

# Fundamental Analysis Redux\*

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**ABSTRACT:** In their classic 1934 text *Security Analysis*, Graham and Dodd warn investors against sole reliance on a few quantitative factors in investment decisions. Instead, they recommend that investment decisions be based on a comprehensive fundamental analysis of the underlying securities. While their views held sway for almost a century, recent years have witnessed a sharp reversal. Scholars of finance often overlook fundamental analysis and their influence has led to a surge of investment products relying solely on a few quantitative factors. These products often have names that appeal to fundamental analysis, such as 'value' and 'quality'. Despite recent advances in quantitative finance, I argue that Graham and Dodd's recommendations still hold true today. I show how popular quantitative approaches to investing overlook important information and select stocks with distorted accounting numbers rather than temporary mispricing. I conclude that effective fundamental analysis is essential for efficient capital markets and requires both good financial reporting and appropriately skilled analysts.

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## I. INTRODUCTION

I have spent much of my career teaching students how to interpret financial statements. One of my key lessons is that they should not make investment decisions based exclusively on a handful of simple financial ratios. Instead, they should conduct a thorough analysis of the underlying business and carefully analyze the extent to which the underlying the accounting numbers reflect economic reality.

Accounting textbooks are replete with examples of how accounting numbers can distort economic reality. Certain mandated accounting principles simply ignore economic reality. The requirement to expense most investments in research and development is a case in point. In other cases, managers must choose between different accounting methods that can poorly reflect economic reality. Examples include different cost flow assumptions and depreciation methods. Finally, many accounting principles require managers to make estimates about the future. Examples here include the allowances for loan losses and employee postretirement benefits. These estimates involve considerable subjectivity and are prone to managerial bias and manipulation.

Examples such as those described above probably sound familiar to anyone that teaches a user-oriented introductory course in financial accounting. They are at the heart of fundamental analysis and can be traced back at least as far as the pioneering work of Graham and Dodd (1934). Consequently, I suspect that many accounting academics believe that fundamental analysis is alive and well. Yet the field of academic finance and the investment world today are increasingly dominated by quantitative investment techniques. These techniques typically select securities using a few simple ratios and portfolio optimization software. Recent changes have been so profound that they recently led the Wall Street Journal to proclaim that ‘The Quants Run Wall Street Now’.<sup>2</sup>

Quantitative investing strategies are often referred to as ‘rules-based’ strategies. A common example is the selection of a portfolio of stocks with high book-to-market ratios. The advantages of such strategies are well documented. These rules-based strategies can quickly and efficiently select securities from a large investment universe. In contrast, the traditional fundamental analyst can typically only analyze a small subset of the investment universe. Quantitative strategies are also objective, thus avoiding the well-documented behavioral biases affecting many human investors, such as chasing glamor stocks or holding on to losing stocks.

These advantages aside, however, many of today’s quantitative investment strategies seem surprisingly naïve. They ignore the basic rules of fundamental analysis, taking accounting numbers at face value and assuming that they reflect economic reality. Moreover, since many of the rules used by quantitative investment

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<sup>2</sup> See Wall Street Journal, May 21, 2017. Available at <https://www.wsj.com/articles/the-quants-run-wall-street-now-1495389108>.

strategies are well known and widely implemented, it is hard to see how they can continue to provide superior investment performance in competitive markets.

My goal in this paper is to reaffirm the importance of fundamental analysis for sound investment decision-making, well-functioning capital markets and efficient resource allocation. I acknowledge the advantages of quantitative investment tools. But I question whether the simple and well-known rules-based strategies that increasingly dominate today's investing landscape are a good substitute for sound fundamental analysis.

## II. A BRIEF HISTORY OF FUNDAMENTAL ANALYSIS

Fundamental analysis is a method of evaluating a security in an attempt to measure its value, by examining related economic, financial and other qualitative and quantitative factors.<sup>3</sup> The history of fundamental analysis can be traced back at least as far as the pioneering book on the topic by Graham and Dodd (1934). This book was published in the aftermath of the stock market crash of 1929 and warned investors and against speculative investment behavior. Instead, Graham and Dodd encourage investors to devote their attention to:

“the field of undervalued securities-issues, whether bonds or stocks, which are selling well below the levels apparently justified by a careful analysis of the relevant facts” [page 13]

Graham and Dodd popularized the term ‘intrinsic value’ to represent the value justified by a careful analysis of the relevant facts.<sup>4</sup> In describing their approach to determining intrinsic value, they emphasize the importance of considering both quantitative and qualitative factors. Chapter 2 is devoted to this topic and concludes that:

“In the mathematical phrase, a satisfactory statistical exhibit is a necessary though by no means a sufficient condition for a favorable decision by the analyst” [p. 40]

Graham and Dodd also emphasize the importance of analyzing the company reports that publish the financial and operating figures underlying an investment. In this respect, they identify inadequate or incorrect data as a principal obstacle to the success of the analyst, recognizing that:

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<sup>3</sup> I obtained this particular definition from Investopedia, available at <https://www.investopedia.com/terms/f/fundamentalanalysis.asp>. Other definitions are available and convey the same basic idea.

<sup>4</sup> The term ‘intrinsic value’ can be traced back at least as far as Armstrong (1848).

“Deliberate falsification of the data is rare; most of the misrepresentation flows from the use of accounting artifices which it is the function of the capable analyst to detect” [p. 20]

Much of the text in Graham and Dodd is devoted to techniques for analyzing the financial statements. Pages 299 through 542 of the text are devoted to the analysis of common stock investments. Of these 243 pages, 192 pages are devoted to techniques for analyzing the income statement and balance sheet. These pages cover such topics as special items, depreciation, amortization and unconsolidated subsidiaries. It is instructive to note that many of the accounting issues covered have since been at the heart of major corporate scandals, including WorldCom, Enron and Valeant Pharmaceuticals.

The techniques of fundamental analysis advocated by Graham and Dodd were broadly embraced by the investment community and planted the seeds from which the financial analyst profession would grow. Prior to Graham and Dodd, the financial analyst profession was virtually non-existent.<sup>5</sup> Following the publication of Graham and Dodd, the financial analyst profession grew and flourished. The New York Society of Security Analysts (NYSSA) was founded in 1937 and published the first issue of *The Analysts Journal* in 1945. The first national organization was established in 1947, when several regional societies voted to form the National Federation of Financial Analysts Societies. The Federation was subsequently renamed the Financial Analysts Federation (FAF) and *The Analyst Journal* was subsequently acquired by the Federation and renamed the *Financial Analysts Journal*. In 1959, the Institute of Chartered Financial Analysts (ICFA) formed to administer the CFA examination and certification, with the first examinations taking place in 1963. The FAF and the ICFA subsequently merged to form what is currently the CFA Institute. Membership has grown from just 8,000 in 1963 to over 135,000 today.

Throughout the remainder of the twentieth century, fundamental analysis was the dominant approach to investing. The CFA curriculum had a strong focus on fundamental analysis. Industry giants such as Fidelity and PIMCO built their businesses on an investment philosophy grounded in rigorous fundamental analysis and leading investors of the era, such as Warren Buffet and John Neff, were strong advocates of fundamental analysis. On Wall Street, a large cadre of sell-side analysts evolved to conduct fundamental analysis on companies and provide investment recommendations and financial statement forecasts to investors.

