis testing or p-values.

To calculate the excess return, we will create two hypothetical portfolios: one that constitutes the companies that match the specific criteria for our strategy, and another that constitute these companies' respective reference indices. We will calculate what excess return the former portfolio will deliver compared to the latter, and we will then annualize this result.

Therefore, let $t = T$ represent November 1, 2016, $t = 0$ represent January 1, 2006, $V_T^{\varphi^G}$ be the value of the portfolio with companies that match Graham's criteria at time T, $V_T^{\varphi^I}$ be the value of the portfolio that constitute these companies respective reference indices at time T, and V_0 be the initial investment. Then the annualized excess return is calculated as,

$$\left(1 + \frac{V_T^{\varphi^G} - V_T^{\varphi^I}}{V_0}\right)^{\frac{365.24}{T}} - 1 \tag{3.1}$$

Note that V_0 is the amount invested both in the stock portfolio and in the index portfolio—in our case, that is a one million euro initial investment in each hypothetical portfolio.

3.1 Strictly Graham

In our first strategy, Klaus buys all companies that fit the Graham criteria—including the price criterion. For the companies he buys, he will study each company's annual report the day they are published. If a company violate a criterion—except the price criterion—Klaus will sell his shares in the specific company at the closing price on the day the annual report was published[1]. To "lock in" the excess return compared the company's reference index, Klaus will reinvest all of proceeds from the stock sale into an index fund[2] that matches the mentioned reference index. Each investment is considered in its local currency, so currency exchange rates are not applied.

Among over 800,000 companies, 11 companies in the Bloomberg universe satisfied all the Graham criteria on January 1, 2006. Among these, three released annual reports in which they broke at least one criterion during 2006 and were sold. In 2007, three companies ceased to exist because of mergers and acquisitions, and two more released annual reports in which they broke the criteria. Among the remaining three companies, two broke the criteria in 2008, and the final one broke the criteria in 2009. Thus, Klaus' portfolio consisted only of index funds from 2009 and until November 1, 2016. The companies gave an average excess return of -8.5 % and with population standard deviation of 35.5 %. This strategy produced a negative 0.6 % annualized excess return, which make us discard the Strictly Graham strategy as a potential market-beating strategy. Table 3.1 displays the specific details.

[1] We downloaded the prices for each company and reference index over the relevant period and noted the dates of publication for each annual report in the Bloomberg terminal.

[2] At closing price the same day.

Company name	Sell date	Return	Reference index	Index return	Excess return
Canadian Utilities Ltd (CU CN)	February 21, 2007	18.1%	SPTSX	30.9%	-12.8%
George Wimpey Ltd (WMPY LN)	March 14, 2007	25.6%	UKX	20.9%	4.8%
MDC Holdings Inc (MDC US)	February 7, 2008	43.0%	SPX	74.7%	-31.7%
Orkla ASA (ORK NO)	April 6, 2009	140.0%	OBX	108.2%	31.8%
PPB Group Bhd (PEP MK)	July 27, 2007	124.4%	FBMKLCI	81.2%	43.2%
Sears Canada Inc (SCC CN)	March 27, 2008	34.0%	SPTSX	30.9%	3.1%
Barratt Developments PLC (BDEV LN)	September 24, 2009	-36.3%	UKX	20.9%	-57.2%
Centex LLC (0226226D US)	May 24, 2008	-7.2%	SPX	74.7%	-81.9%
Taylor Wimpey PLC (TW/ LN)	July 3, 2007	7.7%	UKX	20.9%	-13.2%
Wilson Bowden Ltd (WLB LN)	April 23, 2007	53.7%	UKX	20.9%	32.8%
Kellwood Co (KWD US)	March 17, 2006	89.2%	SPX	74.7%	14.6%
Total					-6.0%
Annualized					-0.6%

Table 3.1: Companies that matched Graham's criteria—including the price criterion—on January 1, 2006. Companies were sold at the end of the day an annual report displayed figures that disqualified the company from being a Graham company any longer. Note that—because the proceeds from the sale were invested in the respective index—the return column displays the company's return up to the selling date *and* the index's return from the selling date and to November 1, 2016. This strategy produced a negative 0.6 % annualized excess return.

