Facts about Formulaic Value Investing

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Forthcoming, *Financial Analysts Journal*

Abstract:

The term 'value investing' is increasingly being adopted by quantitative investment strategies that use ratios of common fundamental metrics (e.g., book value, earnings) to market price. A hallmark of such strategies is that they do not involve a comprehensive effort to determine the intrinsic value of the underlying securities. We document two facts about such strategies. First, there is little compelling evidence that such strategies deliver superior investment performance for U.S. equities. Second, instead of identifying undervalued securities, these strategies systematically identify firms with temporarily inflated accounting numbers. We argue that these strategies should not be confused with value strategies that employ a comprehensive approach to determine the intrinsic value of the underlying securities.

Keywords: Value Investing; Book Value; Earnings; Intrinsic Value; Accounting Artifices.

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Value investing is one of the most popular and enduring styles of investing. The idea that investors should buy securities that represent good value has obvious appeal. Yet the term 'value investing' is increasingly being associated with quantitative investment strategies that use ratios of common fundamental metrics (e.g., book value or earnings) to price. Proponents of these strategies claim that they provide a simple and effective way to achieve superior investment performance (e.g., Lakonishok, Shleifer, and Vishny 1994; Chan and Lakonishok 2004).

Such investment strategies sound like easy wins for investors, but our analysis reveals a less favorable assessment. The "value" moniker creates the impression that these strategies identify temporarily underpriced securities. But the strategies do not use a comprehensive approach to identify temporarily underpriced securities and have systematically failed to do so.

Our findings can be summarized as follows:

1. We found little compelling evidence that a strategy of buying US equities that seem underpriced in light of simple fundamental-to-price ratios provides superior investment performance. The evidence does indicate that small-cap stocks that seem expensive given such ratios have underperformed. Such stocks, however, are relatively capacity constrained, illiquid, and costly to borrow, so the opportunity to exploit these lower returns in practice is unclear.

2. Instead of identifying underpriced securities, simple ratios of accounting fundamentals to price identify securities for which the accounting numbers used in the ratios are temporarily inflated.

    a. The book-to-market ratio systematically identifies securities with overstated book values that are subsequently written down.

    b. The trailing-earnings-to-price ratio systematically identifies securities with temporarily high earnings that subsequently decline.

    c. The forward-earnings-to-price ratio systematically identifies securities for which sell-side analysts offer relatively more optimistic forecasts of future earnings.

We conclude that quantitative investment strategies based on such ratios are not good substitutes for value-investing strategies that use a comprehensive approach in identifying underpriced securities.

A Brief History of Value Investing

The history of value investing is generally traced to *Security Analysis*, the classic text on the subject by Benjamin Graham and David Dodd (1934). In this book, Graham and Dodd advocate the purchase of stocks that are trading at a significant discount to intrinsic value. In doing so, they are careful to eschew a formulaic approach to the determination of intrinsic value. On the issue of investing by using the book-to-market ratio, they state:

> Some time ago intrinsic value (in the case of a common stock) was thought to be about the same thing as "book value," *i.e.*, it was equal to the net assets of the business, fairly priced. This view of intrinsic value was quite definite, but it proved almost worthless as a practical matter because neither the average earnings nor the average market price evinced any tendency to be governed by book value. (p. 17)

Similarly, on the issue of using earnings, they caution that:

> we must, therefore, utter an emphatic warning against exclusive preoccupation with this factor in dealing with investment values. (p. 351)

adding:

> But these earnings per share, on which the entire edifice of value has come to be built, are not only highly fluctuating but are subject also in extraordinary degree to arbitrary determination and manipulation. (p. 352)

Instead, Graham and Dodd (1934) recommend moving beyond reliance on simple fundamental metrics to gain a more complete understanding of the underlying security's intrinsic value. To that end, they suggest that the value investor use the following three-step process:

- The value investor should identify discrepancies between price and intrinsic value.
- The intrinsic value of a security is determined by its future earnings power.
- Future earnings power should be determined on the basis of a careful analysis of both quantitative and qualitative factors.

Graham and Dodd (1934) summarize their approach as follows:

> 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's comprehensive approach to value investing prevailed for about the next 50 years. The reversion to reliance on pricing multiples began to gain traction again in the 1980s. A key catalyst for change was the introduction of computers and the associated development of financial databases, particularly the database of the Center for Research in Security Prices (CRSP).

