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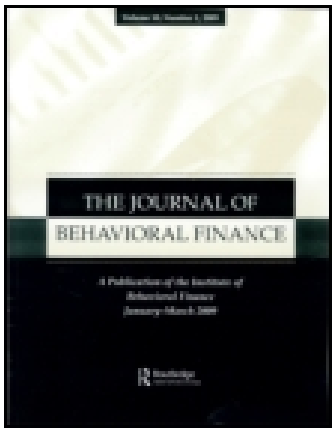

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Overcoming Cognitive Biases: A Heuristic for Making Value Investing Decisions

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Overcoming Cognitive Biases: A Heuristic for Making Value Investing Decisions

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Investment decisions are subject to error due to cognitive biases of the decision makers. One method for preventing cognitive biases from influencing decisions is to specify the algorithm for the decision in advance and to apply it dispassionately. Heuristics are useful practical tools for simplifying decision making in a complex environment due to uncertainty, limited information and bounded rationality. We develop a simple heuristic for making value investing decisions based on profitability, financial stability, susceptibility to bankruptcy, and margin of safety. This achieves two goals. First, it simplifies the decision making process without compromising quality, and second, it enables the decision maker to avoid potential cognitive bias problems.

Keywords: Value investing, Margin of safety, Cognitive biases, Heuristics

INTRODUCTION

Value investing is an investment paradigm proposed by Benjamin Graham (Graham and Dodd [1934], Graham [2006]). According to Graham and Dodd [1934], "an investment operation is one which, upon thorough analysis, promises safety of principal and a satisfactory return. Operations not meeting these requirements are speculative."[1] There are three essential components of this definition to take note of. First, an investment must be based on thorough analysis; second, it should have an assurance of safety of principal; third, it should entail an expectation of satisfactory return. Benjamin Graham further proposed the concept of "margin of safety" as the cornerstone principle for operationalizing this definition of investment. Margin of safety is a measurement of the degree to which an asset is trading at a discount to its intrinsic value. It is pretty straightforward to see how "margin of safety" relates to Benjamin Graham's definition of investment. Thorough analysis enables the investor to obtain an estimate of the intrinsic value of the asset and buying it at a substantial margin of safety ensures safety of principal as well as reasonable expectation of satisfactory return. Since intrinsic value is difficult to calculate accurately, margin of safety provides a cushion against making any poor decisions.

Currently the most prominent practitioner of value investing is Warren Buffett. Besides Buffett, there is a significant number of money managers all over the world who identify themselves as value investors.[2] Buffett [1984] gave a list of nine successful value investors all of who trace their education and training in value investing to Benjamin Graham. Highlighting the roots of their investment style, Buffett referred to these outstanding portfolio managers as the "Superinvestors of Graham and Doddsville." One interesting feature that Buffett pointed out from these "superinvestors" is that no two of them managed their portfolios the same way. All these protégés and disciples of Benjamin Graham went off to different places, buying and selling different securities, yet each ended with a stellar performance. Each one had his own unique way of successfully operationalizing what Graham had taught. What value investors have in common is that their investment operations are rooted in Graham's definition of investment, with the concept of "margin of safety" playing a central role in their investment decision making. One way in particular

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that Warren Buffett and Charlie Munger distinguish their style of investing from other disciples of Benjamin Graham is that they place a lot of emphasis on the quality of management and the strength of the moats protecting the companies they are interested in buying. Thus the Buffett-Munger style is a blend of Philip Fisher's quality of management approach with Graham type "cigar butt" investing. Since 1959 quality of management has become one of the most important criteria for Buffett-Munger.[3]

The idea that value investing could be operationalized in a variety of ways was somewhat acknowledged by Graham and Dodd. In explaining their definition, Graham and Dodd noted that "the phrases *thorough analysis, promises safety*, and *satisfactory return* are all chargeable with indefiniteness, but the important point is that their meaning is clear enough to prevent serious misunderstanding." (Graham and Dodd [1934], p. 55; italics in original). It is the indefiniteness of the key aspects of the definition that makes it possible for people to practice value investing in diverse ways and still achieve comparable results that are all superior to the market average.

Academic research has shown consistently that value investing outperforms other investment styles.[4] In the standard academic literature, a value portfolio is typically defined as one with low price-earnings ratio, low market value to book value ratio, low price to cash flow ratio, or some other similar price-denominated metric (Fama and French [1992, 1998], Chan and Lakonishok [2004]). As Athanassakos [2011] pointed out, this is a limited view of what a value portfolio is. This perspective of value investing is quite different from value investing as practiced by the disciples of Benjamin Graham. It is clear from Buffett [1984], based on the variety of ways in which each of those value "superinvestors" approached their portfolio selection process, that Benjamin Graham's system is more of a paradigm and a philosophical mindset to investing than a set of techniques for portfolio selection based simply on some price ratios.