Yet this same period also marked the beginning of the shift from fundamental analysis to a more quantitative approach to investing. The shift began with developments in academia including modern portfolio theory (see Markowitz, 1952), the Capital Asset Pricing Model (see Sharpe 1964 and Lintner 1965), the

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<sup>5</sup> The New York Society of Financial Statisticians was founded in 1916, the Investment Analysts Society of Chicago was founded in 1925 and the Security Analysts of San Francisco was founded in 1929 respectively.

efficient market hypothesis (see Fama, 1970) and derivative pricing theory (see Black and Scholes 1973). One of the earliest challenges to fundamental analysts came from Fama (1965) in the *Financial Analysts Journal*. In this article, Fama discusses the implications of the theory of random walks for stock prices, concluding that:

“If the random walk theory is valid and if security exchanges are ‘efficient’ markets, then stock prices at any point in time will represent good estimates of intrinsic or fundamental values. Thus, additional fundamental analysis is only of value when the analyst has new information which was not considered in forming current market prices or has new insights concerning the effects of generally available information which are not already implicit in current prices. If the analyst has neither better insights nor new information, he may as well forget about fundamental analysis and choose securities by some random selection procedure.” [p. 59]

These insights from academia have gradually been incorporated in the CFA curriculum, though techniques of fundamental analysis continue to be a staple of the curriculum. Academic textbooks on investing, however, have made a sharper switch from a focus on fundamental analysis to a focus on these more recent academic insights. This shift is illustrated by the coverage of Bodie, Kane and Marcus (2017), which is currently the ‘standard’ textbook for business school courses on investing. The textbook’s contents are summarized as follows:

“The integrated solutions for Bodie, Kane, and Marcus’ Investments set the standard for graduate/MBA investments textbooks. The unifying theme is that security markets are nearly efficient, meaning that most securities are priced appropriately given their risk and return attributes. The content places greater emphasis on asset allocation and offers a much broader and deeper treatment of futures, options, and other derivative security markets than most investment texts.”<sup>6</sup>

In order to exemplify this shift, Table 1 compares the number of chapters focusing on various investment topics in Graham and Dodd (1934) versus Bodie, Kane and Marcus (2017). The main take away is that there has been a shift away from financial statement analysis and toward more recent academic innovations in finance. In noting this shift, it would be remiss of me not to acknowledge the theoretical rigor and practical importance of these academic insights and the masterful job done by Bodie et al. in summarizing these insights for students. But my main purpose here is simply to illustrate that investment texts increasingly assume that prices already reflect fundamentals and use this as a starting point for introducing more recent academic theories on investing.<sup>7</sup>

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<sup>6</sup> Obtained from <https://www.amazon.com/Investments-Zvi-Bodie-Professor/dp/1259277178>.

<sup>7</sup> While Graham and Dodd (1934) obviously did not cover topics developed long after publication, it does anticipate some such topics. For example, the book contains a section on ‘discrepancies between

**Table 1. Summary of Topics Covered in Graham and Dodd (1934) and Bodie, Kane and Marcus (2017)**

	Financial Statement Analysis	Portfolio Theory & Management	Asset Pricing Theory	Efficient Market Hypothesis	Derivative Pricing Theory
Graham and Dodd (1934)	15 Chapters				
Bodie, Kane and Marcus (2017)	1 Chapter	9 Chapters	3 Chapters	2 Chapters	4 Chapters

With this shift of focus in the teaching of courses on investments, the teaching of fundamental analysis is migrating to accounting departments. A strong background in accounting and fundamental analysis is not typically a requirement for either acquiring a doctorate in finance or teaching a course on investments. To fill this void, many accounting departments now offer courses covering fundamental analysis and the associated textbooks are increasingly authored by accounting faculty.<sup>8</sup> The academic accounting journals are also home to much of the ongoing research relating to fundamental analysis.

### III. A BRIEF HISTORY OF QUANTITATIVE ANALYSIS

In this section, I provide a brief history of the emergence of quantitative investing. My focus is on equity investment strategies that utilize accounting numbers, since these strategies compete most directly with fundamental analysis. The material presented in this section draws heavily on Kok, Ribando and Sloan (2017), which provides a history of formulaic value investing and documents some of its drawbacks. As I will describe in more detail below, formulaic value investing was the earliest and is currently the most prominent form of a quantitative equity investing.

Quantitative investment strategies first began appearing with some regularity in the 1980s, though their growth can be traced back to the 1960s, and particularly the development of the CRSP database at the University of Chicago. CRSP provided a comprehensive panel of stock return data that facilitated the quantitative analysis of investment strategies (e.g., backtests). Early work using the CRSP database

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price and value', which includes a forerunner of the Shiller CAPE ratio market timing strategy. Graham and Dodd also includes coverage of stock warrants, noting that warrants with no exercisable value 'have real value nonetheless ...for the right to benefit from any increase in the price of the stock'. The main thrust of their analysis of the stock warrant, however, is as a 'fundamentally dangerous and objectionable device because it effects an indirect and usually unrecognized dilution on common stock values'.

<sup>8</sup> Examples include Palepu and Healy (2012), Penman (2012), Holthausen and Zmijewski (2013) and Lundholm and Sloan (2017).

supported the view that stock markets were generally efficient, with stock prices fully reflecting publicly available information (Fama, 1970). Gradually, however, a number of anomalies emerged whereby future stock returns appeared to be predictable based on publicly available information. Many of the prominent anomalies involved accounting data. Examples include the earnings-to-price ratio, the book-to-market ratio and accounting accruals. Moreover, many of these anomalies could be rationalized as systematic, albeit naïve, applications of fundamental analysis. For example, the book-to-market ratio is often characterized as a form of value investing (e.g., Fama and French 1998).

The emergence of these anomalies was paralleled by the introduction of a series of related ‘style’ or ‘factor’ indices. Russell Investments introduced the first style indices in 1987, which were named the ‘price-driven index’ and the ‘earnings growth index’ respectively. The original idea was that the price-driven index would provide a suitable benchmark for traditional value investors seeking underpriced stocks, while the earnings-growth index would provide a good benchmark for growth investors seeking stocks with high upside potential. The original methodology ranked stocks in the underlying index using the book-to-market ratio and placed the top half (by market capitalization) in the price-driven index and the bottom half in the earnings-growth index. In the years since, Russell has refined the methodology and renamed the price-driven index as the ‘value index’ and the growth-driven index as the ‘growth index’. Other index providers, including S&P, MSCI and CRSP have since followed suit, with each providing their own value and growth indices using their own methodologies.

While the original idea behind these indices was to provide benchmarks for evaluating active portfolio managers, funds replicating the indices themselves soon emerged. The first value and growth index funds were introduced by Vanguard in 1992. The 1994 prospectus describes the investment objectives of the value fund as follows:

“The VALUE PORTFOLIO seeks to replicate the aggregate price and yield performance of the S&P/BARRA Value Index, an index which includes stocks in the S&P 500 Index with lower than average ratios of market price to book value. These types of stocks are often referred to as "value" stocks.”

From these humble beginnings, index-based value funds proliferated and are rapidly overtaking their actively managed counterparts in the value-investing arena (see Kok et al., 2017). Moreover, the marketing material associated with these funds increasingly promote them as vehicles for investing in potentially underpriced stocks. For example, the current Vanguard Value Index Fund’s product summary states that “these stocks may be temporarily undervalued by investors”.<sup>9</sup>

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<sup>9</sup> Quote obtained from [https://personal.vanguard.com/us/funds/snapshot?FundId=0006&FundIntExt=INT&funds\\_disable\\_redirect=true](https://personal.vanguard.com/us/funds/snapshot?FundId=0006&FundIntExt=INT&funds_disable_redirect=true).