CRSP was established at the University of Chicago in 1960 for the purpose of introducing the first comprehensive stock market database. Academic research based on the CRSP database initially supported the view that security markets are largely efficient (see Fama 1970). By the 1980s, however, a large number of "anomalies" had emerged. Prominent examples included significant relationships between future stock returns and stocks' market capitalizations, leverage ratios, book-to-market ratios, and earnings-to-price ratios (see Fama and French 1992).

By the 1990s, the term *value investing* started to be used to describe mechanical investment strategies based on simple ratios of accounting numbers to stock prices. Lakonishok et al. (1994) is a watershed academic study. To quote the first two sentences of that paper:

> For many years, scholars and investment professionals have argued that value strategies outperform the market (Graham and Dodd 1934 and Dreman 1977). These value strategies call for buying stocks that have low prices relative to earnings, dividends, historical prices, book assets, or other measures of value. (p. 1541)

As previously explained, Graham and Dodd (1934) did not in fact advocate buying stocks solely on the basis of such ratios, eschewing a purely statistical approach to value investing. Nevertheless, the label stuck, and many academics began equating ratio-based investing with value investing. For example, Fama and French (1998) referred to stocks with high book-to-market ratios as "value stocks."

Practitioner use of the value moniker to describe investment strategies based on simple ratios has closely paralleled developments in academia. Until the 1980s, the term was generally reserved for investment strategies seeking to identify discrepancies between price and intrinsic value, along the lines suggested by Graham and Dodd (1934). Investors who were recognized for using a comprehensive approach in determining the intrinsic values of securities (e.g., Warren Buffet) were characterized as value investors.

A watershed event for practitioners of value investing occurred in 1987, when Russell Investments introduced the first style indexes. These indexes, initially referred to as the "price-driven index" and the "earnings growth index," were designed to benchmark the performance of portfolio managers who invest in particular subsets of the market. The initial construction of the indexes is described in Haughton and Christopherson (2009, p. 294):

> Price-driven managers focus on the price and value characteristics of a security in the selection process. These investors buy stocks from the low price portion of the market, and are sometimes called *value* or *defensive/yield* managers.

Haughton and Christopherson (2009) considered a number of valuation ratios and fundamental variables in deciding how to construct the Russell Price-Driven Index, ultimately settling on the exclusive use of the book-to-market ratio. Haughton and Christopherson did not claim that the Russell Price-Driven Index identified underpriced securities. The Russell Price-Driven Index was subsequently renamed the Russell 1000 Value Index, and growth variables were incorporated into its construction. In the years since, other index providers have developed their own "value" indexes using various combinations of fundamental-to-price ratios. The fundamental variables currently used by the major index providers to construct their value indexes are summarized in Table 1.

These value indexes initially served as benchmarks for investment managers using traditional value-investing techniques. But soon, quantitative investment funds relying primarily on such ratios began adopting the value moniker. An early example is the Dimensional Fund Advisors US Large Cap Value Portfolio. Begun in 1993, the fund described its investment strategy as follows (see the 1994 Annual Report of DFA Investment Dimensions Group, Inc., p. 10):

> The portfolio seeks to capture return premiums associated with high book-to-market ratios by investing in the U.S. Large Cap Value Series of the DFA Investment Trust Company, which in turn invests on a market cap weighted basis in companies that are approximately $500 million or larger in market cap and have book-to-market ratios in the upper 30% of publicly traded companies.

Today, such products are ubiquitous. The two largest investment funds with "value" in their name are Vanguard's Value Index Fund, with $44 billion in assets, and BlackRock's iShares Russell 1000 Value ETF, with $31 billion in assets.[1] The Vanguard Value Index Fund tracks the performance of the CRSP US Large Cap Value Index, and the product summary includes the statement that "these stocks may be temporarily undervalued by investors." BlackRock's iShares Russell 1000 Value ETF tracks its namesake index, and the fund's fact sheet states that it provides "exposure to companies that are thought to be undervalued by the market relative to comparable companies."[2] In short, the practice of value investing is rapidly reverting to the pre–Graham and Dodd era, with many value strategies relying on a few fundamental-to-price ratios rather than on a comprehensive effort to determine the intrinsic values of the underlying companies.