The purpose of this paper is to develop a systematic approach for making value investing decisions in a way that will avoid cognitive biases. We discuss the role of heuristics in investment decision making in the context of cognitive biases and bounded rationality. We argue that having a prespecified decision making algorithm such as the one we present here has the benefit of minimizing the chances of cognitive biases interfering with the investment decision.

The motivation for developing a system for value investing is twofold. First, we believe that Benjamin Graham's guidelines for successful investing can be implemented if stocks are selected on the basis of profitability, sound cash flow management, long-term financial stability, and margin of safety. Secondly, having such a system specified in advance and applied systematically will reduce the effect of potential cognitive biases. What is required for that decision making system to be successful is that it must be built on elements that will ensure that the three essential components of Benjamin Graham's definition of investment are fulfilled: robust analysis, assurance of preservation of principal, and satisfactory return.

We propose a simple heuristic that incorporates the key tenets of value investing as propounded by Benjamin Graham. The thrust of the quantitative aspect of the heuristic is that it helps to identify and select common stock of companies that (i) have good history and prospects of continued profitability, (ii) are financially stable, and (iii) are priced significantly below their intrinsic values. These quantitative indicators will then be supported with qualitative evaluation of management's integrity and candor by reviewing past annual reports, press releases and other relevant communication, especially responses to situations where management is in error or at fault for some reason. We hypothesize that a consistent and disciplined application of such a heuristic will generate common stock portfolios whose returns will outperform the market average over long periods of time. Furthermore, by specifying the process in advance, one can avoid the impact of cognitive biases if the process is applied with discipline. To facilitate easy discussion, we call this heuristic the O-S heuristic.[5]

The paper makes a number of contributions to the value investing and cognitive biases literature. First, it attempts to give some clarity as to what constitutes value investing when it comes to implementation. It does this by developing a heuristic that is rooted in core variables of interest to value investors. The paper also demonstrates the simplicity and power of value investing by showing how a simple heuristic based on very familiar financial ratios and data from public sources can be used to make effective portfolio selection decisions. Using the premise that a disciplined application of pre-specified decision rules is a safeguard against cognitive biases, a simple heuristic that can deliver the desirable outcomes is certainly a valuable tool to have. We highlight the point that effective value investing decisions can be made despite potential cognitive bias problems.

The rest of the paper is as follows: It begins with a discussion of the role of heuristics in judgment and investment decision making. This is followed by a synoptic overview of the origins and development of value investing. A description of the O-S heuristic, the rationale behind it, and how it is applied in value investing is then presented followed by summary and conclusion.

BOUNDED RATIONALITY, HEURISTICS AND BIASES IN INVESTMENT DECISION MAKING

Psychologists have shown that in an environment with limited knowledge and limited capacity to process information, individuals tend to resort to satisficing algorithms to make decisions (Gigerenzer [1997]). These mental shortcuts are

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also referred to as heuristics.[6] If one is interested in improving the quality of the value investing decision-making process, then a viable approach will be to develop some type of heuristics as a decision support system for the stock selection process.

Kahneman and Tversky are pioneers in the study of heuristics in making intuitive judgments. In a series of papers (Tversky and Kahneman [1974, 1983], Kahneman and Tversky [1973, 1982]), they showed that the use of heuristics makes complex problems tractable. However, they also demonstrated through a number of experiments that in many instances the use of heuristics leads to systematic, predictable, and repeated errors in judgment. In particular, they showed that the use of intuition in making statistical inference leads to outcomes that are inconsistent with the principles of probability and statistics (Tversky and Kahneman [1974]). Their research and publications gave rise to the cognitive biases literature. The use of heuristics within the Kahneman and Tversky school of thought carries the risk of making systematic errors in judgment. These systematic errors in human judgment have come to be known as cognitive biases. Cognitive biases lead to distorted judgments, which eventually lead to poor decisions. The deluge of research in this school of thought has led to the discovery and classification of a long list of cognitive biases that plague decision makers including investment decision makers.[7]

Kahneman and Tversky extended their research on intuitive statistical judgment to decision making under uncertainty. They eventually developed Prospect Theory as a model of decision making under uncertainty (Kahneman and Tversky [1979]). Behavioral economists have since upheld Prospect Theory as a better representation of investment decision making than Expected Utility Theory, which has traditionally been the model of choice.[8]