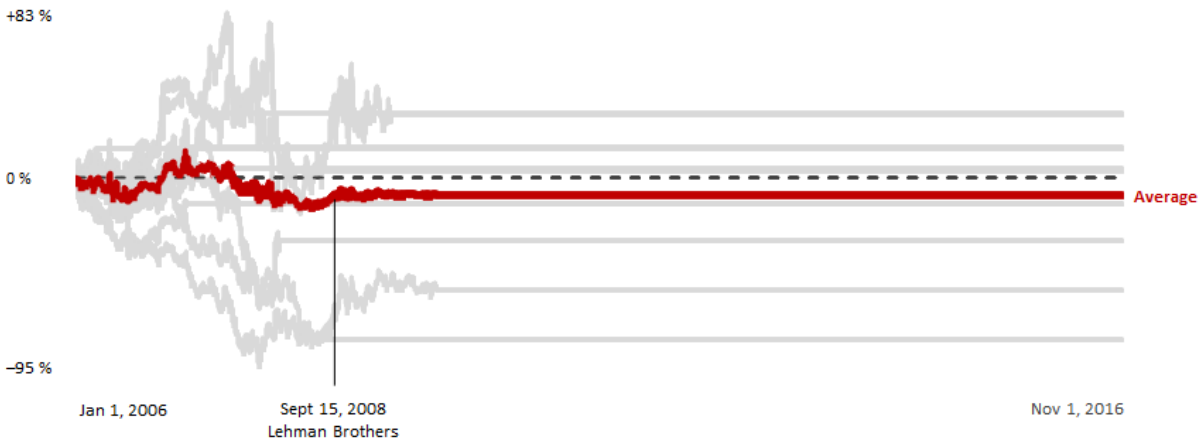


Figure 3.1: Excess return graph for the 11 companies that fit the Strictly Graham strategy. Only two companies remained in the portfolio when the Lehman Brothers collapse occurred, so this strategy was largely unaffected by the ensuing financial crisis. Note that this strategy were beaten by the market during its short lifetime.

3.2 The Museum of Modern Art

Instead of selling the companies when they break one of Graham's criteria, Klaus now ignores the annual reports and stay long in all 11 companies until they are either removed due to mergers and acquisitions—at which point he invests in the company's respective index—or sold on November 1, 2016. We call this the "Museum of Modern Art" strategy[3]. Several investors advocate this type of strategy, among them Charlie Munger and Warren Buffett of Berkshire Hathaway.

> If you buy a business just because it's undervalued then you have to worry about selling it when it reaches its intrinsic value. That's hard. But if you can buy a few great companies then you can sit on your ass ... that's a good thing.—Charlie Munger at the 2000 Berkshire Hathaway Annual meeting (Moore, 2015).

In addition to this sit-on-your-ass investing principle proposed by Charlie Munger, Warren Buffett has stated the following:

> I could improve your ultimate financial welfare by giving you a ticket with only twenty slots in it so that you had twenty punches - representing all the investments that you got to make in a lifetime. And once you'd punched through the card, you couldn't make any more investments at all. Under those rules, you'd really think carefully about what you did, and you'd be forced to load up on what you'd really thought about. So you'd do so much better.—Warren Buffett (Kennon, 2016)

By selling the companies we invest in, we would quickly have used up our punch card. In this strategy, therefore, we will not keep the company in our portfolio as long as possible. The results are displayed in table 3.2 below.

[3] Whatever art that enters The Museum of Modern Art in New York, will tend to be kept there permanently.