The Performance of Formulaic Value Investing

Despite the current popularity of formulaic value-investing strategies, the evidence supporting the outperformance of formulaic value is not very compelling. Loughran (1997) first made this point 20 years ago, when he conducted a detailed examination of the investment performance of the book-to-market ratio and concluded:

> In the largest size quintile of all firms (accounting for 73% of the total market value of all publicly traded firms), book-to-market has *no* significant explanatory power on the cross-section of realized returns during the 1963–1995 period. Thus, book-to-market as such would have less importance to money managers than the literature would have led us to believe. (p. 249)

More recently, Asness, Frazzini, Israel, and Moskowitz (2015) reached a similar conclusion about the performance of standalone formulaic value strategies. Recent research has also shown that the performance of book-to-market and other formulaic value strategies in the United States has become weaker since their initial publication (see Asness et al. 2015; Fama and French 2016; McLean and Pontiff 2016) and that the excess returns to formulaic value strategies are concentrated in small, high-growth stocks with significant short-sales constraints (see Nagel 2005; Beneish, Lee, and Nichols 2015).

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[1]We restricted our analysis to investment funds registered under the Investment Company Act of 1940. The amounts
[2]The information about the investment strategies of both the Vanguard Value Index Fund and the iShares Russell 1000 Value ETF was retrieved from the two funds' websites on 14 November 2016.

In our study, we began our analysis of formulaic value investing by replicating and extending the findings of Asness et al. (2015); Exhibit 5 in their paper examines the performance of the Fama–French value factor that is based on the book-to-market ratio. We obtained our data from Ken French's website[3] and report our results in Table 2. We followed Asness et al. (2015) in reporting results for the full 1926–2015 period, along with subperiod analyses for 1926–1962, 1963–1981, and 1982–2015.[4] The 1963–1981 period is the original period for which the performance of the value factor was initially documented in large-sample backtests (see Rosenberg, Reid, and Lanstein 1985). The 1926–1962 period captures the backfilled data that were subsequently examined in Davis, Fama, and French (2000). The 1982–2015 period represents the experience since the performance of the value factor was initially documented. We also included the more recent 2002–2015 period in the final row of Table 2 because that is the period we used for our subsequent analysis of mean reversion in formulaic value ratios.[5]

The Fama–French value factor is based on a two-by-three sort of US common stocks available in the CRSP database. The two-way sort is based on the median NYSE breakpoint for market capitalization (BIG versus SMALL), whereas the three-way sort is based on the book-to-market ratio using the 30th and 70th percentiles of NYSE stocks (LOW, MEDIUM, and HIGH). Capitalization-weighted returns are computed for each of the six resulting portfolios. HML BIG measures the return on the BIG/HIGH portfolio less the return on the BIG/LOW portfolio; this portfolio represents the performance of the value factor in large-cap stocks. Similarly, HML SMALL measures the return on the SMALL/HIGH portfolio less the return on the SMALL/LOW portfolio, representing the performance of the value factor in small-cap stocks. HML is the simple average of HML BIG and HML SMALL. Note that by equally weighting HML BIG and HML SMALL, HML assigns small-cap stocks a much greater weighting than they would receive in a cap-weighted portfolio.

To aid in understanding the source of the returns to the Fama–French value factor, we also report the returns on four additional factors: HMM BIG, LMM BIG, HMM SMALL, and LMM SMALL. HMM BIG measures the return on the BIG/HIGH portfolio less the return on the

[3] The website URL is http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.
[4] Our data extend through October 2015, whereas the data in Asness et al. (2015) end in July 2014. Thus, our results differ slightly from those reported in Asness et al.
[5] In our subsequent analyses, we used annual return cumulation periods that begin in April 2002 and end in March 2015. Thus, we conducted this associated analysis using returns from April 2002 to March 2015.

BIG/MEDIUM portfolio, whereas LMM BIG measures the return on the BIG/LOW portfolio less the return on the BIG/MEDIUM portfolio. These two factors allow us to understand whether the returns to HML BIG arise from going long the HIGH stocks or going short the LOW stocks. HMM SMALL and LMM SMALL do the same thing for small caps.

Table 2 reports market model alphas for the resulting portfolios. The first result to note is that the alpha for HML is largest (6.47%/year) over 1963–1981, the period for which Rosenberg et al. (1985) initially documented the value premium. This result is quite robust, with all portfolios except LMM BIG showing evidence of a statistically significant value premium. Outside this period, however, the evidence for a value premium is weak to nonexistent. There is no evidence of a significant value effect in the 1926–62 period. This result may come as a surprise to many readers because Davis et al. (2000) analyzed a similar period and concluded that there is a reliable value premium in returns. The two sets of results can be reconciled by noting that Davis et al. reported the average return to the HML portfolio, whereas we report the average one-factor alpha for HML. It turns out that the HML portfolio has a beta of 0.37 over this period (unreported), and so the average returns documented by Davis et al. are explained by exposure to the market factor. There is, however, evidence of a value premium in the more recent 1982–2015 period, with an annual alpha of 5.21% for HML, which further inspection reveals is primarily attributable to HML SMALL. This finding led Asness et al. (2015, p. 45) to conclude that "there is no strong stand-alone value premium among large caps. Perhaps there never was."