In a recent summary of the anthology of the work by Kahneman, Tversky, and their research collaborators, Kahneman [2011] pointed out that the cognitive process in decision making boils down to two systems: System 1 and System 2, originally introduced by Stanovich and West [2000]. System 1 is intuitive, makes decisions usually by association, operates at the unconscious level and is fast. System 2, on the other hand, operates at the conscious level, uses logic and reasoning, and is slow. Both systems work together all the time, but unless System 2 puts the brakes on System 1 or System 1 voluntarily defers to System 2 (in cases where System 1 itself perceives the situation as complex), the decision maker will end up with System 1's decision. However, System 1 does not always recognize complex situations as complex and goes ahead to make a decision anyway. The problem is that System 1's outcome normally does not stand up to reason and logic and is almost invariably out of line with the laws of probability. One way to make sure that decisions adhere to logic and rationality is to specify in advance what the decision making process is. That slows down System 1 and then System 2 gets the chance to dominate the decision-making process and we are able to get rational outcomes. System 1 still gets to participate in the decision-making process by supplying the relevant associative components but System 2 controls the process and the outcome. The way our paper relates to this is that by creating a heuristic that we have empowered to be the judge, we slow down System 1 and we are able to get System 2-dominated outcomes.

At the root of market equilibrium models of traditional finance is the assumption of the rational decision maker. This rational person is presumed to be capable of arriving at an optimal decision, regardless of the amount of data that needs to be processed, the complexity of the problem, or the time frame for making the decision. This stylized *homo economicus* is no doubt very different from the real world *homo sapiens* or what Thaler [1999] calls the "quasi-rational investors" who are actually engaged in day-to-day investment decision making. This dichotomy between the rational economic decision maker of traditional finance and the error-liable (possibly error-prone) person in behavioral finance is nicely summarized by Statman [1999, p. 20]: "Standard finance people are modeled as 'rational,' whereas behavioral finance people are modeled as 'normal.'"

The concept that the rationality of decision makers can be limited by the large amount of information they have to work with, their own cognitive and computational abilities, and limited time was developed by Herbert Simon [1957]. He referred to that limitation to rationality as bounded rationality. In the context of Simon's [1957] bounded rationality, decision makers do not make optimal decisions but rather make "satisficing" decisions within their data processing and cognitive limitations. One tool that facilitates the process of making satisficing decisions is the use of heuristics.

Two questions arise from this observation of limited abilities to make globally optimal decisions. First, are there effective shortcuts for making decisions? Second, are the decisions that are made using these shortcuts of the same quality as the optimal decisions that would have been made in the absence of these limitations? With regard to the first question, the answer from psychologists studying this phenomenon is that, yes, decision makers do use mental shortcuts to make their decisions. The answer to the second question is a bit problematic. While the heuristic-based decision can be seen and empirically examined, the optimal decision is only a concept that is never observable. Therefore, it is impossible to compare the actual decision outcomes. However, the consensus of psychologists and other behavioral scientists is that heuristic-based decisions will be inferior to the corresponding globally optimal (albeit unobservable) decisions.

Gigerenzer and Gaissmaier [2011] define heuristic as "a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or

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accurately than more complex methods" (p. 454). We use the term heuristic in this paper to mean an informal expeditious decision tool. It is generally understood that an effective way to keep cognitive biases from dominating one's investment decision is to focus on the investment decision process more than the desired outcome.[9] Thus confidence in the expected outcome of your investment decision is based on the confidence you have in the process and the data. As Benjamin Graham put it, "you are neither right nor wrong because the crowd disagrees with you. You are right because your data and reasoning are right" (Graham [2006], p. 524). Focus on data and reasoning amounts to focus on process. Thus a way to rein in any hidden cognitive biases is to develop a working heuristic in advance and apply it with strict discipline. The writings of Benjamin Graham and speeches by Warren Buffett indicate that this approach is an important element in their process of making investment decisions. It is important to specify the decision process and the underlying algorithm or heuristics in advance and to apply them with consistent discipline so as to minimize the effect of cognitive biases in investment decision making. This is because of evidence that when decisions are made on the fly, new information, expectations, and other emotional and perceptual influences can distort our ability to stay on track to make unbiased judgments.[10]

VALUE INVESTING AND MARGIN OF SAFETY

It is widely accepted that value investing as an investment philosophy evolved in the early 1930s, when Benjamin Graham, then a lecturer in Finance at Columbia Business School, wrote *Security Analysis* (co-authored with David Dodd) in 1934. Bierig [2000] narrated the evolution of value investing from the writings, speeches, lectures, and practices of Graham and his disciples. Kwag and Lee [2006] traced back the root of value investing to the 1920s, although Graham and Dodd published the first edition of *Security Analysis* in 1934 and *The Intelligent Investor* in 1949.

Prior to Graham, Roger W. Babson, an American entrepreneur and theorist, used a valuation method to determine what he termed "normal" value by applying a suitable multiplier to average earnings. His investing philosophy was fundamental based, pretty close to today's value investing. He wrote *Enduring Investments* in 1921 long before Graham and Dodd's *Security Analysis* in 1934. G. C. Selden wrote *Psychology of the Stock Market* in 1912 based on years of study and experience as a fellow at Columbia University. Selden [1912] introduced the "They" theory of the market, which is basically "Mr. Market," the market metaphor introduced in Graham's *The Intelligent Investor*, in 1949. We conjecture that Graham might have been influenced by the writings of Babson and Selden.

