

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 many decades, 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’. I argue that Graham and Dodd’s recommendations continue to have merit. 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 informative financial reporting and comprehensive fundamental analysis are essential for the efficient functioning of capital markets.

Keywords: Fundamental analysis, Quantitative investing, Market efficiency.

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I. INTRODUCTION

I have spent much of my career teaching students how to interpret financial statements. A key lesson I impress on students is that they should not make financial decisions based solely on a handful of financial ratios. Instead, they should conduct a thorough analysis of the underlying business and carefully analyze the extent to which the accounting numbers reflect economic reality.¹

Accounting textbooks are replete with examples of how accounting principles can distort economic reality. The requirement to expense most investments in research and development is a case in point. In other cases, managers must choose between accounting methods that can poorly reflect economic reality. Examples include different inventory cost flow assumptions and different long-lived asset depreciation and amortization methods. Finally, many accounting numbers require substantial judgement and estimation. Examples include the allowance for loan losses on receivables and the liability for employee postretirement benefit obligations.

These examples should sound familiar to anyone that teaches a user-oriented 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 strategies. These strategies typically select securities using a few financial ratios, often in conjunction with mathematical portfolio optimization techniques. Recent changes have been so profound that the *Wall Street Journal* recently proclaimed that ‘The Quants Run Wall Street Now’.²

Quantitative investing strategies are often referred to as ‘rules-based’ strategies. A common example is the construction of a portfolio of stocks with high book-to-market ratios. The benefits of such strategies are well documented. These rules-based strategies can quickly select securities from a large investment universe, while the traditional fundamental analyst can typically analyze only 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. Finally, the past performance of quantitative strategies can be objectively verified using backtests.

These benefits 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. Moreover, once the rules used by quantitative investment strategies become well known and widely implemented, it is hard to understand how they can provide superior investment performance in competitive markets. My goal in this

¹ I provide some specific examples illustrating how accounting numbers can distort economic reality in section V.

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

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 benefits of quantitative investing, but argue that the simple and well-known rules-based strategies that increasingly dominate today's investing landscape are not good substitutes for 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.³ The history of fundamental analysis can be traced back at least as far as Graham and Dodd (1934). This book, published in the aftermath of the stock market crash of 1929, warned investors against speculative 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.⁴ 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 financial reports underlying an investment and identify inadequate or incorrect data as a principal obstacle to the success of the analyst, recognizing that:

“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, covering such topics as special items, depreciation, amortization and unconsolidated subsidiaries. It is instructive to note that many of the accounting issues covered by Graham and Dodd have since been revisited in corporate scandals including WorldCom, Enron and Valeant Pharmaceuticals.

³ 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.

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

The techniques of fundamental analysis advocated by Graham and Dodd were broadly embraced by the investment community and helped to plant the seeds from which the financial analyst profession grew.⁵ 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 formed 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 8,000 in 1963 to over 135,000 today.

By the 1970s, fundamental analysis was the dominant approach to investing. The CFA curriculum incorporated a strong focus on fundamental analysis, industry giants such as Fidelity 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 as a basis for providing investment recommendations and financial forecasts to investors.

The gradual shift away from fundamental analysis and toward quantitative investing began with developments in academia including modern portfolio theory (see Markowitz, 1952), the capital asset pricing model (see Sharpe 1964 and Lintner 1965), the efficient market hypothesis (see Fama, 1970) and option pricing theory (see Black and Scholes 1973). One of the earliest challenges to fundamental analysis 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]

Grossman and Stiglitz (1980) subsequently pointed out a subtle limitation of this line of thinking. They reasoned that because fundamental analysis is costly, prices cannot perfectly reflect available information, since if they did, fundamental analysts would

⁵ 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.

receive no compensation. In other words, markets should have just enough mispricing that fundamental analysts receive a normal level of compensation for their services. Despite this reasoning, some popular textbooks on investing embrace the efficient markets hypothesis as a justification for sidelining fundamental analysis. For example, the description of Bodie, Kane and Marcus (2017), one of the standard textbooks for business school courses on investing, states:

“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.”⁶

Table 1, which compares the number of chapters focusing on certain investment topics in Graham and Dodd (1934) versus Bodie, Kane and Marcus (2017), illustrates the shift away from financial statement analysis and toward more recent academic insights in finance. In noting this shift, I 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. Table 1 simply illustrates that investment texts increasingly assume that prices largely reflect fundamentals and use this assumption as a starting point for introducing certain academic theories on investing.⁷

Table 1. Summary of Selected 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 often not a requirement for either a doctorate in finance or teaching a course on investments. To fill this void, many accounting

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

⁷ While Graham and Dodd (1934) could not cover topics developed after publication, it does anticipate some such topics. For example, it contains a section on ‘discrepancies between price and value’, which includes a forerunner of the Shiller CAPE ratio market timing strategy. It 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’.

departments now offer courses covering fundamental analysis and the associated textbooks are increasingly authored by accounting faculty.⁸ Academic accounting journals are also home to a large body of research on fundamental analysis.⁹

III. A BRIEF HISTORY OF QUANTITATIVE INVESTING

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 in this section draws on Kok, Ribando and Sloan (2017), which provides a history of formulaic value investing and documents its limitations. As I describe in more detail below, formulaic value investing was the earliest and is currently the most prominent form of quantitative equity investing.