Note also that the premium to HML SMALL falls, becoming insignificant in the more recent 2002–15 period, perhaps because of increased investor awareness of the historical value premium and/or reductions in arbitrage costs.

In the last two columns of Table 2, the HML SMALL alpha is further decomposed into the alpha from going long the HIGH stocks (HMM SMALL) and short the LOW stocks (LMM SMALL). As can be seen, the small-cap value effect is driven primarily by the underperformance of LMM SMALL. Outside the 1962–81 period for which the value premium was initially documented, there is no significant evidence of a value premium for high book-to-market stocks.

Providing further evidence on the practical significance of the value premium, Table 3 reports summary statistics for the portfolios underlying the results in Table 2. Of particular interest are the characteristics of the SMALL/LOW portfolio, which has been primarily responsible for driving the value premium since 1981. The first fact to note from Panel A of Table 3 is that this portfolio averages only 3% of total stock market capitalization, which seems insufficient to support claims of a healthy value effect in US equities. The second fact to note is that it includes a large number of small-cap securities. Thus, any attempt to exploit this effect at scale would have faced significant liquidity constraints and transaction costs.

Panel B of Table 3 reports the average estimated loan fee for these securities, which is an estimate of the annual rate that the owner (short seller) of the security would receive (pay) for lending (borrowing) the stock. The fee is significantly larger for the LOW/SMALL securities that drive the value premium, averaging 2.8% a year. This result suggests that sophisticated market participants are already aware that these securities are overpriced. Frictions in the lending market, however, prevent full arbitrage. Note that the stock return data from CRSP include dividend income but not lending income. Thus, the hypothetical returns to the HML factor reported in Table 2 would have been lower after incorporating lending income/fees. Relatedly, an investment strategy of buying everything except the LOW/SMALL stocks forgoes the lending income that a passive holder of the LOW/SMALL stocks could collect. Blocher and Whaley (2016) provides direct evidence that lending income is particularly high for small-cap and growth ETFs. In summary, at least so far as US equities are concerned, we see no compelling evidence to support the claim that a strategy of investing in stocks with high book-to-market ratios has provided healthy outperformance.

Thus far, we have considered only a formulaic investment strategy based on size and book-to-market ratios. What about the performance of formulaic strategies using other valuation ratios, such as the earnings-to-price ratio? Note that data-snooping biases become a concern once we open the door to considering any possible combination of multiple fundamental variables. With this consideration in mind, one convenient way to assess the performance of different implementations of formulaic value investing is to consider the performance of the "value versions" of the indexes offered by the major index providers and outlined in Table 1. These indexes use a variety of different ratios and weighting schemes, with each provider having established the basic methodology some time ago, thus offering some out-of-sample evidence on the performance of different approaches to multiples-based investing.

Table 4 summarizes the performance of each of the four value indexes relative to their broad index counterparts for various periods through the end of 2015. Despite the fact that the indexes use a variety of fundamentals and weighting schemes, the results are remarkably consistent. The value indexes have provided returns that are very similar to, and typically slightly lower than, those of their blended counterparts—and with similar risk. As a result, the value indexes have similar Sharpe ratios. Again, there is no compelling evidence to support the healthy outperformance of ratio-based value investing.

What Does Formulaic Value Really Identify?

If investing on the basis of fundamental-to-price ratios does not identify underpriced securities, what *does* it identify? The theory behind value investing using fundamental-to-price ratios is straightforward. The fundamental measure in the numerator reflects the intrinsic value of the security, and the price in the denominator tells us how much we must pay to buy the security. A high ratio thus identifies a relatively "cheap" security. If the price reverts to the intrinsic value, the former should rise, causing the security to outperform. So, how did the theory fail in practice? We can answer this question by decomposing changes in these ratios.

Before introducing the formal decomposition, let's first consider the two reasons why a relatively high fundamental-to-price ratio could revert to the mean.

1. The price could increase, which is what advocates of ratio-based investing have in mind when they recommend using these ratios as a form of value investing.