While Graham himself did not use the term "value investing" in describing the investment paradigm that he developed, that phrase became the common terminology by which that approach to investing is known. In the mainstream academic literature, the term value investing is used mainly to imply an investment portfolio that is based on selecting stocks with low price to earnings ratio, low price to cash flow ratio, or other similar price-related ratios. Value investing is also usually contrasted with "growth investing." The traditional approach is that stocks that have high prices relative to some other financial metric are classified as growth and those that have relatively low prices compared with those financial indicators are classified as value. Defining value merely by ratios such as earnings-to-price (E/P), book-to-market equity (B/M) (Fama and French [1992]), cash flow to price (C/P) (Chan and Lakonishok [2004]), and dividend yield (D/P) (Fama and French [1998]) is of little use in explaining how value investing works, since practitioners of value investing typically do not follow this simplistic approach. Other examples of the common classification include Dhatt, Kim, and Mukherji [1999], who examined the value premium of stocks in the Russell 2000 Index by forming portfolios based on P/E, P/S, and M/B ratios.

In contrast to the traditional academic definition of value, the legendary value investors and their modern disciples do not use these metrics as the sole basis for making their portfolio decisions. At best, they are used as preliminary screeners. Athanassakos [2011] refers to the use of P/E, P/B, and similar ratios in categorizing value stocks as the naïve approach. As he rightly noted, from a value investor's perspective, a stock is not classified as "value" until is has undergone the type of company analysis that value investors use. Bourguignon and de Jong [2003] also take issue with the traditional method of distinguishing between value and growth saying that distinction rests on ambiguous grounds.

Rather than follow the traditional academic definition of value using low P/E or other similar price-related ratios, we endeavor to come up with a comprehensive system for value investing by analyzing the writings and thinking of legendary value investors like Warren Buffett. While the term "value investing" has become associated with Warren Buffett, it is interesting to note that he considers that terminology a misnomer:

> "...we think the very term 'value investing' is redundant. What is 'investing' if it is not the act of seeking value at least sufficient to justify the amount paid? Consciously paying more for a stock than its calculated value—in the hope that it can soon be sold for a still-higher price—should be labeled speculation (which is neither illegal, immoral nor—in our view—financially fattening)."[11]

In the book *The Essays of Warren Buffett: Lessons for Corporate America* (Cunningham, [2001]), Buffett reiterated the same. He emphasized the distinction between price (what an investor pays) and value (what he gets) in carefully separating investment from speculation thus emphasizing the role of margin of safety in the value investing paradigm.

The defining characteristic and the operational pivot of value investing is the concept of margin of safety. In Graham and Dodd's [1934] original discussion of margin of safety, it is described as the degree to which an investor is protected from a fall in stock price due to a decline in earnings of the company. Margin of safety is the anchor for ensuring the safety of principal and satisfactory return that Graham and Dodd stipulate as essential for an operation to qualify to be called investment. Value investors take margin of safety very seriously. In the words of Buffett,

> "If we calculate the value of a common stock to be only slightly higher than its price, we're not interested in buying. We believe this margin-of-safety principle, so strongly emphasized by Ben Graham, to be the cornerstone of investment success."[12]

Margin of safety is the final step in the value investor's decision making process. While margin of safety can be quantified once the intrinsic value is estimated,[13] the other elements of Benjamin Graham's paradigm are not easily quantifiable. Instead, they are a mindset or disposition rooted in practical economically and financially sound reasoning derived from Graham and Dodd's definition of investment. In that context, not every aspect is directly amenable to mathematical formula or calculation. This feature allows value investing to be practiced in a variety of ways that are not identical but consistent with each other. In this paper we use the term "value investing" in the spirit of what we believe to be Benjamin Graham's proposed style of investing. That approach requires an adequate margin of safety on the value of shares of companies whose fundamentals meet some core financially prudent criteria that will not only preserve the principal but also yield satisfactory return.

A HEURISTIC FOR MAKING VALUE INVESTING DECISIONS

Our goal is to develop a simple but rigorous process for making stock selection decisions. The key requirement of the process is that it must conform to Graham and Dodd's [1934] definition of investment. We believe that an investment decision-making system designed on that basis will be robust and yield satisfactory (above average) returns with little risk. In this context, risk is defined not as volatility of stock prices but rather as the chances of losing the principal. The robustness of the system simply means that the heuristic should be applicable to stocks in a wide range of industries, markets, and economic climates (all phases of the economic cycle). For purposes of discussion we call this heuristic the "O-S Heuristic."