Following the success of index-based value strategies, indices were created to track the performance of other prominent anomalies discovered in the academic literature. Featuring prominently among these are indices tracking momentum and quality. These indices are typically referred to as ‘factor indices’ or ‘smart betas’. I will focus here on the quality factor, since this factor relies most heavily on accounting data.

The quality factor is not well defined and serves as something of a catchall for various anomalies that are based on accounting data. Table 2 summarizes the implementation of the quality factor for nonfinancial stocks by three major index producers. All of the index producers include a variant of accounting return on investment. This is motivated by the work of Novy Marx (2013) and others showing that accounting rates of return on investment predict future stock returns in backtests. Two of the producers include measures of leverage, with high leverage representing lower quality. FTSE Russell includes accruals and change in asset turnover, both of which are measures of potential balance sheet bloat that have had a negative relation with future profitability and stock returns (see Sloan 1996; Richardson et al. 2006). Fidelity includes the cash flow margin, which also helps mitigate the impact of balance sheet bloat on earnings-based performance measures. MSCI and Fidelity also include tilts against volatility with earnings volatility and cash flow stability respectively.

Table 2. Implementation of the ‘Quality Factor’ by Three Major Index Producers. (+) indicates that a higher value signifies higher quality, while (-) signifies that a higher value signifies lower quality.

<b>Index Producer</b>	<b>Measures of Quality</b>
MSCI	Return on Equity (+), Debt-to-Equity (-), Earnings Variability (-)
FTSE Russell	Return on Assets (+), Change in Asset Turnover (+), Accruals (-), Industry-Relative Operating Cash Flow to Debt (+)
Fidelity	Free Cash Flow Margin (+), Return on Invested Capital (+), Free Cash Flow Stability (+)

Investment funds tracking quality indices have proliferated in recent years. A search on First Bridge using the term ‘quality’ revealed over 30 quality-based ETFs.<sup>10</sup> The largest of these is the iShares Edge MSCI USA Quality Factor, with over \$4.5B under management.

The latest trend in index-based factor ETFs is multiple factor investing. The idea behind these funds is to provide exposure to several factors in one product. The most popular family of indices here are the MSCI Diversified Multiple-Factor Indices. These indices aim to maximize exposure to four factors – Value, Momentum, Quality

<sup>10</sup> See <http://www.firstbridgedata.com/>.



and Low Size. The most popular product in this space is the iShares Edge MSCI Multifactor Index, with about \$1B under management.

Our discussion of quantitative investing this far has focused on index-based products. Such products, however, represent just the tip of the iceberg. The majority of investment managers using rules-based quantitative strategies employ their own proprietary strategies. The largest managers in this space include Dimensional Fund Advisors, AQR Capital Management, Arrowstreet Capital, Acadian Asset Management and Quantitative Management Associates. Collectively, they manage hundreds of billions of dollars. Quantitative strategies are also being actively embraced by the largest investment management companies including Blackrock, Vanguard and Fidelity, with all three now offering a suite of factor-based investment products. It therefore comes as no surprise that the Wall Street Journal recently proclaimed that ‘The Quants Run Wall Street Now’.<sup>11</sup>

#### **IV. A PERSPECTIVE ON QUANTITATIVE INVESTING**

My brief histories of fundamental analysis and quantitative analysis should illustrate how approaches to investing have come almost full circle since the publication of Graham and Dodd in 1934. Graham and Dodd’s original text cautioned against making investments purely on the basis on a handful of metrics, such as book value and earnings. Instead, they recommend that investors undertake a more thorough fundamental analysis to determine intrinsic value. With the advent of the efficient markets hypothesis (EMH), investors were encouraged to assume that prices already reflected intrinsic value and concentrate of forming appropriately diversified portfolios. This led to the popularity of indexing. Subsequently, research on the EMH uncovered various anomalies, whereby subsets of stocks with specific characteristics were shown to have outperformed the broader market. Several of the most robust anomalies were based on accounting numbers. Appealing to asset pricing theory, these metrics have been used to create investment products that are labeled as ‘factors’ and ‘smart betas’. Monikers are attached to these factors that associate them fundamental analysis, such as ‘value’ and ‘quality’ and they are marketed as strategies that are designed to yield superior investment performance.

This brings us back to the issue of market efficiency. Why should simple, well-known and readily available strategies to consistently generate superior investment performance in competitive markets? It seems counterintuitive to argue that fundamental analysis to identify discrepancies between price and intrinsic value is unlikely to identify mispriced securities, while simultaneously arguing that an investment strategy based on the book-to-market ratio systematically identifies mispriced securities.

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<sup>11</sup> See Wall Street Journal, May 21, 2017. Available at <https://www.wsj.com/articles/the-quants-run-wall-street-now-1495389108>.

Kok et al. (2017) address this issue directly in the case of formulaic value investing. They show that claims about the outperformance of formulaic value strategies are overstated. For U.S. markets, they find no compelling evidence to support the outperformance of formulaic value strategies. Moreover, they point out that none of the major commercially available U.S. value indices have shown consistent evidence of outperformance over the past decade.

If formulaic value strategies are not identifying mispriced stocks, then what are they identifying? Kok et al. show that these strategies systematically identify securities with temporarily inflated accounting numbers. For example, a strategy of buying stocks with high book-to-market ratios systematically identifies stocks with temporarily overstated book values that are subsequently written down. In many cases, these overstated book values arise quite transparently from accounting rules that fail to reflect economic reality. For such reasons, Graham and Dodd (1934, p.17) dismissed investing on book value as 'almost worthless'. I will provide a case study to illustrate this phenomenon in the next section.

Proponents of quantitative investing often respond to the limitations of investing on simple value ratios alone by supplementing them with other factors, such as the quality and momentum factors mentioned earlier (see Asness et al. 2015). On the face of it, this seems like a good idea. The shortcoming of simple valuation ratios is that they tend to be high for companies with deteriorating financial performance that has been incorporated in price, but has not yet incorporated in the accounting numbers. Supplementing valuation formulas with market-based metrics, such as momentum, should help to weed out the companies with deteriorating financial performance. But the same basic question remains. If such strategies are well known, easy to implement and readily available to investors, why should they consistently generate superior investment performance in competitive markets?

We can shed some evidence on the above question by examining the history of a major index that has been designed to replicate a multiple factor investing strategy. The MSCI USA Diversified Multiple-Factor Index aims to maximize exposure to the value, momentum, quality and low size factors while maintaining the risk profile of a broad US index. Backtests indicate that this combination of factors has provided a higher return than the overall market. For example, between November 1998 and the February 2015 launch date of the index, backtests indicated that the index had impressively outperformed the broader market. Yet since its launch date, the index has closely tracked and slightly underperformed the broader market.<sup>12</sup> Moreover, much of the backtest outperformance came from the earlier part of the backtest period. Some readers may wonder what fundamental insights could be missed by this multiple-factor index. How could a portfolio of small cap stocks with low valuations, high quality and strong price momentum not generate superior

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<sup>12</sup> This commentary reflects performance through the end of February 2018. See <https://www.msci.com/documents/10199/15f5d610-5ecc-4bc5-850c-5a9857928267> for a factsheet on this index.

performance? I will provide a case study in the next section to illustrate how such a screen can miss important fundamental insights.