Company name	Return	Reference index	Index return	Excess return
Canadian Utilities Ltd (CU CN)	117.3%	SPTSX	30.9%	86.4%
George Wimpey Ltd (WMPY LN)	11.3%	UKX	20.9%	-9.6%
MDC Holdings Inc (MDC US)	-47.5%	SPX	74.7%	-122.2%
Orkla ASA (ORK NO)	111.5%	OBX	108.2%	3.4%
PPB Group Bhd (PEP MK)	370.7%	FBMKLCI	81.2%	289.5%
Sears Canada Inc (SCC CN)	-12.7%	SPTSX	30.9%	-43.6%
Barratt Developments PLC (BDEV LN)	-41.0%	UKX	20.9%	-61.9%
Centex LLC (0226226D US)	-82.7%	SPX	74.7%	-157.3%
Taylor Wimpey PLC (TW/ LN)	-44.8%	UKX	20.9%	-65.7%
Wilson Bowden Ltd (WLB LN)	50.3%	UKX	20.9%	29.5%
Kellwood Co (KWD US)	-6.4%	SPX	74.7%	-81.0%
Total				-12.1%
Annualized				-1.2%

Table 3.2: Companies that matched Graham's criteria—including the price criterion—on January 1, 2006. Companies were *not* sold if an annual report displayed figures that would otherwise have disqualified the company from being a Graham company any longer. This strategy produced a negative 1.2 % annualized excess return.

Although the companies would now have sufficient time to display their market-beating strength, only four out of eleven actually did. In total, this strategy produced a negative 1.2 % annualized excess return, which is worse than the original, Strictly Graham strategy on page 9. We will therefore discard this variant of the Museum of Modern Art strategy as a potential market-beating strategy. However, it is interesting to note that the companies gave a *positive* average excess return of 3.2 % with a population standard deviation of 105 %. This is because each company affects the average stronger than they do the portfolio, in which they have only a small position relative to the whole.

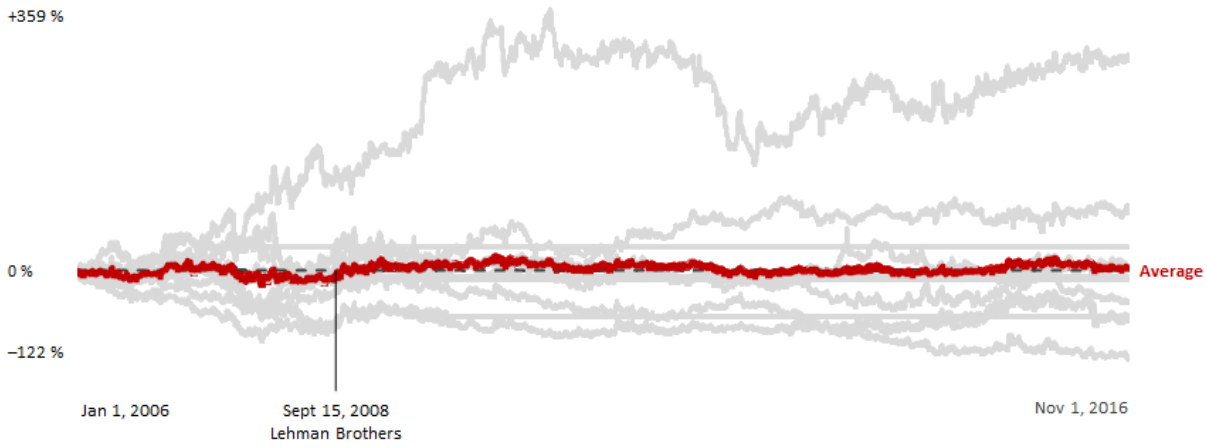


Figure 3.2: Excess return graph for the 11 companies that fit the Museum of Modern Art strategy. The excess returns was not heavily affected by the financial crisis. Note that this strategy were beaten by the market with a negative 1.2 % annualized excess return.

Note that although this strategy yields worse returns than selling the companies when they break the criteria, we will continue to study the sit-on-your ass strategy advocated by Munger and Buffett: Graham focused on long-term ownership, and in our case all companies in our portfolio would otherwise have been sold within 5 years. We will therefore be long in all our investments in the subsequent strategies.