2. The fundamental metric could decrease, which is what Graham and Dodd (1934, p. 20) had in mind when they warned about "accounting artifices which it is the function of the capable analyst to detect." In such cases, the security was never really cheap. Instead, other investors had already figured out that the fundamental metric was temporarily inflated and set the price accordingly.

It is also possible that a high ratio could stay high (see Beaver and Morse 1978). Depicting what typically occurs, Figure 1 plots the average annual mean reversion in three common fundamental-to-price ratios. The three fundamentals are book value (the book value of common stockholders' equity at the most recent fiscal year-end), trailing earnings (basic earnings per share before extraordinary items and discontinued operations for the most recent fiscal year), and forward earnings (the mean sell-side analyst forecast of EPS for the current fiscal year). Our sample includes all companies in the Russell 3000 Index on 1 April of each year from 2002 to 2014. We measure each of the ratios annually as of 1 April, using the price on that date and the fundamental data from the last available annual report (for book value and trailing earnings) or the latest available consensus forecast of earnings for the current fiscal year (for forward earnings). All data are sourced from Factset, and each of the ratios is winsorized at the 1% tails.

Ratio-based investment strategies, such as the index strategies listed in Table 1, typically rebalance their holdings at least annually. Figure 1 provides evidence on the extent to which each of the ratios reverts over the subsequent year. In Figure 1, all companies in the Russell 3000 are ranked on each ratio on 1 April for each year from 2002 to 2014. Companies are then assigned to quintiles in each year on the basis of the resulting ranks. Companies in the highest quintile of the ratio in a given year are assigned to the first quintile. This quintile thus captures the supposedly cheap securities. For reference purposes, the average ratios for the lowest quintile of stocks (the "expensive" securities) and collectively for the middle three quintiles are tracked.

Panel A of Figure 1 plots mean reversion for quintiles formed on the book-to-market ratio. It shows that book-to-market ratios are slowly mean reverting. The cheap stocks in the high quintile have an average book-to-market ratio of 1.27 in the ranking year, which falls to 1.18 in the subsequent year. In comparison, the average book-to-market ratio for the middle stocks climbs from 0.50 to 0.55. Thus, high book-to-market ratios largely reflect long-term differences between book values and stock prices. There is, however, some modest mean reversion that must be explained by either increasing prices or declining fundamentals.

Panel B provides a similar plot for quintiles formed on the trailing-earnings-to-price ratio. It shows strong evidence of mean reversion for the cheap stocks in the high quintile. The average ratio for this quintile falls from 0.11 to 0.04, whereas the average for the middle ratios hovers around 0.03. The strong mean reversion for the high-ratio stocks must be explained by sharp increases in prices and/or sharp reductions in earnings.

Finally, Panel C of Figure 1 plots quintiles formed on the forward-earnings-to-price ratio. It offers modest evidence of mean reversion. For the cheap stocks in the high quintile, the average forward-earnings-to-price ratio falls from 0.10 to 0.08, whereas the average for the middle quintiles hovers around 0.05. Again, the mean reversion for the high-ratio stocks must be explained by increases in prices and/or reductions in forecasts of future earnings.

Having established that each of the three fundamental-to-price ratios exhibits some degree of mean reversion, we now introduce our procedure for decomposing mean reversion into price-driven reversion and fundamental-driven reversion. Denoting the fundamental variable as F and the price as P, we can write

$$F_{t+1}/P_{t+1} = (F_t/P_t)(F_{t+1}/F_t)(P_t/P_{t+1}).$$

Following Daniel and Titman (2006), we take natural logarithms and rearrange as follows:

$$\underbrace{\log(F_{t+1}/P_{t+1})}_{\text{Ending Ratio}} = \underbrace{\log(F_t/P_t)}_{\text{Beginning Ratio}} + \underbrace{\log(F_{t+1}/F_t)}_{\text{Change in Fundamental}} - \underbrace{\log(P_{t+1}/P_t)}_{\text{Change in Price}}$$

This decomposition neatly separates each ratio into a temporary component owing to changing fundamentals, a temporary component owing to changing prices, and a permanent component.[6] As noted by Daniel and Titman (2006), it is important to adjust both F and P to offset changes because of such corporate events as stock splits and dividends. As a practical matter, this adjustment is achieved by simply using the log-cum-dividend stock return for $\log(P_{t+1}/P_t)$ and then solving for $\log(F_{t+1}/F_t)$ using the beginning and ending ratios:

$$\log(P_{t+1}/P_t) = \log(1+R_{t+1})$$

and

$$\log(F_{t+1}/F_t) = \log(F_{t+1}/P_{t+1}) - \log(F_t/P_t) + \log(1+R_{t+1})$$

[6]Note that we cannot use this decomposition for securities with negative fundamentals. Negative fundamentals often occur for low-quintile stocks. This analysis is thus restricted to stocks in the top and middle quintiles. For the relatively small number of cases in which a middle-quintile stock has a negative ratio, we assign a value of –7 to the logged ratio.