Quantitative investment strategies first began appearing with some regularity in the 1990s, though their growth can be traced to the 1960s, and particularly the development of the Center for Research in Security Prices (CRSP) database at the University of Chicago. CRSP provides a comprehensive panel of stock return data that facilitates the quantitative analysis of investment strategies (e.g., backtests). Early work using the CRSP database supported the view that stock markets are generally efficient, with stock prices fully reflecting publicly available information (Fama, 1970). Gradually, however, anomalies emerged, suggesting future stock returns could be predicted using publicly available information. Some of the most prominent anomalies were based on accounting data including the earnings-to-price ratio, the book-to-market ratio and accounting accruals. Moreover, these anomalies could be rationalized as systematic, albeit naïve, applications of fundamental analysis. For example, investing on 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 accompanied by the introduction of ‘style’ or ‘factor’ indices. Russell Investments introduced the first style indices in 1987, 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 suitable 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. Russell subsequently 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, included S&P, MSCI and CRSP followed suit, providing their own value and growth indices using their own methodologies.

⁸ Examples include Palepu and Healy (2012), Penman (2012), Holthausen and Zmijewski (2013), Lundholm and Sloan (2017) and Easton et al. (2018).

⁹ Penman (1992) provides an early and complementary discussion of the limitations of ‘modern finance’ and outlines a framework for research on fundamental analysis.

While these indices were initially created to provide benchmarks for evaluating active portfolio managers, funds replicating the indices soon emerged. Vanguard introduced the first value and growth index funds in 1992. The 1994 prospectus describes the investment objectives of the Vanguard Value Portfolio 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 beginnings, index-based value funds proliferated and are rapidly overtaking their actively managed counterparts in the value-investing arena. Moreover, the informational materials associated with these funds increasingly identify them as vehicles for investing in potentially underpriced stocks (see Kok et al., 2017).

Following the popularity of index-based value strategies, indices were created to track the performance of other prominent anomalies discovered in the academic literature. Prominent examples include indices tracking momentum and quality. These indices are often 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.

Table 2. Measures Used to Construct a ‘Quality Factor’ by Three Major Index Producers. (+) means a higher value signifies higher quality, while (-) means a higher value signifies lower quality.

Index Producer	Measures of Quality
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 (+)

The quality factor is something of a catchall for various anomalies based on accounting data. Table 2 summarizes the implementation of the quality factor for nonfinancial stocks by three major index producers. All producers include a variant of accounting return on investment in their indices. 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 producers include measures of leverage, with high leverage representing lower quality. FTSE Russell includes accruals and change in asset turnover, 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 free cash flow margin, which also aims to mitigate the impact of balance sheet bloat on earnings-based performance measures. Finally, MSCI includes earnings variability and Fidelity includes cash flow stability, with lower variability and high stability representing higher quality. Investment funds tracking quality indices have proliferated; a

search on First Bridge using the term ‘quality’ revealed over 30 quality-based ETFs.¹⁰ The largest of these is the iShares Edge MSCI USA Quality Factor ETF, with over \$4.5B under management as of April 2018.

The latest innovation in index-based factors is multiple factor investing, which is intended to provide exposure to several factors in one index. The most popular family of these indices is the ‘MSCI Diversified Multiple-Factor’ family, which aims to maximize exposure to four factors – Value, Momentum, Quality and Low Size. The most popular ETF product in this space is the iShares Edge MSCI Multifactor USA ETF, with about \$1B under management as of April 2018.

My discussion of quantitative investing thus far has focused on index-based products. These represent just the tip of the iceberg. The majority of investment managers using rules-based quantitative strategies employ their own proprietary strategies. Some of the largest managers in this space are 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 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 proclaimed ‘The Quants Run Wall Street Now’.