Quantitative investment strategies are usually recommended on the basis of impressive backtest performance. Yet there are several reasons to be skeptical of backtest results as indicators of future performance. I discuss each in turn:

### **Data Mining (p-hacking)**

We typically only get to see backtests that worked. If researchers conduct millions of backtests, some will uncover strategies that generated high returns by chance alone. But there is no reason to think that such strategies will work in the future. Recent research concludes this has been a serious problem in finance and that many of the 'anomalies' that have been uncovered in prior research are likely due to data mining (see Harvey 2017, Linnainmaa and Roberts 2017, Hou, Xue and Zhang 2017 and Chordia, Goyal and Saretto 2017).

### **Competition**

Perhaps the most compelling reason not to expect any well-documented and easily replicable investment strategy to generate consistently superior investment performance is competition. My own work on the "accruals" strategy in Sloan (1996) is a good example here. The strategy involves buying stocks with high cash flows but low earnings and selling stocks with low cash flow but high earnings. The idea is that investors tend to fixate on current earnings when forecasting future earnings, ignoring important information in cash flows. The strategy worked well. The idea was initially effective in predicting future earnings changes and investors did not seem to fully appreciate this idea, so the strategy also predicted future stock returns. Since publication, the idea has continued to work well in predicting future earnings changes, but it no longer seems so effective in predicting future stocks returns (see Green, Hand and Soliman, 2011). The fact that it still predicts future earnings suggests that the idea has merit and was not just data mining. What seems to have happened here is that the strategy became widely known and exploited, resulting in its demise for predicting stock returns. Research by Pontiff and MacLean (2016) provide comprehensive evidence that performance of academic trading strategies declines after publication.

### **Implementation Costs**

Backtest results ignore many of the real-world costs and frictions involved in exploiting an investment strategy. This is particularly true in small and illiquid securities. The bid-ask spread and the price pressure that would have resulted from additional trades are two potentially large but difficult to quantify costs. Costs of short selling are also relevant to strategies where the gains come from the short side. Kok et al. (2017) provide evidence that the abnormally high backtest returns to small cap value strategies are primarily attributable to short-selling growth stocks.

They show that these same stocks can be difficult and expensive to short sell in practice, issues that are ignored in the backtests. It is also worth noting that the owners of these stocks can lend them out and collect a lending fee. This lending fee represents income generated by the stock in much the same way as dividends represent a form of income on dividend-paying stocks. Yet backtests typically include dividend income but ignore lending income.

I will close this section by summarizing my perspective on quantitative investing. First, quantitative tools have undoubtedly improved the ability of investors to systematically identify and exploit market inefficiencies. Quantitative tools can be used to enhance fundamental analysis and they are particularly helpful in identifying and exploiting systematic behavioral errors or oversights that are made by many investors. The key drawback of quantitative investing strategies is that once they are well-known and readily accessible, competition is likely to render them obsolete. In this respect, my thoughts go back to Fama's (1965) words on the implications of market efficiency for fundamental analysis. Successful investment strategies in competitive markets require either new information or better insights. Well known and readily available quantitative strategies offer neither.

## V. CASE STUDIES

In the previous section, I argue that rules-based quantitative investment strategies can miss important quantitative and qualitative insights that can have implications for future performance. In competitive markets, sophisticated investors conducting rigorous fundamental analysis typically uncover these insights and so they are reflected in security prices. Consequently, quantitative investment strategies identify stocks that may superficially look like good investments, but in reality can have serious problems with dire implications for future performance.

In this section, I outline two case studies to illustrate the pitfalls of quantitative investment strategies. The first case study looks at Whiting Petroleum Corporation, an oil and gas company, in 2015. This case study illustrates why there was a large rotation of energy stocks from 'growth' indices in 2014 to 'value' indices in 2015.<sup>13</sup> Whiting's book-to-market ratio rose above 2 in 2015. But this had nothing to do with price falling below intrinsic value. Instead, vagaries of the accounting rules caused Whiting's book value to deviate significantly from its intrinsic value. The second case study looks at Big Five Sporting Goods, a sporting goods retailer, in 2017. This stock rose to the top of generic 'multiple-factor' investment strategies at the beginning of 2017. This case will illustrate how multiple-factor quantitative

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<sup>13</sup> This rotation is discussed in <http://www.ftserussell.com/files/press-releases/ftse-russell-announces-preliminary-lists-2015-russell-indexes-reconstitution>. Whiting Petroleum experienced a similar shift. This stock was held by the Vanguard Growth Index Fund and the Vanguard Mid Cap Growth Index Fund up until June 2015. Between June 2015 and December 2015, it was moved out of these funds and put in the Vanguard Small Cap Value Index Fund.

strategies can miss important information with negative implications for future performance.

### Case Study 1: Whiting Petroleum

Whiting Petroleum is an independent oil and gas company engaged in development, production, acquisition and exploration activities, primarily in the Rocky Mountains Region of the United States. Whiting's major assets are the proven reserves of its portfolio of oil and gas properties. Table 3 below summarizes data relating to Whiting's financial position from 2013 through 2016. Note that the standardized value of Whiting's proven oil and gas reserves plummeted from \$10,843M at the end of 2014 to \$4,574M at the end of 2015. This was accompanied by a sharp decline in Whiting's market capitalization from \$5,507M to \$1,927M. The differences between the values of the proven reserves and the market capitalizations are largely explained by the fact that Whiting was financed by about \$5,000M of debt during this period. The declines in both the value of Whiting's reserves and its market value were driven by a steep drop in the price of oil. The price for a barrel of oil had been in excess of \$100 a barrel during the fall of 2014, but had plummeted to \$55 by the end of 2014 and had further dropped to \$34 by the end of 2015.

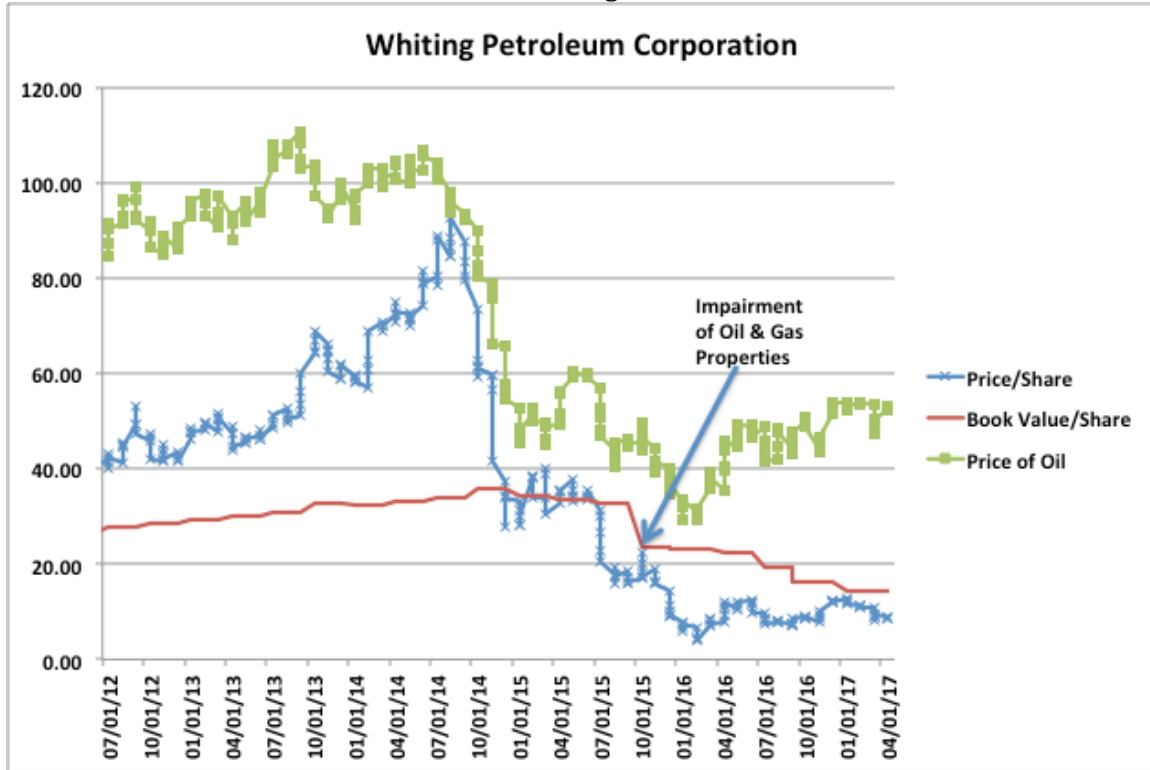
Table 3. Summary Information on Whiting Petroleum's Financial Position Between 2013 and 2016. All amounts except Proved Reserves are in \$millions.