Finally, to isolate the drivers of mean reversion in the fundamental-to-price ratios for top-quintile stocks versus that of middle-quintile stocks, we report the difference in the mean values of each of the three components across the two groups of stocks.[7] We also report the results of a *t*-test for the difference in means between the two groups.

Panel A of **Figure 2** depicts the decomposition of the change in the book-to-market ratio for high-quintile stocks minus that of middle-quintile stocks. The average difference in the log ratios falls from 0.92 to 0.69. The reduction is driven by a relative decline in book values for the high-quintile stocks of 0.28. In fact, the average price of the high-quintile stocks shows a relative decline of 0.05, which partially offsets the mean reversion in book value. In other words, the mean reversion for the high book-to-market ratio is completely driven by falling book values. Stocks with high book-to-market ratios are not cheap stocks; they are stocks with temporarily inflated book values.

Panel B reports the decomposition of the change in the trailing-earnings-to-price ratio for high-quintile stocks minus that of middle-quintile stocks. The average difference in the log ratios falls dramatically, from 1.33 to 0.45. The 0.88 reduction is driven by a relative decline in trailing earnings for the high-quintile stocks. The relative price change is insignificantly different from zero. Falling earnings drives all the considerable mean reversion in the high trailing-earnings-to-price ratio. Stocks with high trailing-earnings-to-price ratios are not cheap stocks; they are stocks with temporarily high earnings.

Finally, Panel C of Figure 2 reports the decomposition of the change in the forward-earnings-to-price ratio for high-quintile stocks minus that of middle-quintile stocks. The average difference in the log ratios falls from 0.71 to 0.46. The 0.25 reduction is driven by a relative decline in forward earnings for the high-quintile stocks. The relative price change is close to zero. Once again, all the mean reversion in the high forward-earnings-to-price ratio is driven by falling forecasts of earnings. Stocks with high forward-earnings-to-price ratios are not cheap stocks; they are stocks with temporarily high forecasts of earnings.

To summarize, not one of these three popular fundamental-to-price ratios has been effective in detecting temporarily underpriced stocks in our sample period. Instead, they have

[7] The 1% tails of each component are winsorized to mitigate the effect of outliers.

been very effective in identifying stocks with temporarily inflated fundamentals. The intuition underlying why these ratios detect stocks with temporarily inflated fundamentals is straightforward. Sophisticated value investors engaging in detailed fundamental analysis have presumably figured out that the fundamentals are temporarily inflated and have set prices accordingly.

Figure 3 provides additional evidence on the nature of the accounting distortions associated with high fundamental-to-price ratios by examining the subsequent financial performance of the underlying companies. The first variable examined is unusual charges incurred over the subsequent year. These charges most frequently consist of asset write-downs that are required by accounting rules when an asset's carrying value overstates its fair value. For example, following a large decline in the price of oil, many oil-producing companies would be required to write down their oil-producing assets; although because of reporting lags, accounting rules, and managerial discretion, the timing of the write-downs may lag the decline in the price of oil by a year or more.

The second variable that we report is the reduction in earnings in the subsequent year. This variable identifies situations in which earnings are temporarily high in the ranking year. The third variable is the revision in the consensus analyst forecast of the following year's EPS. Specifically, for a ratio computed on 1 April 2014, we track the change in the forecast of EPS for fiscal 2015, from 1 April 2014 through 1 April 2015. This variable reveals any staleness present in analysts' EPS forecasts at the date the ratios are computed. The fourth variable is the subsequent error in the current-year consensus EPS forecast, identifying any systematic bias in the consensus forecast.

The final variable, 'GAAP-Street Earnings', is the difference between subsequently realized EPS for the year according to generally accepted accounting principles (GAAP) versus the adjusted earnings numbers tracked by Wall Street's sell-side analysts (Street). Relying largely on the guidance of managers, sell-side analysts often omit expenses from Street earnings forecasts, causing the difference to be negative. These omitted expenses can include both nonrecurring items, such as asset write-downs, and recurring items, such as stock-based compensation expense and amortization expense (see Black and Christensen 2009). Each variable is deflated by beginning price (for per-share amounts) or market capitalization (for entity-level amounts), and the 1% tails are winsorized.