A key motivation for developing the O-S heuristic is to provide a system for investors to rein in the tendency for their "animal spirits" to interfere with their rational decision-making process. As Montier [2010] pointed out:

> "Focusing on process seems to lead to better decisions. The same is true in investment. Focusing upon process frees us up from worrying about aspects of investment which we really can't control – such as return. By focusing on process we maximize our potential to generate good long-term returns." (p. 210)

The philosophical underpinning of the O-S heuristic is that it is possible to create a simple value investing decision-making tool using criteria based on earnings potential, financial stability, and fair valuation. Furthermore, application of this tool will help the user to develop a consistent and disciplined approach to value investing decision making that will avoid cognitive biases and yield satisfactory results. A major requirement of our heuristic is that it must be a tool that even investment novices can use and still produce satisfactory portfolio returns. In other words, the skill or temperament of the user is irrelevant. The system takes care of itself. It is important to note also that the process can be implemented using only publicly available data (such as financial statements at money.msn.com or finance.yahoo.com).

The way the O-S heuristic works is that once an investor identifies a company he or she is interested in or a company has come to the investor's attention for whatever reason, the investor will pass the company through a number of screens. At the end, the investor will make one of three decisions: (i) reject the stock, (ii) put it on a watch list, or (iii) buy it. If a company is not investment worthy, then the decision to reject it will be made immediately at the stage that the screening criteria point to that. A company will be put on the watch list if all the financial metrics are sound as revealed by the screening criteria but the stock price fails to meet the margin of safety criterion. Failing the margin of safety criterion means either the stock is selling above the intrinsic value or there is not sufficient margin of safety to classify it as a safe investment. A recommendation to buy a stock means that all the financial metrics are sound and the "price is right" (i.e., it is selling at a price that gives a good margin safety which we define as market price at least 20% below the intrinsic value).

The O-S heuristic has four parts: the "5-Minute QuickScan," "Value Indicators," "Valuation and Margin of Safety," and "Susceptibility to Bankruptcy," all of which we explain in this section.

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Screening Criterion # 1: 5-Minute QuickScan

The 5-Minute QuickScan is a preliminary screening tool to determine if a company is worth taking through all the screening criteria. It is actually a device for us to limit our analysis to only companies that meet some minimum desirable criteria. Basically, what we are saying is that we are not interested in all stocks traded on the stock markets. We are only interested in a certain segment of the market (the good quality segment), and the 5-Minute QuickScan is the tool by which we select the types of stocks we want to analyze.

We emphasize that in using the heuristic we are not necessarily aiming at having every good company in our portfolio. However, we want only good companies (by value investing standards) in our portfolio. This implies that in some situations we may miss good investments. But that is fine with us, as long as the portfolio we end up with has only financially sound value stocks. In the words of Benjamin Graham [2006], "... a conservative approach may carry with it the rejection of really attractive investment opportunities. Such a possible disadvantage is inherent in the role of the defensive investor, and he must accept it philosophically" (p. 139).

The criteria for the 5-Minute QuickScan and rationale are shown in Table 1. The 5-Minute QuickScan criteria are ratios that are commonly known to be indicators of value, profitability, and financial stability. They include ratios such as P/E ratio, return on equity, and debt equity ratio. We focus on mid to large cap stocks and exclude the small caps. The rationale for excluding small caps is that we want to create a tool that anybody, even novices, can use safely to make investment decisions. According to Graham [2006], the O-S heuristic is geared toward the defensive investor more than the enterprising investor. While there is evidence that small caps tend to outperform their large cap counterparts, it is our opinion that investment in small caps requires much deeper insight into investments and we are

Table 1
Five-Minute QuickScan Screening Criteria

Criterion/Question	Decision Rule	Rationale
1 This is to check whether the company's ticker symbol has a .OB (NASDAQ bulletin board stock) or .PK (pink sheet) extension	Reject if the ticker has either .OB or .PK extension.	Information about .OB or .PK shares tends not to be up to date or always reliable. Although .OB companies have to file regular forms with the SEC, they are still not as safe as stocks listed on the major exchanges.
2 Is the company's market capitalization below $500 million?	Include only companies with market cap > $500 million	The original intent of setting up this heuristic is to design a system that investment novices can use and not lose money. For that clientele we felt it advisable to limit them to well established companies and this criterion increases the chances of that.
3 Recent IPO	Reject if the company does not have at least 5 years of public trading data.	Same reason as criterion # 2 – to limit the search to relatively well established companies with a reasonable (5 years) public trading history.
4 3 to 5 years of positive EBIT?	Include only companies with positive operating profit for at least 3 years but preferably 5 years or more.	A critical indicator of future profitability is a track record of past profitability. Operating profit is regarded as a sign that this company can sustain itself through its business operation and also an indicator that it may have a sound business model.
5 3 to 5 years of cash flow from operating activities?	Include only companies with positive cash flow from operating activities for at least 3 years but preferably 5 years or more.	This shows that the company is able to end up with positive cash flow of its own. Rationale similar to criterion # 4.
6 5 years of ROE >10%	Accept only companies with at least 3 continuous years of ROE > 10%. If one of the past three years has ROE < 10% then look for 3 years out of the past 5 years.	ROE is an indicator of profitability and a 3 to 5-year track record is an indicator that the profitability has been sustained in the past.
7 5 years of Debt/Equity ratio < 1	Accept only companies that meet that condition.	The goal is to limit the set to low leverage companies. We prefer companies with zero debt.
9 Tangible Book Value > 0 for the past 3 years.	Accept only companies that meet the condition.	While companies with good business models and sustainable competitive advantage can have negative net tangible value, analysis of such companies might be beyond the scope of starters.