IV. A PERSPECTIVE ON QUANTITATIVE INVESTING

The histories of fundamental analysis and quantitative analysis illustrate how approaches to investing have come 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 of a handful of quantitative factors, such as book value and earnings, and recommended that investors undertake a thorough fundamental analysis to determine intrinsic value. With the advent of the efficient markets hypothesis (EMH), investors were encouraged to assume that prices reflect intrinsic value and to concentrate on forming appropriately diversified portfolios. This led to the popularity of indexing. Subsequently, research on the EMH uncovered various anomalies, whereby 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, the characteristics underlying these anomalies have been used to create investment products labeled ‘factors’ and ‘smart betas’. Monikers are attached to these factors to associate them with fundamental analysis, such as ‘value’ and ‘quality’ and they are marketed as strategies designed to yield superior investment performance.

This brings us back to Fama’s (1965) comments on investing in efficient markets. Can today’s markets be so inefficient that investing based on simple and well-known financial ratios can systematically identify mispriced securities? Kok et al. (2017) address this issue directly in the case of formulaic value investing strategies, such as strategies based on the book-to-market ratio. For U.S. equities, they find no compelling evidence to

¹⁰ See <http://www.firstbridgedata.com/>. The search was conducted in April 2018.

support the outperformance of the book-to-market strategy. They find that the backtest results supporting the outperformance of the book-to-market strategy are primarily driven by the underperformance of small cap growth stocks. But these backtests ignore lending fees and other impediments to arbitrage that are particularly pronounced for small cap growth stocks. Thus, Kok et al. question whether these returns are realizable in practice.

If formulaic value strategies do not identify temporarily underpriced stocks, what are they identifying? Kok et al. show that these strategies identify securities with temporarily high accounting numbers. For example, a strategy of buying stocks with high book-to-market ratios 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 do not capture economic reality on a timely basis. It is for similar reasons that Graham and Dodd (1934, p.17) dismissed investing on book value as ‘almost worthless’. I provide a case study on Whiting Petroleum in the next section to illustrate this phenomenon.

Proponents of quantitative investing have responded to the limitations of formulaic value strategies by including other factors, such as the quality and momentum factors mentioned earlier (e.g., Asness et al. 2015). On the face of it, this seems like a good idea. The major shortcoming of simple valuation ratios is that they tend to be high for companies with deteriorating financial performance that has already been incorporated in price, but not yet reflected in the accounting numbers. Supplementing valuation ratios with momentum and quality factors should help to weed out such companies. But the same basic question remains. To the extent such strategies are now well known, easy to implement and readily available, why should they consistently generate superior investment performance in competitive markets?

We can shed some evidence on this question by examining the history of an index 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 investing on this combination of factors has provided a higher return than the return on the overall market. For example, between November 1998 and the February 2015 launch date of the index, backtests indicated that the index impressively outperformed the broader market. Yet since its launch date, outperformance has waned.¹¹ Moreover, much of the backtest outperformance comes from the earlier part of the backtest period. Only time will tell how well these indices perform, but the early evidence suggests their out of sample performance doesn’t live up to the backtests. Some readers may wonder what fundamental insights are missed by these multiple-factor indices. How could a portfolio of small cap stocks with low valuations, high quality and strong price momentum not be a good investment? I will provide a case study on Big Five Sporting Goods in the next section to illustrate how such a strategy can miss important fundamental insights.

¹¹ This statement is based on performance through the end of April 2018.

Quantitative investment strategies are usually backed by impressive backtest performance. Yet there are three reasons to be skeptical of backtest results as indicators of future performance. I discuss each in turn:

Data Mining (p-Hacking)

We typically see only backtests that ‘worked’, in the sense of providing significant evidence of return predictability. If researchers conduct hundreds 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 suggests that this has been a serious problem in finance and that many of the ‘anomalies’ 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 a well-documented and easily replicable investment strategy to generate consistently superior performance is competition. My own work on the ‘accruals’ strategy in Sloan (1996) is an example. The strategy involves buying stocks with high cash flows but low earnings and selling stocks with low cash flows but high earnings. The idea behind the strategy is that the cash component of earnings is more persistent than the accrual component of earnings, but that investors tend to fixate on earnings and ignore information in cash flows. The strategy was initially successful in forecasting future stock returns. Since publication, the cash component of earnings has continued to be more persistent than the accrual component of earnings, but the strategy has become less effective in predicting future stock returns (see Green, Hand and Soliman, 2011). The fact that the cash component of earnings continues to be more persistent suggests the original idea had fundamental merit and was not just data mining. What seems to have happened is that as the strategy became widely known and exploited, its ability to predict future stock returns deteriorated. Pontiff and MacLean (2016) provide evidence that the performance of trading strategies published in academic journals declines in the years after the publication date.

Implementation Costs

Backtest results ignore many real-world costs and frictions involved in exploiting an investment strategy, particularly so for trades in small and illiquid securities. The price impact that would have resulted from additional trades is one potentially large but difficult to quantify cost. Lending fees 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 small cap growth stocks. They show that these stocks can be difficult and expensive to short sell in practice, issues that are given little consideration in typical backtests. It is also worth noting that the owners of these stocks can lend them to short sellers and collect the lending fee. This fee represents income generated by the stock in much the

same way as dividends represent income generated on dividend-paying stocks. Yet backtests typically include dividend income but exclude lending income.