End of Calendar Year	Proved Reserves (Million Barrels of Oil Equivalent)	Standardized DCF Measure of Proved Reserves	Net Book Value of PP&E (Primarily O&G Properties)	Book Value of Common Equity	Market Value of Common Equity
2013	438.5	6,594	7,595	3,837	7,341
2014	780.3	10,843	12,143	5,703	5,507
2015	820.6	4,574	10,750	4,759	1,927
2016	615.5	2,698	9,143	5,149	4,351

Given that Whiting's major asset was its proven reserves of oil and that Whiting was so highly leveraged, it makes sense that Whiting's stock price plummeted in response to the collapse in the price of oil. Yet it is also apparent that the net book value of Whiting's PP&E and the associated book value of common equity did not drop by nearly as much. This caused Whiting's book-to-market ratio to rise sharply. Figure 1 shows how Whiting's book value per share and stock price responded to the drop in the price of oil. While Whiting's stock price responded to the drop in the price of oil in a timely manner, Whiting's book value responded much more slowly. Whiting did not record an impairment to its oil and gas properties until the third quarter of 2015, and the impairment only amounted to about \$10/share, even though the decline in the price of oil had wiped out about \$70/share from Whiting's

stock price. This caused Whiting's book-to-market ratio to increase from around 0.4 in mid 2014 to 2.0 just before the write-down and down to around 1.0 immediately after the write-down.

Figure 1. Graph of Price/Share and Book Value/Share for Whiting Petroleum versus the Price for a Barrel of Oil from 2014 through 2017.



Those familiar with the accounting for oil and gas properties should realize what happened here. Whiting uses the 'successful efforts' method to account for its oil and gas properties. This means that when Whiting discovers a commercially viable property, it capitalizes the exploration and developments costs incurred for that property as an asset. If the fair value of a property exceeds the capitalized costs, the accounting rules do not allow Whiting to revalue the property upwards. Thus, if Whiting has a lucky strike or if the price of oil skyrockets, Whiting will have a very low book-to-market ratio. This has nothing to do with Whiting being overpriced. It arises simply because the accounting rules fail to reflect the intrinsic value of Whiting's oil and gas properties, making book value a poor measure of intrinsic value.

The accounting rules, however, are not symmetric. If the fair value of Whiting's oil and gas properties falls, Whiting may have to record an asset impairment. But the accounting here is not mark-to-market. Whiting is only meant to record an asset impairment when the undiscounted recoverable cash flows from the oil and gas properties fall below the carrying value. Once this criterion is met, the properties are required to be impaired to fair value. For assets such as oil and gas fields, where

the life of the properties is often 10 years or more, there is typically a large difference between the amounts for the undiscounted future cash flows and the discounted future cash flows. Thus, the accounting system has a built in lag, whereby impairments are delayed until and unless the recoverability test is breached, and then a large 'catch up' impairment is recorded.

The Whiting case study highlights two major pitfalls of using the book-to-market ratio to identify underpriced stocks. First, the accounting rules typically require nonfinancial assets to be recorded at amortized cost, regardless of how profitable the assets may be. For companies that are fortunate enough to develop highly profitable assets, book value will significantly understate intrinsic value. Examples range from the discovery of a lucrative oil field to the development of a highly popular smart phone. The second pitfall of the book-to-market ratio is that even when the intrinsic value of an asset drops well below its book value, an accounting impairment may not be required. Moreover, if impairment is required, it will typically occur with a significant lag to the decline in intrinsic value. One of the main culprits here is that many long-lived assets are not required to be written down until their book value drops below their recoverable (i.e., undiscounted) future cash flows. Moreover, considerable management discretion is often involved in forecasting future cash flows. So even for assets like indefinite-lived intangibles, where a fair value criterion is used for impairment, accounting impairments often lag economic impairments.<sup>14</sup>

## **Case Study 2: Big Five Sporting Goods**

Big Five Sporting Goods is a sporting goods retailer operating in the Western United States. It sells goods primarily through its chain of over 400 company-owned stores. During late 2016 and early 2017, the stock of this company looked very attractive using a generic multiple factor model approach. Table 4 lists the values of six financial ratios that are popular in these multiple factor models. Viewed from the perspective of the quants, Big Five is firing on all cylinders, ranking above the median on all six metrics. It has a rare combination of a cheap valuation, strong momentum and high quality. It is not surprising then, that Big Five was the darling of investment strategies using a multi-factor quantitative approach. Table 5 lists the top ten investors in Big Five as of March 31, 2017 based on 13-F filings with the SEC. This list is a whose-who of big quantitative investors.<sup>15</sup> The top holder, Blackrock, is the dominant player in factor-based ETFs. Not far behind are Dimensional Fund Advisors, Numeric Investors, LSV Asset Management, Arrowstreet Capital, and Acadian Asset Management, all of whom specialize in implementing ideas from academic finance.<sup>16</sup>

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<sup>14</sup> See Ramanna and Watts (2012) and Li and Sloan (2017).

<sup>15</sup> I identified Big Five from work-in-progress with Steve Sloan and Jieyin Zheng in which we analyze the top holdings of the major quantitative investors. Big Five topped our list as having the highest proportion of its shares owned quants as of March 31, 2017.

<sup>16</sup> The final column in Table 5 indicates the ownership interest that each investor in Big Five would have if it held each stock on a capitalization-weighted basis. Vanguard appears in the top ten by

Table 4. Financial Ratios for Big Five Sporting Goods versus Comparable Investment Universe at 3/31/2017. Ratios use prices at 3/31/2017 and financial statements for the 2016 fiscal year, which ends on December 31, 2016 for Big Five. The Factset U.S. Market Index Represents the Comparable Investment Universe. Source: Factset.

<b>Ratio:</b>	<b>Associated Factor</b>	<b>Big Five Sporting Goods</b>	<b>Universe Lower Quartile</b>	<b>Universe Median</b>	<b>Universe Upper Quartile</b>
Trailing Earnings-to-Price	Value	0.051	0.002	0.035	0.053
Book-to-Market	Value	0.616	0.234	0.425	0.661
12 Month Stock Return	Momentum	39.8%	5.5%	22.9%	45.1%
Return on Equity	Quality	0.084	-0.029	0.083	0.166
Debt to Equity	Quality	0.065	0.181	0.631	1.250
Market Capitalization	Low Size	333	550	1,620	5,143
<b>Restated Ratio</b>					
Restated Return on Equity*	Quality	0.039	-0.018	0.053	0.111
Restated Debt to Equity**	Quality	1.500	0.371	0.847	1.578

\*Restated return on equity replaces net PP&E with gross PP&E in the computation of common equity.