uncomfortable recommending this tool for small cap investing given that our goal is to make it widely accessible.[14]

Once a company passes the 5-Minute QuickScan screen, the analysis proceeds to Stage 2, called the "Value Indicators" worksheet, which has two segments: (a) Earnings Strength, Earnings Stability,[15] and Moat Indicators; and (b) Financial Strength and Financial Stability.

Screening Criterion # 2: Earnings Strength, Earnings Stability and Moat Indicators

The "moat" is a metaphor created by Warren Buffett to describe the idea of a company that has competitive advantage over its competitors in the industry, which is one of the key desirable characteristics that he wants from a company. A company with durable competitive advantage is classified as having a wide moat. While the idea of a moat is not hard to capture conceptually, the concept does not lend itself easily to financial quantification. However, if a company has a durable competitive advantage, that should be revealed in profits that are persistently above average.

Profitability and Moat Indicators

There are ten items on this checklist. We use five years of financial statement data to apply the screens. The items and the qualification requirements are presented below:

i. Return on Invested Capital (ROIC): ROIC must be at least 10% in each of the past five years.
ii. Equity Growth Rate: The annual compounded equity growth rate (measured by the rate of growth of book value per share) must be at least 10% for the past five years.
iii. Rate of Growth of Earnings per Share (EPS): The annual compounded EPS growth rate must be at least 10% for the past five years.
iv. Sales Growth Rate: The annual compounded rate of growth of sales must be at least 10%.
v. Operating Cash Flow (OCF) Growth Rate: The annual compounded rate of growth for OCF must be at least 10%.
vi. Free Cash Flow (FCF) Growth Rate: The annual compounded rate of growth for both FCF must be at least 10%.
vii. Gross Margin: A gross margin greater than 40% is classified as an indicator of durable competitive advantage.
viii. Operating Margin: First we find the average operating margin for the industry or a core group of competitors. Then we look at the company's operating margin, which must be above the average of the industry or its competitors.
ix. Net Margin: Net margin greater than 20% is considered a sign of durable competitive advantage and net margin less than 10% is interpreted as the company being in a highly competitive environment.
x. Free Cash Flow (FCF) Margin: FCF margin greater than 10% is considered a sign of durable competitive advantage.

Financial Strength and Financial Stability

This category is subdivided into two parts: short-term financial health and long-term financial health.

A. Short-term Financial Health
There are four indicators in this section:
i. Current Ratio: Current ratio has to be at least 2.
ii. Quick Ratio: It has to be at least 1.5.
iii. Interest Coverage Ratio: Interest coverage ratio has to be at least 5.
iv. Operating Cash Flow Ratio: OCF ratio has to be at least 1.

B. Long-term Financial Health
There are three indicators in this section:
i. Leverage Ratio: Leverage ratio (measured by Debt to Total Assets) has to be less than 0.5 except utilities for which leverage ratio equal to or less than 1.0 is acceptable.
ii. Debt to Equity Ratio: Debt-Equity ratio has to be less than 1.
iii. Long-Term Debt to Operating Cash Flow Ratio: This ratio is used to measure how long it will take to pay off long-term debt using OCF and it has to be three years or less.

Screening Criterion # 3: Company Valuation and Margin of Safety

Once a company is accepted based on the outcomes of earnings potential and financial strength, we then proceed to the valuation phase. Here we estimate the intrinsic value of the company using two valuation models: the P/E Ratio approach and the Discounted Free Cash Flow (DFCF) approach.