I close this section by summarizing my perspective on quantitative investing. First, quantitative tools have undoubtedly improved the ability of investors to identify and exploit systematic market inefficiencies. Quantitative tools can be used to complement fundamental analysis and they are particularly helpful in identifying and exploiting investors' systematic behavioral errors. The key drawback of quantitative investing strategies is that once they are well known and readily accessible at low cost, competition should limit their effectiveness in generating superior investment performance.

V. CASE STUDIES

In the previous section, I argue that rules-based quantitative investment strategies can overlook important fundamental insights. In competitive markets, sophisticated investors conducting fundamental analysis should uncover these insights, causing them to be reflected in security prices. Consequently, quantitative investment strategies may mistakenly identify such securities as good investment opportunities.

In this section, I present 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 shift of energy stocks from 'growth' indices in 2014 to 'value' indices in 2015.¹² Whiting's book-to-market ratio rose above two in 2015. But this had little to do with price falling below intrinsic value. Instead, 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, that rose to the top of generic 'multiple-factor' investment strategies at the beginning of 2017. This case illustrates how multiple-factor quantitative strategies can miss fundamental insights with important implications for intrinsic value.

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 its proven reserves of oil and gas. Table 3, which summarizes Whiting's financial position from 2013 through 2016, shows 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 2015.¹³ This was accompanied by

¹² This shift is discussed in <http://www.ftserussell.com/files/press-releases/ftse-russell-announces-preliminary-lists-2015-russell-indexes-reconstitution>.

¹³ Pursuant to FASB and SEC rules, the commodity price used in the year-end standardized measure is based on the unweighted arithmetic average of the first-day-of-the-month price for each month of the fiscal year. This is why the standardized measure peaks at the end of 2014 even though oil prices had already begun their tumble by then.

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 declined to \$55 by the end of 2014 and \$34 by the end of 2015.

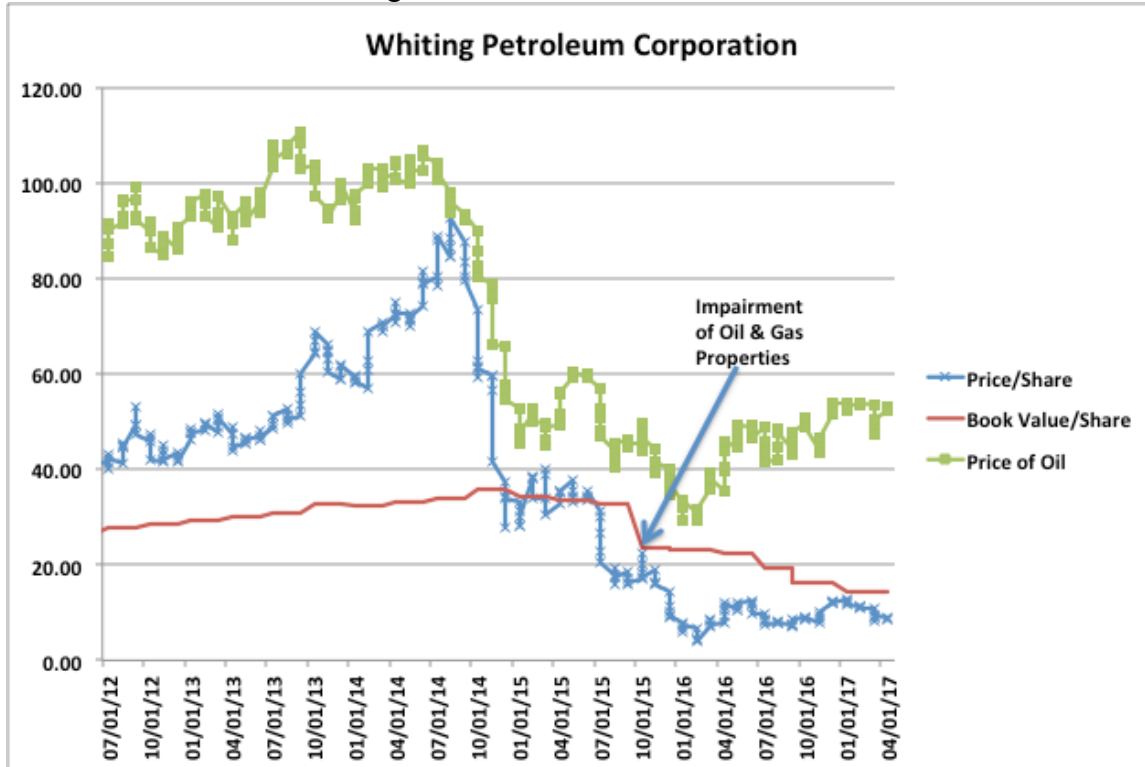
Table 3. Summary Information on Whiting Petroleum’s Year-End Financial Position From 2013 to 2016. All Amounts Except Proved Reserves in \$Millions. Source: Factset.