Panel A of Figure 3 plots the results for the book-to-market ratio. Stocks in the highest quintile have much larger unusual charges over the subsequent year. These are companies with overstated book values, and much of the mean reversion in the book-to-market ratios is attributable to subsequent asset write-downs. These companies have only small reductions in earnings in the subsequent year. This result is perhaps surprising because the large unusual charges should depress earnings in the subsequent year. It is explained by the fact that stocks with high book-to-market ratios tend to be distressed stocks that often have low earnings and large unusual charges in the ranking year. Stocks with high book-to-market ratios also have negative subsequent forecast revisions and forecast errors, indicating that analysts were slow to lower their estimates for these companies. Finally, GAAP earnings are subsequently much lower than Street earnings for these stocks, probably because unusual charges are frequently excluded from Street earnings.

Panel B provides a similar set of plots for the trailing-earnings-to-price ratio. The striking result from this panel is that stocks with high trailing-earnings-to-price ratios experience sharp reductions in the subsequent year's earnings. Stocks with high trailing-earnings-to-price ratios also have more subsequent unusual charges, negative forecast revisions, and negative forecast errors.

Finally, Panel C of Figure 3 plots the forward-earnings-to-price ratio. Stocks with high forward-earnings-to-price ratios have more subsequent unusual charges, negative forecast revisions, and negative forecast errors. These stocks are experiencing deteriorating financial performance that the consensus analyst forecasts are slow to reflect. They also exhibit a large negative difference between GAAP earnings and Street earnings, which indicates that the earnings numbers analysts forecast for these stocks systematically exclude a significantly larger amount of expenses.

In summary, the evidence presented in this section shows that investment strategies based on simple fundamental-to-price ratios systematically identify companies with temporarily inflated accounting numbers and earnings forecasts. The results suggest that sophisticated investors have already anticipated these accounting distortions and set prices accordingly.

The Interaction between Formulaic Value and Momentum

Quantitative investment managers often use formulaic value ratios in conjunction with other investment formulas. A popular choice is momentum, which involves overweighting stocks that have appreciated over the past year or so.[8] Momentum has a negative statistical correlation with fundamental-to-price ratios, making it a particularly suitable companion for producing attractive backtest results (e.g., Asness et al. 2015).

Our analysis aids in understanding the special interaction between formulaic value and momentum. We have already shown that investment strategies based on high fundamental-to-price ratios do not identify temporarily underpriced securities. Instead, they identify securities with temporarily inflated accounting numbers. More specifically, these strategies frequently identify securities that have recently experienced negative news that is incorporated into the stock price but not yet reflected in the accounting numbers. Conditioning on the past year's stock returns is a crude way to weed out such stocks.

Figure 4 illustrates this effect. It replicates the plots in Figure 2 after splitting the highest quintile of fundamental-to-price ratio stocks into two groups on the basis of whether the underlying stocks have experienced positive momentum (greater than median stock return over the past 12 months) or negative momentum (less than median stock return over the past 12 months). The *t*-test on each component tests for the difference in means between the positive-momentum group and the negative-momentum group. For all three of the ratios, we see that the positive-momentum group experiences significantly less mean reversion. The lower mean reversion for the positive-momentum stocks is attributable to smaller reductions in the underlying fundamentals. For the forward-earnings-to-price ratio with positive momentum (Panel C), we even see some weak evidence of mean reversion owing to price increases. To summarize, by conditioning on both a high fundamental-to-price ratio and positive momentum, we can weed out some of the stocks whose fundamentals are temporarily inflated because of a

[8]Other common measures include measures of quality and profitability (e.g., Asness et al. 2015).

delayed accounting response to deteriorating business conditions. This finding marginally improves our ability to identify underpriced securities.

Quantifying the Benefits of a More Detailed Fundamental Analysis

Our results thus far indicate that simple fundamental-to-price ratios primarily identify securities with temporarily distorted fundamentals. The results also suggest that sophisticated investors have already anticipated these temporary distortions and priced the stocks accordingly. Can a value-investing strategy that attempts to adjust for these predictable distortions yield superior returns? We answer this question by using multiple regression analysis to control for the correlation between fundamental-to-price ratios and subsequent changes in fundamentals.