A. P/E Ratio Valuation: The intrinsic value (V_0) of the stock is determined as $V_0 = V_{10}/(1+k)^{10}$, where $V_{10} = (\text{Avg}(P/E))*E_0*(1+g)^{10}$, and where
Avg (P/E) = 10-year average P/E ratio for the company (with obvious outliers and negative P/E ratios excluded);
E_0 = Latest full year (12-month) EPS;
g = Rate of growth of earnings, obtained as lowest of (the four-year EPS growth rate, the four-year Book Value per Share growth rate, or analysts' estimate of the next five years' EPS growth rate),
i.e., g = Min [four-year EPS growth rate, four-year Book Value per Share growth rate, analysts' estimate of the next five years' EPS growth rate];

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k = Discount rate (required rate of return), set at 15%.[16]
B.Discounted Free Cash Flow (DFCF) Valuation: The intrinsic value, V_0, in this case is estimated as $V_0 = FCF_1/(1+k)^1 + FCF_2/(1+k)^2 + FCF_3/(1+k)^3 + \ldots \ldots + V_{10}/(1+k)^{10}$
where
FCF_t = Free Cash Flow in year t;
g_1 = lower of 10% or the company's four-year FCF growth rate, that is, Min [10%, company's four-year FCF growth rate];
g_2 = 3% (estimate of long-term rate of growth of GDP)[17];
$FCF_t = FCF_{t-1}(1+g_1)$;
$FCF_{11} = FCF_{10}(1+g_2)$;
$V_{10} = FCF_{11}/(k-g)$.

At this stage we record the estimates of the intrinsic values and also obtain the current trading price from the market by getting a quote from one of the many web sites that give market trading information (e.g., money.msn.com). The gap between the quoted price and the intrinsic value, expressed as a percentage of the intrinsic value, is the margin of safety.

Screening Criterion # 4: Susceptibility to Bankruptcy

The purpose of this criterion is to avoid value traps. A value trap is a situation where a supposedly value stock may experience further and possibly permanent price decline. For obvious reasons, value investing is particularly vulnerable to this type of risk. We figure that it will be useful to design the heuristic to guard specifically against that risk. We use two indicators, namely Piotroski's F and Altman's Z indices, to determine if a company is at risk of bankruptcy in the near future.[18]

i. Piotroski F-Score: Companies are accepted if the F-Score is 8 or 9 and they are rejected if the F score is less than or equal to 2. However, for companies with F score between 3 and 7, the decision to accept or reject is more subjective and the overall profile of the company in light of the other ratios is considered in arriving at a decision.
ii. Altman Z-Score: A company with a Z-score less than 1.8 is rejected. A Z-score of 3 or higher is accepted. For companies with Z-scores between 1.8 and 3, the entire profile of the company is considered before a final "accept" or "reject" decision is made.

Final Decision

There is a qualitative dimension that runs concurrently with the quantitative indicators listed above. These quantitative indicators can testify to management's intelligence and capability but not integrity. As stated earlier, the user of the heuristic will need to supplement the quantitative indicators with a qualitative appraisal of management's integrity and candor by reviewing past annual reports, press releases and other relevant communication, especially responses to situations where management is in error or at fault for some reason.

For inclusion in the portfolio, the company must be selling at a price that amounts to a margin of safety of at least 20%. That means the current price must be at least 20% below the estimated intrinsic value. If the margins of safety from both valuation methods are in the acceptance zone, the company is included in the value portfolio. But sometimes it is possible that the intrinsic value based on P/E ratio valuation method yields an acceptable margin of safety whereas the DFCF method does not or vice versa. In those cases, we make the decision based on the overall profile of the company. If all other indicators are stellar, the company may be included in the "buy" portfolio but if it just passes the other criteria then it will be put on the watch list.

There is one important point we want to make about margin of safety. So far we have referred to margin of safety in the context of price relative to intrinsic value. However, in reading Benjamin Graham, it is obvious that he advocates conservative valuation. We interpret that as another implementation of the idea of margin of safety. We purposely followed a conservative approach in developing the heuristic as a way of embodying margin of safety in the overall analysis. This is especially so when it comes to rates of growth. For example, in choosing the rate of growth of earnings we choose the lowest of three numbers:

i. the four-year EPS growth rate,
ii. the four-year Book Value per Share growth rate, or
iii. Analysts' estimate of the next five years' EPS growth rate.

Similarly, in choosing the rate of growth of Free Cash Flow, the choice is the lower of two numbers:

i. Rate of growth of 10% or
ii. the company's four-year FCF growth rate.

The point here is that while the literature does not formally refer to these choices as margin of safety, we want to note that the conservativeness of the entire analysis can be classified as pursuing the goal of margin of safety. Thus we have margin of safety in the analysis and margin of safety in making the purchase decision.

The O-S heuristic in its current form is applicable to all industries except the financial sector. We place no limitation on its use with regard to phases of the economic cycle. It is also applicable in all phases of the economic cycle. With regard to the requirement for it to achieve above average returns, we reason that, by definition, the market return is the average of two sets of portfolios: portfolios with above average returns and portfolios with below average

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returns. By carefully controlling the stock selection process, we lower the risk of the portfolios and avoid losses that will cause portfolios to achieve below average returns. If the O-S selection criteria are consistently applied, the resulting portfolios should be among the set with above average returns. The process is also robust enough, based on the financial ratios on which it is built, that investors can use it dispassionately and consistently, thus mitigating the influence of cognitive biases.