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 is its proven reserves and that Whiting was highly levered, 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 moved in lock step with the price of oil, Whiting’s book value exhibited a much more muted response. Whiting did not record an impairment to its oil and gas properties until the third quarter of 2015, and that impairment amounted to only 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, with a decline to about 1.0 immediately after the write-down.

Those familiar with the accounting for oil and gas properties should realize what happened. 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 low book-to-market ratio. This has nothing to do with Whiting being overpriced. It arises simply because the accounting rules do not reflect the fair value of Whiting’s oil and gas properties.

Figure 1. Price/Share and Book Value/Share for Whiting Petroleum versus the Price for a Barrel of Oil from 2012 through 2017. Source: Factset.



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. The condition for impairment is that the undiscounted recoverable cash flows from the oil and gas properties fall below the carrying value. Once this condition 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 often exceeds 10 years, there is typically a large difference between the undiscounted future cash flows and the discounted future cash flows. Thus, the accounting system has a built in lag, causing impairments to be delayed until the recoverability test is breached, at which time a large ‘catch up’ impairment is typically recorded.

The Whiting case study highlights two pitfalls of using the book-to-market ratio to identify mispriced stocks. First, accounting rules typically require nonfinancial assets to be recorded at a value no higher than amortized cost. For companies holding appreciated assets, book value will understate fair value. Examples where this situation may arise range from the discovery of a lucrative oil field to the development of a popular smart phone. The second pitfall is that even when the fair value of an asset drops below its book value, an accounting impairment may not be required. Moreover, any impairment will typically occur with a significant lag to the decline in fair value, because many long-lived assets are not required to be impaired until their book values drop below their recoverable (i.e., undiscounted) future cash flows. Moreover, considerable management discretion is usually 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.¹⁴

Case Study 2: Big Five Sporting Goods

Big Five Sporting Goods is a sporting goods retailer operating in the Western United States, primarily through a 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 eight financial ratios popular in multiple factor models. Viewed from this perspective, Big Five is firing on all cylinders, ranking above the median on all eight metrics. It has a rare combination of a high valuation ratios, strong momentum and high quality. It is not surprising then, that Big Five was popular with 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. 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.¹⁵

With high valuation ratios, strong momentum and high quality, what is not to like about Big Five? Something apparently, since while the quants were buying, two other groups of investors were selling. First, the short position in Big Five soared from less than 5% of the shares outstanding in early 2016 to almost 50% of the shares outstanding by March 2017. Secondly, Stadium Capital Management, Big Five's largest pre-existing stakeholder, sold its entire 13% stake between June 2016 and March 2017. Stadium Capital is a hedge fund with a traditional concentrated value investing philosophy that conducts detailed fundamental analysis on its holdings.

¹⁴ See Ramanna and Watts (2012) and Li and Sloan (2017).

¹⁵ 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 virtue of its size and actually holds an underweight in Big Five. The other investors all hold significant overweights in Big Five. Of the remaining investors, Principal, Millennium 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 known 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 had overweights in Big Five at 3/31/2017.

Table 4. Financial Ratios for Big Five Sporting Goods versus Investment Universe at 3/31/2017. Ratios Use Prices at 3/31/2017 and Financial Statements for the 2016 Fiscal Year. The Factset U.S. Market Index Represents the Investment Universe. All Data Sourced from Factset. Better than Median; Worse than Median.

Ratio:	Associated Factor	Big Five Sporting Goods	Universe Lower Quartile	Universe Median	Universe Upper Quartile
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
Operating Cash Flow-to -Price	Value	0.222	0.041	0.070	0.110
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
Accruals to Assets	Quality	-0.129	-0.084	-0.047	-0.013
Market Capitalization	Low Size	333	550	1,620	5,143
Restated Ratio					
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 leases using a 5% discount rate and assumes amounts due beyond 5 years are spread uniformly over the subsequent 5 years.

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

Name	Position (000)	% Outstanding	% Index
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 have the quants outsmarted the shorts and fundamental investors or vice-versa? It turns out that a rather superficial fundamental analysis of Big Five reveals significant insights. Bricks 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 peaked at 439 in 2014 and was down to 432 by the end of 2016. Two of Big Five's main competitors had been even less fortunate. The Sports Authority and the Sports Chalet both filed for bankruptcy in early 2016 and 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.”