3.3 Adjusting the Price Criterion

Among the 41 companies that matched Graham's criteria, only 11 matched his additional price criterion. However, Warren Buffett has previously stated that "It's far better to buy a wonderful company at a fair price than a fair company at a wonderful price" (Buffett, 1990). Buffett did not learn this from Graham, but from Charlie Munger. Graham, however, were a bargain-seeker that wanted a large *margin of safety* on each investment, which ultimately led him to a price criterion of $\frac{P}{E} \cdot \frac{P}{tBV} \leq 22.5$. Therefore, we wanted to analyze whether the price criterion should be updated. Specifically, we wanted to analyze whether the more expensive companies—that is, companies with a high $\frac{P}{E} \cdot \frac{P}{tBV}$—may produce market-beating returns.

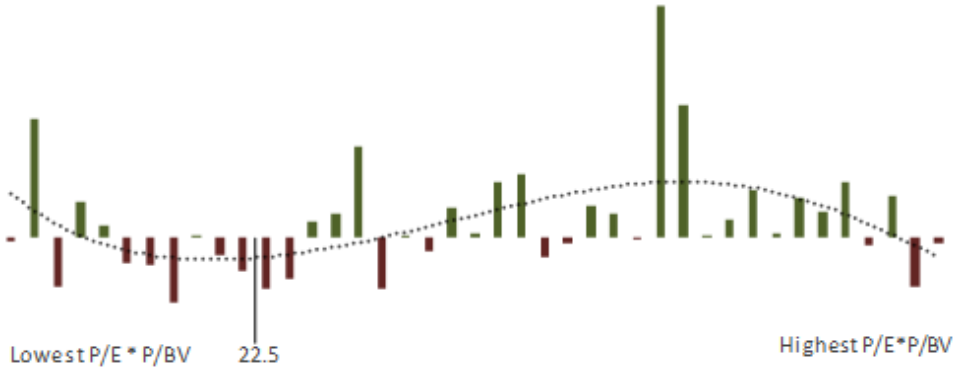


Figure 3.3: Excess returns for all 41 Graham companies, ranked from lowest to highest $\frac{P}{E} \cdot \frac{P}{tBV}$. The 11 leftmost companies were included in the Strictly Graham and the Museum of Modern Art strategies. The figure displays that expensive companies generally produce market-beating returns.

As figure 3.3 illustrates, companies with a higher $\frac{P}{E} \cdot \frac{P}{tBV}$ tend to produce market-beating returns, which aligns well with Buffett's quote on buying wonderful companies at fair prices instead of buying fair companies at wonderful prices. Table 3.3 below summarizes four various strategies regarding the price criterion.

Price criterion			
Lower bound	Upper bound	# of companies	Annualized excess return
0	22.5	11	-1.2%
0	∞	41	3.0%
70	∞	21	5.5%
70	300	18	6.3%

Table 3.3: Four variants of the price criteria with the number of companies included in the portfolios and their annualized excess returns. The optimal strategy is to ignore the cheapest and the most expensive companies—specifically, by buying stocks that has $\frac{P}{E} \cdot \frac{P}{tBV}$ between 70 and 300. This strategy produced a 6.3 % annualized excess return.

Table 3.3 shows that if we discard the price criterion completely, buying all 41 companies that match the remaining Graham criteria, then our portfolio would have produced a 3.0 % annualized excess return. Furthermore, by adjusting the price criterion interval such that $\frac{P}{E} \cdot \frac{P}{tBV} \geq 70$, the portfolio would have produced a 5.5 % annualized excess return. This suits well with Buffett's quote. Additionally, you would expect the market to acknowledge quality companies by pricing it highly. But, as we have seen here, these companies will continue to outperform their reference indices despite their initial high prices. And finally, it is important to note that some companies have unreasonable high $\frac{P}{E} \cdot \frac{P}{tBV}$'s. Specifically, Hennes & Mauritz AB (HMB SS), Esprit