\*\*Restated debt to equity incorporates the constructive capitalization of operating lease commitments using a 5% discount rate and assuming that amounts due beyond 5 years are spread uniformly over the next 5 years.

With a low valuation, strong momentum and high quality, what is not to like? Apparently something, since while the quants were buying, two other distinct groups of investors were actively selling. First, the short position in Big Five exploded from around 5% of the float in the fall of 2016 to over 40% of the float in March of 2017. Secondly, Stadium Capital, Big Five's largest pre-existing stakeholder, unloaded its entire 13% stake between June 2016 and March 2017.

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virtue of its sheer size and actually holds an underweight in Big Five. The other investors all hold significant overweights in Big Five. Of the remaining investors, Principal, Millenium and Geode, all offer some quantitative products based on ideas from academic finance. Not listed, but making it into the top 25, are several other well know quantitative investors with significant overweights in Big 5, including Renaissance Technologies, Two Sigma Advisors, Two Sigma Investments, Bridgeway Capital Management, American Century, Bogle Investment Management and AQR Capital Management. All of these investors owned at least 1% of the shares outstanding at 3/31/2017.



Stadium Capital, is a hedge fund with a traditional concentrated value investing philosophy that conducts detailed fundamental analysis on all of its holdings.<sup>17</sup>

Table 5. Top Ten Largest Institutional Investors in Big Five Sporting Goods at 3/31/2017, as compiled from 13-F Filings and sourced from Factset. The Final Column Reports the Market Value of the Investor's Total Holdings in the Facstet US Equity Market Index as a Percentage of the Index's Total Market Capitalization. Source: Factset.

<b>Name</b>	<b>Position (000)</b>	<b>% Outstanding</b>	<b>% Market</b>
BlackRock Fund Advisors	3,559	16.16	4.75
Dimensional Fund Advisors LP	1,855	8.42	0.75
Numeric Investors LLC	1,122	5.09	0.04
LSV Asset Management	1,114	5.06	0.21
The Vanguard Group, Inc.	989	4.49	7.04
Arrowstreet Capital LP	875	3.97	0.08
Acadian Asset Management LLC	763	3.46	0.06
Principal Global Investors LLC	662	3.00	0.30
Millennium Management LLC	643	2.92	0.18
Geode Capital Management LLC	592	2.69	0.92
Total	12,174	55.26	14.32

So what is going on here? Have the quants outsmarted the shorts and insiders with their academic insights, or do the shorts and insiders know something that the quants have overlooked? It turns out that a rather superficial fundamental analysis of Big Five reveals significant additional insights. Brick and mortar sporting good retailers had been losing market share to online competitors, such as Amazon, for several years. Big Five was not immune to these competitive pressures and had already begun closing stores. Its store count had peaked at 439 in 2014 and was down to 432 by the end of 2016. Two of Big Five's main competitors, however, had been even less fortunate. The Sports Authority and the Sports Chalet both filed for bankruptcy in early 2016 and had closed all their stores by late 2016. Big Five naturally experienced a boost to sales as customers frequenting sporting goods stores now had fewer competitors to choose from. Big Five acknowledged as much in its earnings announcement for the third quarter of 2016:

“We are very pleased to deliver an exceptionally strong third quarter performance, with earnings meaningfully above the prior year as well as the high end of our guidance range,” said Steven G. Miller, the Company's Chairman, President and Chief Executive Officer. “Results were driven by strong sales growth, including increases in both customer transactions and average sale, as well as improved merchandise margins, and clearly reflected the benefit from the closure of over 200 Sports Authority and Sport Chalet store locations in our markets.”

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<sup>17</sup> I interviewed the fund managers at Stadium Capital and they confirmed that they sold the stake because the price in the second half of 2016 had risen substantially above their internal estimates of the intrinsic value of the stock.

Another factor benefitting Big Five in the Fall of 2016 was the pending US election. The Democratic candidate, Hillary Clinton, was favored to win and was running on a platform that included additional restrictions on the sale and ownership of firearms. Firearms were one of Big Five's most popular lines, and sales were booming (no pun intended) in the run-up to the November election as gun enthusiasts looked to purchase ahead of any new regulations. But the election took a different path and fears about gun regulations subsequently waned.

Given the factors contributing to Big Five's performance, it is not surprising that sales soon resumed their secular downtrend. By the third quarter of 2017, both total sales and same-store sales were in decline. Management explained the situation as follows in their 2017 third quarter earnings announcement.

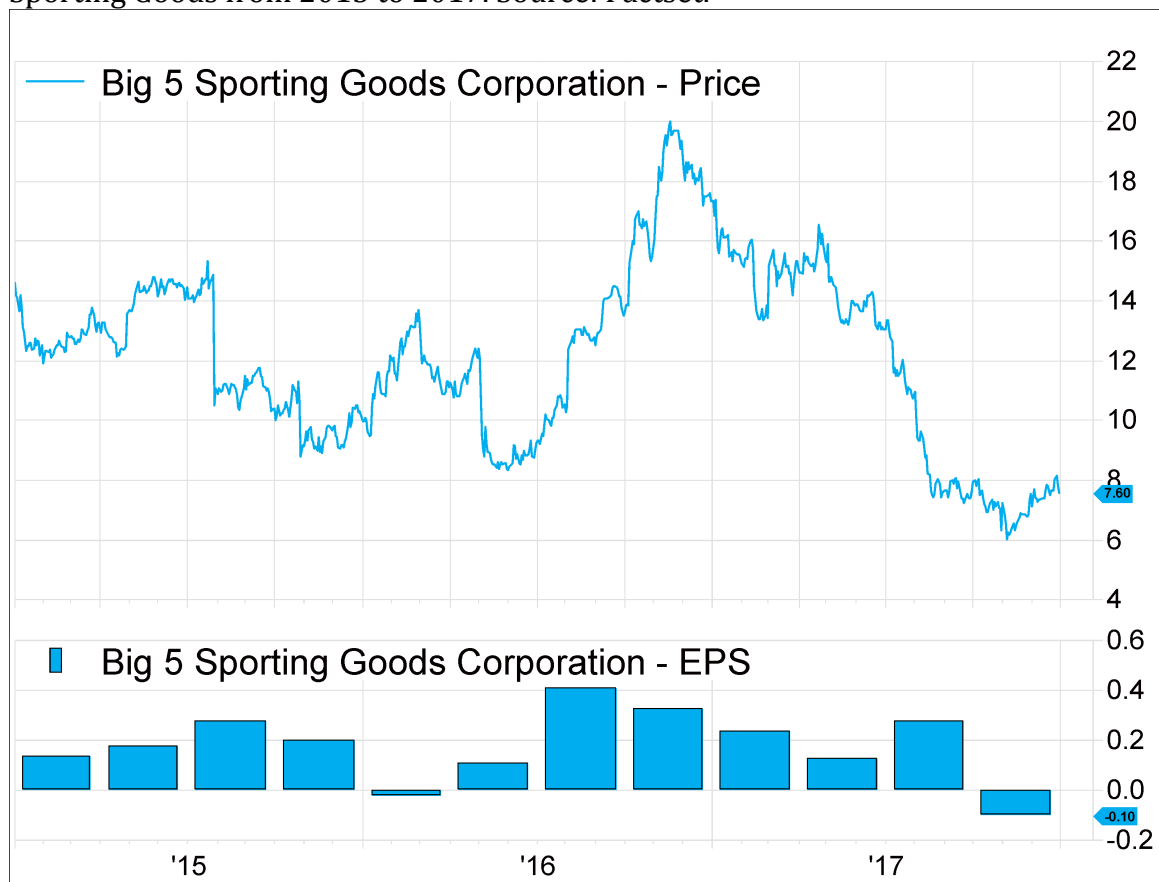
“Given the challenging and competitive retail environment, we are pleased to have retained a significant portion of the market share gains that we achieved following last year's competitor store closures in our markets. While our third quarter same store sales declined from the prior year, we achieved two-year stacked quarterly same store sales growth for the period of 3.8%. For the third quarter, same store sales in our hardgoods category declined in the mid-single-digit range, reflecting the continued reduced demand for firearm-related products, and same store sales in our apparel and footwear categories were slightly down.”