Another factor benefitting Big Five in the third quarter of 2016 was the pending US election. The Democratic candidate, Hillary Clinton, was generally 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 new 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 the 2017 third quarter earnings announcement.

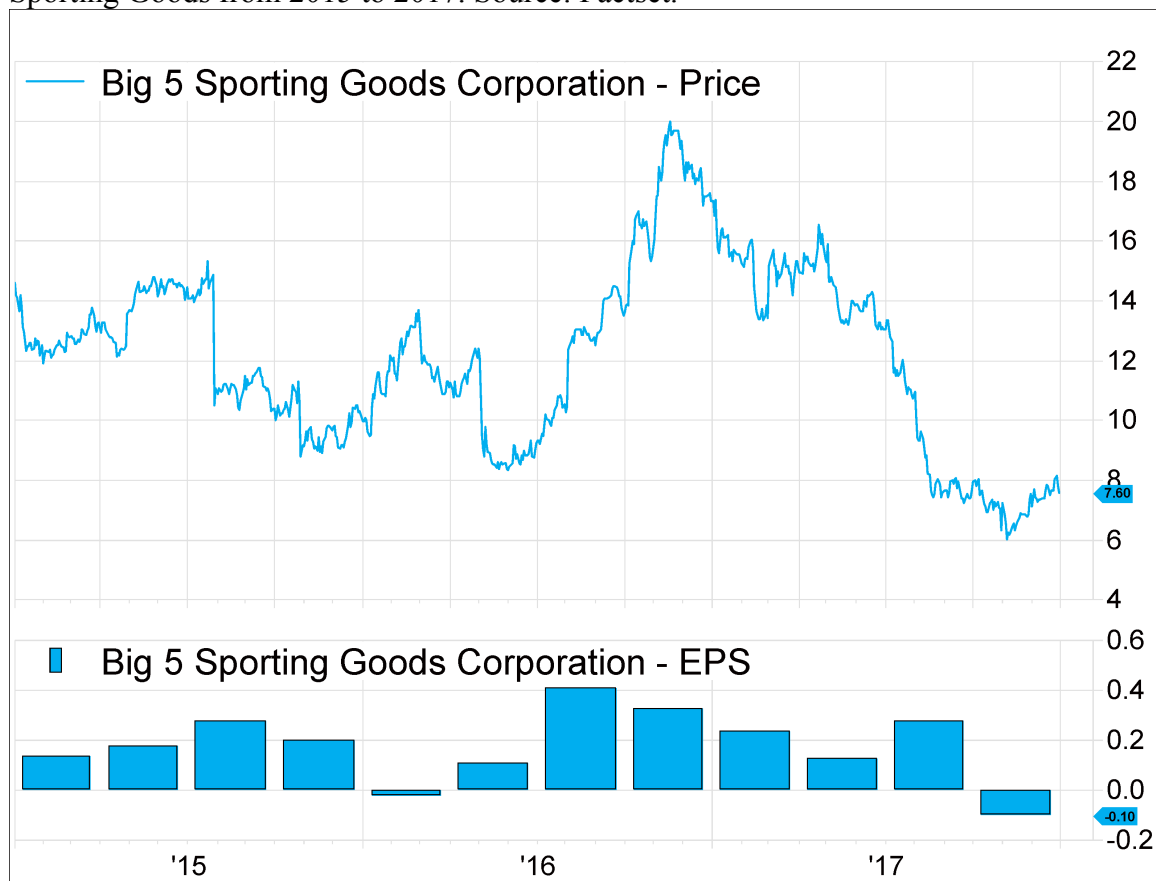
“Given the challenging and competitive retail environment, we are pleased to have retained a significant portion of the market share gains that we achieved following last year's competitor store closures in our markets. While our third quarter same store sales declined from the prior year, we achieved 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.”

This brief analysis explains 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 respite for Big Five, but its longer run outlook was less rosy because it

was operating in a declining industry. 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 2016 and the first two quarters 2017 grew over the same quarters in the previous year. 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 Big Five's price increased by over 100% in response to the growing earnings in the last two quarters of 2016, then reversed all the gains in 2017 as the growth in earnings proved short-lived.