Holdings Ltd (330 HK), and Medtronic PLC (MDT US) had a price criterion score of 350, 398, 529, respectively. There may thus be factors regarding these companies that the numbers used in Graham's criteria does not pick up, and it is therefore reasonable to discard them. Among these, one produced substantial positive, one substantial negative, and one slightly negative returns. By narrowing the price criterion we just studied—$\frac{P}{E} \cdot \frac{P}{tBV} \geq 70$—to $\frac{P}{E} \cdot \frac{P}{tBV} \in [70;300]$—our portfolio produced a whopping 6.3 % annualized excess return. The 18 companies that match this price criterion is presented in table 3.4 below.

P/E x P/BV	Company name	Excess return from Jan 01, 2006 to Nov 01, 2016
72.35	Nucor Corp (NUE US)	8.8%
92.95	Parker-Hannifin Corp (PH US)	136.7%
92.99	WW Grainger Inc (GWW US)	154.7%
99.33	Harley-Davidson Inc (HOG US)	-47.2%
104.62	Universal Forest Products Inc (UFPI US)	-13.6%
105.04	Reliance Steel & Aluminum Co (RS US)	74.7%
112.61	Secom Co Ltd (9735 JP)	55.8%
112.89	Alberto-Culver Co (841850Q US)	-0.5%
116.97	Novo Nordisk A/S (NOVOB DC)	563.5%
124.05	NIKE Inc (NKE US)	320.7%
132.77	Gates Worldwide Ltd (TOMK LN)	2.8%
139.95	Thor Industries Inc (THO US)	44.6%
151.69	Illinois Tool Works Inc (ITW US)	115.9%
156.48	Vulcan Materials Co (VMC US)	10.5%
168.95	Cintas Corp (CTAS US)	94.8%
227.30	Teleflex Inc (TFX US)	62.5%
231.44	Becton Dickinson and Co (BDX US)	132.9%
254.60	Wm Wrigley Jr Co (WWY US)	-18.4%

Table 3.4: All 18 Graham companies with $\frac{P}{E} \cdot \frac{P}{tBV} \in [70;300]$, sorted after increasing $\frac{P}{E} \cdot \frac{P}{tBV}$.

3.4 Portfolio Management

Thus far, we have seen that a portfolio strategy consisting of Graham companies that is not sold and that has a high $\frac{P}{E} \cdot \frac{P}{tBV}$ number—specifically, ranging from 70 to 300—provide a 6.3

% annualized excess return. Because mutual funds constantly seek out new strategies that may "beat the market", it will therefore be relevant to study how a mutual fund will fare when it is affected by currency rates. The annualized excess return will therefore use formula (3.1) on page 8, but the value of each member in the portfolio will be adjusted for the currency appreciation or depreciation that occurred between time $t = 0$ and $t = T$.

In this section, we will ignore management fees as we believe a simple, algorithmic portfolio strategy like the one we propose can be managed at costs similar to the most inexpensive index funds. Table 3.5 displays how a European, an American, and a Norwegian mutual fund would have performed, taking into consideration each country's respective currency appreciation or depreciation from January 1, 2006 to November 1, 2016.

Price criterion			Annualized excess return, denominated in...		
Lower bound	Upper bound	# of companies	EUR	USD	NOK
0	22.5	11	-1.2%	-1.2%	-1.0%
0	∞	41	3.0%	2.8%	2.7%
70	∞	21	5.5%	5.4%	4.9%
70	300	18	6.3%	6.2%	5.5%

Table 3.5: Four variants of the price criteria with the number of companies included in the portfolios and their annualized excess returns in mutual funds denominated in EUR, USD, and NOK. The optimal strategy is to ignore the cheapest and the most expensive companies—specifically, by buying stocks that has $\frac{P}{E} \cdot \frac{P}{tBV}$ between 70 and 300.

Table 3.3 on page 14 showed that our proposed portfolio could achieve a 6.3 % annualized excess return. When taking into consideration currency fluctuations, the annualized excess return will be 6.3 %, 6.2 %, and 5.5 % for the European, American, and Norwegian mutual fund, respectively.