Although the O-S heuristic is designed to make purchase decisions, it can be used to make decisions to sell as well. To use it to make a sale decision, all you have to do is to apply it to a company that is already in your portfolio to determine if the fundamentals have changed enough to warrant removing it from your portfolio. You can also sell the stock if it is trading at a high premium to the intrinsic value and you want to liquidate it to buy undervalued assets.

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SUMMARY AND CONCLUSION

This paper presented a brief overview of the origins of value investing and discussed the problem of cognitive biases in investment decision making. Psychologists suggest that when decision makers find themselves with limited capacity to deal with complex data and high degrees of uncertainty (as in making investment decisions), they resort to the use of heuristics as a simplifying tool. However, intuitive heuristics are prone to cognitive bias errors. One way to minimize the chances of being subject to cognitive biases is to specify the decision-making process (or rule) in advance and stick to it with strict emotional discipline. In light of that, we developed a heuristic for making value investing decisions. The financial ratios that the heuristic uses, the valuation methodology, and the final decision-making process all conform to Graham and Dodd's [1934] definition of investment. We believe that a disciplined adherence to this heuristic in making investment decisions will avoid the common pitfalls of cognitive biases. This paper presented only the methodology. A useful follow-up to this work which we are currently pursuing is to conduct an empirical study to determine if the portfolios that emerge from the use of this heuristic yield satisfactory returns with low risk compared with market benchmarks.

NOTES

1. p. 54 of Graham and Dodd [1934]; see also Graham [2006], p 3.
2. See a partial list under "Well-known Value Investors." Retrieved from http://en.wikipedia.org/wiki/Value_investing
3. We would like to thank an anonymous reviewer for highlighting this aspect of Buffett-Munger value investing strategy.
4. See, for example, Athanassakos [2011], Chan and Lakonishok [2004], and Fama and French [1998].
5. O-S are the initials of the last names of the authors.
6. We recognize there is controversy in the psychology literature regarding heuristics perceived as a mental shortcut versus heuristics as an intuitive process using quick and associative processes to make judgments. We refer to heuristics as mental shortcut as the Gigerenzer school of thought (Gigerenzer [1996, 1997], Gigerenzer and Goldstein [1996]) and heuristics as an intuitive process as the Kahneman and Tversky school (Tversky and Kahneman [1974]). For purposes of this paper, we use the term "heuristics" in a generic sense to represent an informal, shorter, and faster approach to making decisions as opposed to a formal logical process that conforms to the norms of statistical inference.
7. See, for example, Pompian [2012], where more than 20 biases are listed, or Baron [2008] with over 50 biases listed.
8. See Thaler [1985], Benartzi and Thaler [1995].
9. See, for example, chapter 16 of Montier [2010].
10. See for example, James Montier. *The Little Book of Behavioral Investing: How Not To Be Your Own Worst Enemy*, New York: Wiley & Sons, 2010, p. 210; Dan Ariely. *Predictably Irrational: The Hidden Forces that Shape Our Decisions*, New York: HarperCollins Publishers, 2008, Ch. 9. A systematic critical analysis of the writings, speeches, and interviews of Warren Buffett will show that this is what he does; but that is the subject of another paper.
11. Chairman's letter tow the Shareholders of Berkshire Hathaway Inc., 1992, http://www.berkshirehathaway.com/letters/1992.html.
12. Chairman's letter to the Shareholders of Berkshire Hathaway Inc., 1992, http://www.berkshirehathaway.com/letters/1992.html.
13. Note that intrinsic value is an approximation, not a precise number.
14. We believe professionals who understand the logic of the heuristic can easily adapt it for use with small cap companies.
15. By earnings stability, we do not mean earnings smoothing rather earnings predictability as ascertained by a history of stable earnings.
16. Based on the fact that nominal U.S. stock returns averaged between 9% and 12% (7% real return) over a 200-year period. See, for example, Siegel [2002], especially chapters 2 and 12. 15% is also the rate of growth of book value that Warren Buffett has set as benchmark for Berkshire Hathaway.

17. This is in line with our estimate of long-term GDP growth rate. In the long-run (after the company has exhausted its competitive advantage), it will only grow at the rate of growth of GDP). 3% is the average steady state rate of growth of GDP for G-8 countries. According to the Bureau of Economic Analysis, historically, from 1947 until 2012, the U.S. GDP growth rate averaged 3.23%, reaching an all-time high of 17.20% in March 1950 and a record low of negative 10.40% in March 1958.
18. See Piotroski [2000] and Altman [1968] on how these indices are calculated.

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