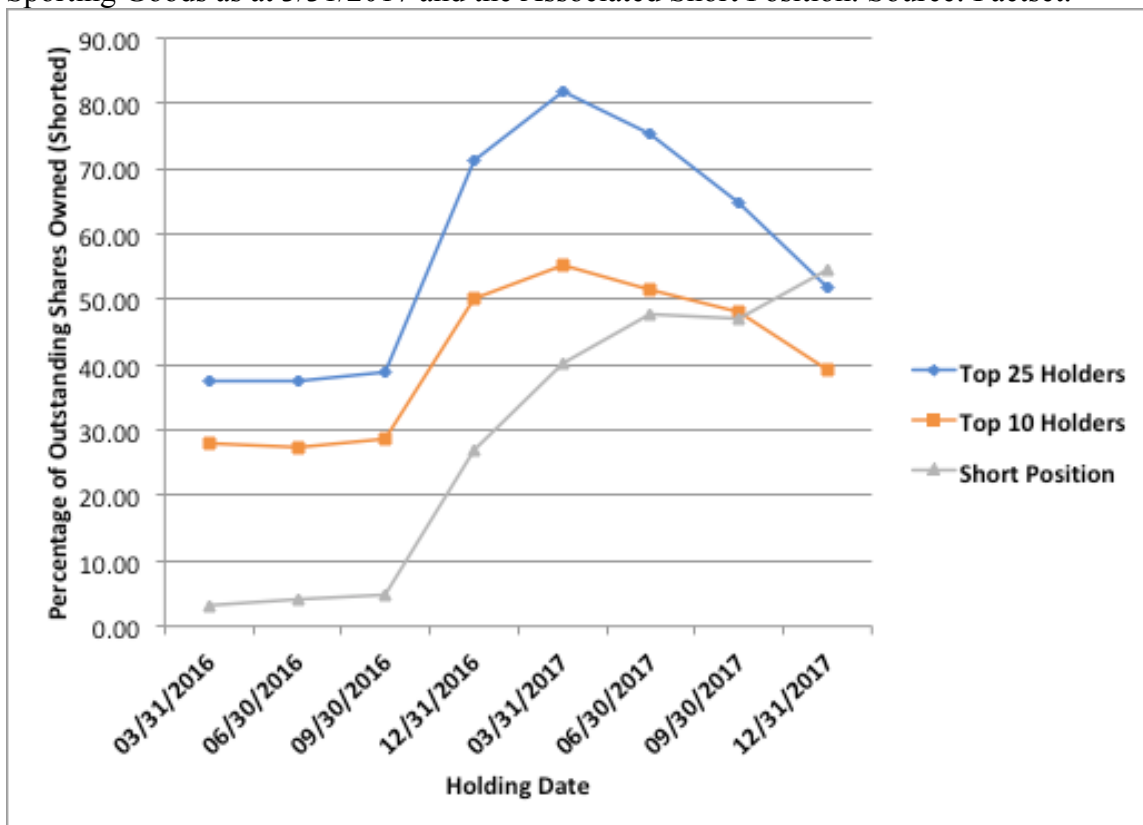
Figure 3 illustrates how quantitative investors bought shares in Big Five as performance temporarily improved, and then sold the shares as the secular decline set back in. This figure plots the ownership trends for the top holders of Big Five as of 3/31/2017, which was the point in time that quantitative investors dominated ownership. 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. Figure 3 also shows that short sellers supplied most of these shares. But as sales slowed and stock price momentum petered out in the second half of 2017, these same investors started selling the stock, reducing their ownership to about 50% 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, low leverage and large negative accruals. Why didn’t these ratios alert quants to Big Five’s fundamental shortcomings? Let’s start with return on equity. If Big Five operated in a struggling industry, why was its accounting rate of return a relatively solid 8.4% for 2016? Part of the reason was that Big Five had 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 cost of Big Five’s PP&E is likely to be even higher than the gross PP&E. We can approximate Big Five’s economic rate of return on equity by adding accumulated depreciation to the book value of equity.¹⁶ 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. If it were to open new stores, the economic return on the new investment would be much lower.

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



¹⁶ I acknowledge this is a rough approximation made here for ease of exposition. The more technically correct approach would be to restate Big Five’s accounts using sinking fund depreciation.

With regard to Big Five's extremely conservative debt-to-equity ratio, one might think Big Five's main assets would be all the prime West Coast real estate on which its stores are built. If so, 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 many other bricks and mortar retailers, Big Five uses operating leases to finance its retail store sites. The PP&E discussed in the last paragraph is mostly furniture, equipment and leasehold improvements. The fundamental analyst will identify these 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).

Finally, we turn to Big Five's large negative accruals. The negative accruals reflect the fact that Big Five's operating cash flow of \$73.7M was substantially higher than its net income of \$16.9M. This high cash flow also caused Big Five's operating cash flow to price valuation ratio to be very high in 2016. But is this increased cash flow sustainable and is it a leading indicator of future earnings? In this case, it turns out that some rudimentary fundamental analysis suggests not. The primary reason for the high cash flow was an unusually large increase in the ending balance of accounts payable. As Big Five explains in the management discussion and analysis section of its 2016 Form 10-K:

“The increase in cash provided by operating activities ... was due primarily to the timing of payments for purchases of merchandise inventory, which resulted in an increase in accounts payable.”