The table above compares each company to its own respective reference index. When running a mutual fund, however, it is more probable to use *one* reference index to measure the entire portfolio against. Table 3.6 below displays how an American mutual fund would perform when comparing the entire portfolio to the MSCI World Index.

Price criterion			Annualized excess return, denominated in...
Lower bound	Upper bound	# of companies	USD
0	22.5	11	-1.6%
0	∞	41	3.8%
70	∞	21	6.9%
70	300	18	7.7%

Table 3.6: Four variants of the price criteria with the number of companies included in the portfolios and their annualized excess returns in an American mutual fund that used the MSCI World Index as reference index. The optimal strategy is to ignore the cheapest and the most expensive companies—specifically, by buying stocks that has $\frac{P}{E} \cdot \frac{P}{tBV}$ between 70 and 300. This strategy produced a 7.7 % annualized excess return.

When comparing the portfolio to the MSCI World Index, the portfolio achieves a 3.8 % annualized excess return if the screening process disregarded the price criterion completely and a 7.7 % annualized excess return if the $\frac{P}{E} \cdot \frac{P}{tBV}$ criterion were set to be between 70 and 300. We therefore conclude by stating that a Museum of Modern Art strategy, adjusted to buying seemingly expensive stocks, exceeds the market returns in scenarios that work well both in practice and in theory.

4

Critique of the paper

This assignment required substantial data gathering and computations before we could apply the data. There are several weaknesses with the data and with some of our solutions that we will present in the following paragraphs. Furthermore, there are a multitude of variations and strategies that would have been interesting to explore further, but that were beyond the scope of this paper.

4.1 Critique of Graham's Criteria

First of all, we want to critique that Graham's criteria leave no room for small errors. Even if a single criterion are broken once, the company may be excluded from our portfolio for years. For instance, if a company does not pay dividend one year, it may not pass Graham's criteria again for at least 20 years.

We also want to critique Graham's criteria for not considering a company's financial leverage. Considering that Graham were interested in finding low-risk companies, a debt-to-equity criterion of, say, 40 % or less would be natural to include. We did not include this criterion in in our model, but it would be interesting to see whether such a criterion may generate a portfolio that produce even better excess returns than the one we have generated and presented in table 3.4 on page 15.

Third, Phillip Fisher (1997) wrote in *Common Stock and Uncommon Profits*, that it is not important to pay dividends each year. Instead, an investor should invest in companies that at least has a *stable dividend policy*, meaning that a company may choose not to pay dividends, but they may not *reduce* its year-over-year dividend to pass Fisher's dividend criterion. It would

be interesting to see whether this strategy would generate further improved market-beating strategies or not.

Fourth, Graham's seven criteria listed in *The Intelligent Investor* are based on quantitative data only. However, multiple qualitative criteria are both relevant and interesting to study, as they are bound to affect a company's market-beating abilities. For instance, Warren Buffett's Berkshire Hathaway combines Graham's quantitative ideas with Fisher's qualitative ideas, and producing major excess returns as a result. Evaluating qualitative criteria would be outside the scope of this paper, but it could be interesting for later studies.

And finally, Graham's price criterion does not consider the opportunity cost of secure investments. It might have been useful to complement this criterion with an additional intrinsic value formula that measures, say, the increase in a company's tangible book value over the final ten years, adds a weighted average of dividend payments, and discounts with a ten-year government bond.

4.2 Critique of Our Data

We also wish to critique our own data. We have demonstrated that our strategies produce excess returns, but the conclusions may have been influenced by the following faults.