We now can now understand why Big Five had high valuation ratios and strong momentum in late 2016 and early 2017. The closure of Sports Authority and Sports Chalet provided a brief respite for Big Five. But Big Five's longer run outlook was less rosy. Just like the well-known story of 'buggy whip' manufacturers at the advent of the automobile industry, Big Five is operating in an industry that is increasingly obsolete. Figure 2 illustrates how the closure of Sports Authority and Sports Chalet boosted Big Five's EPS (bottom panel) and stock price (top panel). Big Five's EPS has a strong seasonal component, but you can readily see how EPS in the final two quarters of '16 and the first two quarters '17 grew over the same quarters in the previous year. But you can also see how this growth was short lived and a pattern of secular year-over-year declines set in for the last two quarters of 2017. The top panel shows how price increased by over 100% in response to the growing earnings in the last two quarters of 2016, but then reversed all the gains in 2017 as the growth in earnings proved short-lived.

We can now see why the quants saw Big Five as such an attractive investment starting in late 2017. Big Five already looked cheap using simple valuation ratios because of its poor long-term growth prospects. The strong results in the third quarter caused by the unexpectedly abrupt closure of its competitors sparked a stock price rally, with the stock price doubling between July and November. This made Big Five look like a great momentum stock, and so the multi-factor quants piled in. Figure 3 shows the ownership trends for the top holders of Big Five as of 3/31/2017. The top 25 holders as of 3/31/2017 had increased their ownership

from just 40% at 9/30/2016 to over 70% by 12/31/2016 and over 80% by 3/31/2017. But as momentum petered out in the second half of 2017, these same investors started dumping the stock, taking their ownership down to 50% by the end of 2017. A good illustrative example is Numeric Investors, a well-known quantitative investor that increased its ownership from 0% at 9/30/2016 to over 5% at 12/31/2017 and back down to less than 1% by the end of 2017.

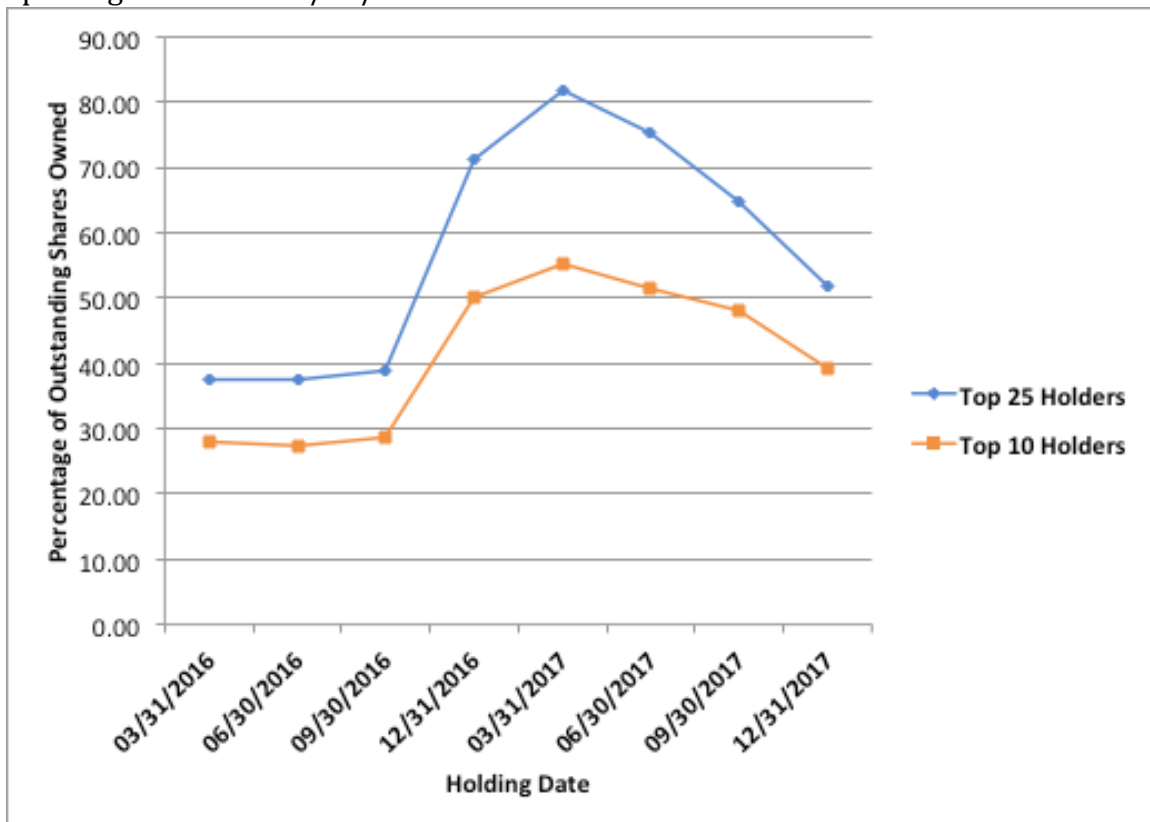
Figure 2. Graph of Stock Price and Quarterly Earnings Per Share (EPS) for Big Five Sporting Goods from 2015 to 2017. Source: Factset.



We have yet to talk about Big Five’s solid ‘quality’ ratios - its high return on equity and low leverage. Why didn’t these ratios alert quants to the fundamental shortcomings of Big Five? Let’s start with return on equity. If Big Five operated in such an unprofitable industry, why was its accounting rate of return a relatively solid 8.4% for 2016? Part of the reason was that Big Five had some temporary pricing power due to the sudden exit of its major competitors. But another reason is what fundamental analysts refer to as the ‘old plant trap’. Big Five was in a mature and declining business, so the amortized cost of its property, plant and equipment (PP&E) significantly understated its original cost. To put this in perspective, Big Five’s book value of PP&E at the end of 2016 was \$78M (i.e., net PP&E), but the original cost of this equipment was \$319M (i.e., gross PP&E). Moreover, since many of these costs were incurred years ago, the replacement costs are likely to be even

higher. We can approximate Big Five’s economic rate of return on equity by adding accumulated depreciation to the book value of equity.<sup>18</sup> Doing so causes the return on equity to drop by more than half to 3.9%. Thus, it appears that even in the temporarily favorable retailing environment of 2016, Big Five was not generating a very good economic rate of return.

Figure 3. Aggregate Ownership Trends for the Top Institutional Holders of Big Five Sporting Goods as at 3/31/2017. Source: Factset.