The increase in accounts payable was a consequence of Big Five's unexpectedly high sales in the fourth fiscal quarter of 2016 that caused it to replenish inventory late in the quarter. The late timing of these inventory purchases meant that Big Five didn't have to pay for the inventory until the beginning of the next fiscal year, even though much of the inventory had been sold by year-end. As such, it was just a temporary timing difference in the payout of the cash rather than a sign of permanently higher cash flow or higher future earnings.

The Big Five case illustrates several pitfalls of the generic multi-factor approach to investing. First, as in the Whiting case, the use of value factors leads to false inferences along the lines explained by Kok et al. (2017). Cheap valuation ratios typically identify firms with temporarily high fundamentals. Second, screening on momentum doesn't necessarily eliminate firms with deteriorating fundamentals. Even these firms experience occasional periods of outperformance due to the exit of competitors or other short-term shocks. Finally, accounting quality measures, such as high accounting rates of return, low leverage ratios and low accruals, can overlook important fundamental insights. The old plant trap is a classic example and it is particularly pernicious for multi-factor quants 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 example of how accounting ratios can distort economic reality. And limitations of cash flows as a measure of periodic performance are the reason why accrual accounting was developed in the first

place. My students often question whether investors overlook such fundamental insights. I offer quality factor funds as prime examples.

Fortunately, accounting rules are about to change to require the constructive capitalization of most operating leases. This is a good example of how improved accounting rules can better reflect economic reality and so protect investors who rely on simple accounting ratios. In the meantime, I expect that quantitative investors will continue to adapt their strategies to adjust for well-known accounting distortions. But in an ever-changing and increasingly complex business world, I don't think we will soon see the day when accountants and quantitative investors will render traditional fundamental analysis obsolete.

VI. CONCLUSIONS AND IMPLICATIONS

Advances in quantitative finance have produced many benefits including lowering the cost of information processing, facilitating the detection of certain systematic errors in security pricing, facilitating the construction of low risk portfolios and 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 effects, particularly a 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, marginal investors must have good estimates of the intrinsic values of the underlying securities. Popular quantitative approaches to investing employ naïve estimates of intrinsic value.

How did we get here? The original paradigm in quantitative finance embraced the idea that prices were already 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 backtests have uncovered relations between certain accounting ratios and future stock returns. These accounting ratios are increasingly being used to construct investment strategies that appeal to fundamental analysis, with labels such as 'value' and 'quality' and are claimed to offer superior investment performance. The current situation parallels the pre-Graham and Dodd era, whereby investors fixate on simple accounting ratios and overlook the importance of detailed fundamental analysis.

This brings me to my main conclusions:

1. Comprehensive fundamental analysis is essential for the effective functioning of capital markets and the efficient allocation of resources.
2. Comprehensive fundamental analysis requires information to help investors assess the prospects for the future net cash inflows to an entity.

3. Comprehensive 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. Comprehensive fundamental analysis enables capital markets to function effectively and facilitates the efficient allocation of resources. Some finance academics have dismissed fundamental analysis on the grounds that it does not offer an easy path for '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. Well-trained fundamental analysts, just like well-trained MBA graduates, 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 there will continue to be a healthy long-run premium for the well-trained and industrious fundamental analyst. Being a good fundamental analyst in today's environment includes taking advantage of innovations in quantitative finance. But the ultimate goal continues to be good estimates of intrinsic value.

My second conclusion is that comprehensive fundamental analysis requires information to help investors assess the prospects for the future net cash inflows to an entity. The language here may sound familiar, because I have borrowed it from the FASB's *Statement of Financial Accounting Concepts No. 8* on the objectives of financial reporting (see OB3 on p. 2). As accounting and finance academics, I don't think we should adopt the position that markets are sufficiently efficient that we need not concern ourselves with making financial reports more useful to investors. 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 in this respect is that the development of these improvements is often left to relatively small bodies with relatively limited funding, such as The FASB and IASB. I think that there is an opportunity for the academic community to play a broader role in helping to design financial reports that enable investors to generate better forecasts of future cash flows.

My final conclusion is that good fundamental analysis requires analysts with broad business skills who can effectively synthesize both quantitative and qualitative information. A good fundamental analyst needs a sound 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.

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 sound business 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 from across these related disciplines.

Let me close by emphasizing that as accounting academics, we are in a strong position to capitalize on the opportunities identified above. We have the unique skills required to improve financial reporting and to train fundamental analysts. If we are successful, we should significantly enhance the functioning of capital markets and increase the efficiency with which resources are allocated. After all, accounting isn’t just debits and credits.

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