First of all, we chose to invest only on the 1st of November 2006—instead at whatever point a company passed Graham's criteria—basing our decision on the notion that Graham companies outperform others *in the long term*. It could still have been interesting to buy and sell securities as they entered and exited the population of Graham securities during the near eleven-year time period, and then analyze how the excess returns would have been. However, this would be too time-consuming for this paper. Furthermore, because we invested once, our portfolio is highly exposed to price levels from early 2006. A better strategy might have been to split the purchase over a time period to even out fluctuations in the price levels—say, by buying one-twelfth of our total stake every month for a year. It could also have been interesting to study what time of year, week, day etc, it would be generally most profitable to invest according to the criteria, but this is something value-traders generally do not pay much attention to.

Second, our revenue criterion is based on the USD currency and on the US inflation. This can be problematic for the securities that are either accepted or rejected by a small margin, as the security can be tipped over or under the limit by the foreign exchanges—foreign exchanges that we did not update daily (or even yearly). Since we also adjusted the revenue criterion with US inflation only, our selection process of companies that passed the revenue criterion could have been improved. However, since Graham and Zweig presented the criterion with an *approximate* monetary value (Graham & Zweig, 2003), we also treated it as such.

Third, the Bloomberg Terminal's EPS figure includes extraordinary items, and this distorts both the EPS criterion and—more importantly—the price criterion. If a company receives any extraordinary profits, the security appears cheaper and may erroneously be bought.

And finally, we have based our entire analysis on financial data available in the Bloomberg Terminal. Our disclaimer is that the data available might include errors, but it has been beyond our capacity to control them, for instance by validating the data against Morningstar Direct's database.

5

Conclusion

In this paper, we have studied Benjamin Graham's criteria for investing in common stocks, whether companies that match these criteria produce market-beating returns, whether some criteria should be adjusted, and whether it is possible to apply a simple strategy in real life and still produce significant excess returns.

We find that although the original Graham criteria does not produce excess returns, adjusting the price criterion will. Specifically, buying expensive companies that match Graham's criteria and with a $\frac{P}{E} \cdot \frac{P}{tBV}$ between 70 and 300 produced a 6.3 % annualized excess return when comparing each stock to its respective reference index, and this strategy produced a 7.7 % annualized excess return if an American mutual fund had followed this strategy and compared its performance to the MSCI World Index. Note that the strategy includes not selling a Graham company even though it violates the criteria in at least one year following the long position. This rings true with Warren Buffett's philosophy, as he made clear in a Congressional panel in 1991: "Lose money for the firm and I will be understanding. Lose a shred of reputation for the firm, and I will be ruthless." (FINN, 2016). According to this quote, Buffett may not want to sell his position if a company fails to fill the criteria in any given year, as long as the management acted to their best ability given the internal and external circumstances.

We began this paper by describing how the student Klaus borrowed 1 million euros from his grandmother in 2005. On January 1, 2006, he then bought a number of securities for an equal amount each. If he had applied the abovementioned strategy, then the value of his portfolio of 18 Graham companies would accumulate to 2.78 million euros on November 1, 2016. In comparison, a portfolio consisting of the stock's respective reference indices would accumulate to 1.79 million euros. Furthermore, if Klaus had paid, say, a 6 % interest rate on his loan and repaid all on November 1, 2016, then he would *still* net out an impressive profit—this time a profit of 0.98 million euros.

Despite our comprehensive critique of Graham's criteria and of our data, and based upon our 2006 data set, we will therefore propose the following statement.

> To achieve market-beating returns, it is sufficient to apply the following simple, algorithmic strategy: to buy common stocks in companies that match Graham's criteria, but to adjust the price criterion such that $\frac{P}{E} \cdot \frac{P}{tBV}$ lies between 70 and 300, to hold the stocks indefinitely, and to reinvest dividends in the same company whenever they are paid. This strategy has, for stocks that were bought in 2006 and held until 2016, produced substantial returns compared to their reference indices—whether each company were compared against its own respective index or against a common world index—both when the portfolio were adjusted for currency fluctuations and when it was not. In short, this strategy produced between a 5.5 % and a 7.7 % annualized excess return, depending on which situation one wishes to study, by punching 18 holes in our ticket to buy wonderful companies at a fair price and by following the sit-on-your-ass investing principle.

6

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