We next turn to Big Five’s extremely conservative debt-to-equity ratio. One might initially think that Big Five’s main assets would be all the prime West Coast real estate on which its stores are built. But if this was the case, why hasn’t Big Five availed itself of any mortgage debt to finance its real estate? Any good retail analyst will immediately know the answer to this question. Like most other retailers, Big Five uses operating leases to finance its retail store sites. The PP&E that we talked about in the last paragraph is mostly furniture, equipment and leasehold improvements. The good fundamental analyst should immediately identify these

<sup>18</sup> I acknowledge that this is a rough approximation that is made here for ease of exposition. The more technically correct approach would be to restate Big Five’s accounts using economic (i.e., sinking fund) depreciation. While this alternative depreciation method produces a periodic return on equity that is more economically meaningful, it is not a generally accepted accounting principle. The generally accepted accounting principles (straight-line and accelerated depreciation) are conservative, causing accounting rates of return to initially understate their economic counterparts, with this effect subsequently reversing for firms with aging asset bases.

operating leases as a form of off balance sheet financing and adjust the debt to equity ratio for the constructive capitalization of the future minimum non-cancelable lease payments. Doing so increases Big Five's debt-to-equity ratio from 0.065 (high top quartile) to 1.500 (close to bottom quartile).

The Big Five case illustrates several pitfalls of the generic multi-factor approach to investing. First, the use of value factors entails similar problems to those we saw in the Whiting case and explained by Kok et al. (2017). Cheap valuation ratios typically identify firms that are in secular decline and are prone to deteriorating fundamentals. Second, screening on momentum doesn't necessarily eliminate firms that are in secular decline. Even these firms experience occasional periods of outperformance due to the exit of competitors or other unexpected short-term shocks. Finally, accounting measures of quality, such as the accounting rates of return and leverage ratios, are subject to potentially severe accounting distortions. The old plant trap is a classic example and it is particularly pernicious for multi-factor quant screens, as it boosts the accounting rate of return for mature firms in secular decline. The exclusion of operating lease obligations from leverage ratios is another classic example of how accounting ratios can distort economic reality. My students often question whether there are any investors that are fooled by such transparent accounting gimmickry. I offer quant funds using simple debt to equity ratios as a measure of quality as proof that there are.

Fortunately, the U.S. accounting rules are about to change to incorporate the constructive capitalization of most operating leases. This is a good example of how improved accounting can reduce accounting distortions and so protect investors who rely on simple ratios. Perhaps one day, the accounting rules will even embrace economic depreciation. But in an ever-changing and increasingly complex business world with ever-present opportunistic managers, I don't see the day when accountants will solve the problem of determining intrinsic valuation and render fundamental analysts obsolete.

## **Conclusions and Implications**

Advances in quantitative finance have produced many benefits. These include:

1. Lowering the cost of information processing.
2. Facilitating the detection of systematic errors in security pricing.
3. Facilitating the construction of low risk portfolios.
4. Facilitating the design and pricing of complex financial instruments that can enhance risk sharing.

While acknowledging these benefits, I argue that the focus on quantitative finance has also had negative side effects. Foremost among these is decreased focus on

fundamental analysis in security selection. An important role of capital markets is the efficient allocation of scarce resources. For capital markets to perform this role effectively, the marginal investors must have good estimates of the intrinsic value of the underlying securities. Popular quantitative approaches either ignore intrinsic value or use naïve estimates of intrinsic value.

How did we get here? The original paradigm in quantitative finance embraced the idea that prices were already very close to reflecting intrinsic value. Since attempts to estimate intrinsic value were unlikely to uncover significant mispricing, the topic was not judged to be a worthy of significant academic inquiry. Popular textbooks and ‘investments’ courses have embraced this paradigm and pay little attention to fundamental analysis. More recently, academics in quantitative finance have identified numerous ‘anomalies’, whereby certain accounting ratios have shown a relation to future stock returns. These measures are increasingly being used to construct investment strategies that appeal to fundamental analysis, with labels such as ‘value’ and ‘quality’ and they claim to offer superior investment performance. The current situation has many parallels to the pre-Graham and Dodd era, whereby investors are fixating on superficial accounting ratios and overlooking the importance of detailed fundamental analysis.

This brings me to my main conclusions:

1. Good fundamental analysis is essential for the effective functioning of capital markets and the efficient allocation of resources.
2. Good fundamental analysis requires information that allows investors to assess the amount, timing and uncertainty of the future cash flows on an investment.
3. Good fundamental analysis requires analysts with a wide set of business skills who can effectively analyze and synthesize both qualitative and quantitative information.

Let me briefly discuss each of these in turn. First, fundamental analysis is much more than just another investment technique. Unlike technical analysis and multi-factor quantitative models, the ultimate goal of fundamental analysis is to forecast the future cash flows and hence the intrinsic value of a security. It is only through sound fundamental analysis that capital markets can function effectively and facilitate the efficient allocation of resources. Some finance academics have dismissed fundamental analysis on the grounds that it is not an easy path to ‘beating the market’. My response here is that there are no easy paths to beating the market. The early days of quantitative finance may have uncovered some systematic inefficiencies, but these are now well known and unlikely to persist. Fundamental analysis, however will endure. The returns to fundamental analysis should follow the basic principles of any competitive market. Good fundamental analysts, just like any good MBA graduate, should earn a premium in the labor market. Like any other

market, the market for fundamental analysts may experience temporary demand and supply imbalances, but I expect that there will continue to be a healthy long-run premium for the well-trained and industrious fundamental analyst. Being such a fundamental analyst in today's environment includes keeping abreast of the latest innovations in quantitative finance. But the ultimate goal continues to be good estimates of intrinsic value.

My second conclusion is that good fundamental analysis requires information that helps investors determine the amount, timing and uncertainty of the future cash flows on a security. The language here may sound familiar, because I have borrowed it from the FASB's Concept Statement Number 1 on the objectives of financial reporting by business enterprises. What I am saying here is that good fundamental analysis requires good financial reporting. The disclosure and capitalization of operating lease payments that I discussed earlier is a good example. As accounting and finance academics, I don't think we should take the position that markets are already so efficient that we should not concern ourselves with the state of financial reporting. Instead, I think we should strive to improve financial reporting so that markets can become even more efficient. There is considerable evidence in the accounting literature that improvements in financial reporting lead to reductions in the cost of capital. One thing that I have always found surprising here is that the development of these improvements is often left to relatively small bodies with limited funding, such as The FASB and IASB. I think that there is a huge opportunity for the academic community to play a larger role in helping to craft financial reports that enable investors to generate better forecasts of future cash flows.

My final conclusion is that good fundamental analysis requires analysts with a broad set of business skills who can effectively synthesize both quantitative and qualitative information. A good fundamental analyst needs a good knowledge of finance, accounting, economics, strategy, marketing and operations just for starters. More importantly, a good fundamental analyst needs to be able to integrate the combined knowledge from these different fields to generate good forecasts of future cash flows. How many of us who teach in accounting and finance can even claim to have such skills? Quantitative skills, like the ability to harness 'big data' are increasingly important, but so are qualitative skills, such as being able to identify good managers and strategies and being able to communicate with managers, suppliers and customers. The good news here is that most of us teach in business schools where we strive to provide our students with just such a mix of skills. Nevertheless, I think that there is still a big opportunity for us as educators and researchers to deliver courses and conduct research that better integrates insights across disciplines.

Let me close by emphasizing that as accounting academics, we are in the prime position to capitalize on the opportunities identified above. We have the unique skillset required to produce better financial reporting systems and to train better fundamental analysts. If we are successful, we should significantly enhance the

functioning of capital markets and increase the efficiency with which resources are allocated. Accounting isn't just debits and credits after all.

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