Our regression analysis uses the sample and variables described earlier. To keep things simple, we focus on the book-to-market ratio. We begin by regressing future-year log stock returns on the rank of the current-year book-to-market ratio. To facilitate the interpretation of the regression coefficients, we rank stocks into deciles within each year and then score the deciles from 0 (lowest book-to-market ratio) to 1 (highest book-to-market ratio) in increments of 1/9. The resulting regression coefficients can be interpreted as the estimated hedge portfolio returns to going long the highest decile and short the lowest decile. Following Fama and MacBeth (1973), we estimate a separate regression for each year and report the means and *t*-statistics of the annual regression coefficients. Results for the regressions of future annual stock returns on the book-to-market ranks are reported in the first row of Table 5. The estimated hedge portfolio return on the book-to-market ranks is an insignificant 4.1% a year.

We next regress future-year log stock return on the rank of future-year change in log book value. We use the same decile-ranking procedure that we describe in the previous paragraph, and thus, the coefficient on the change in log book value represents the estimated hedge portfolio return to going long the top decile of change in book value and shorting the bottom decile of change in book value. Note that this approach is essentially an investment strategy that assumes perfect foresight of the change in book value and is thus not implementable in real time. The results are shown in the second row of Table 5. Not surprisingly, the strategy yields a healthy 36.1% annual hedge portfolio return.

The 36.1% return is not the maximum attainable return from perfect foresight of changes in book value. If one did have perfect foresight of such changes, one would base a trading strategy on only the *unexpected* component of the changes, which is where the book-to-market ratio can help. Recall that a high book-to-market ratio indicates that the market is anticipating a decrease in book value. By including the book-to-market rank in the regression, we can control for the expected change in book value, thus estimating the return to investing on the unexpected component of the change in book value. The corresponding estimated regression coefficient on the book-to-market rank reflects the return to investing on the book-to-market rank after controlling for the expected component of the change in book value. In other words, the coefficient on the book-to-market rank in this multiple regression provides an estimate of the hedge portfolio return that a sophisticated fundamental analyst could have obtained by adjusting the book-to-market ratio for expected changes in book value.

The results from regressing future stock returns on both the rank of the current book-to-market ratio and the rank of the future change in book value are shown in the third row of Table 5. The coefficient on the book-to-market ratio is a highly significant 17.8%, whereas the coefficient on the change in book value increases from 36.1% to 42.6%. The key takeaway from this regression is that a sophisticated fundamental analyst could have dramatically increased the return to the book-to-market strategy by adjusting for expected changes in book value. The simple book-to-market formula yields an insignificant annualized hedge portfolio return of 4.1%, whereas using book-to-market ratios adjusted for expected changes in book value yields a highly significant return of 17.8%. Thus, book-to-market ratios contain significant information about future stock returns that should be obtainable by sophisticated fundamental analysts who can back out the predictable changes in book value that are already priced into the ratio.

Conclusion

Our main contribution in this article is to demonstrate that formulaic value-investing strategies primarily identify stocks with temporarily inflated accounting numbers. These are precisely the accounting distortions that Graham and Dodd (1934, p. 20) deem the function of a capable analyst to detect. Quantitative approaches to detecting these distortions—such as combining formulaic value with momentum, quality, and profitability measures—can help in avoiding these “value traps.” A capable analyst, however, should be able to significantly enhance quantitative approaches with Graham and Dodd–style security analysis.

More generally, our results show that major securities markets are highly competitive. Over 80 years ago, Graham and Dodd (1934) argued that trading strategies based on simple valuation ratios were unlikely to generate superior investment performance. The advent of computers and financial databases has generated new interest in such strategies, thousands of which have been backtested. It is not surprising that some strategies have worked in some markets over some periods. It is also not surprising that some strategies have produced impressive backtest results in illiquid stocks with significant impediments to arbitrage. We caution against using this evidence to conclude that such strategies can deliver healthy outperformance in the future.

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Table 1.

Formulae used by major index providers to categorize equities as 'value' stocks and 'growth' stocks.

Index Provider	**Value Formulae**	**Growth Formulae**
S&P	book-to-price, earnings-to-price, sales-to-price	three-year change in earnings per share (EPS) over price per share, three-year sales per share (SPS) growth rate, momentum (12-month % price change)
Russell	book-to-price	I/B/E/S forecast medium-term EPS growth (2-year), SPS historical growth (5-year)
MSCI	book-to-price, 12-month forward earnings-to-price, dividend-to-price	long-term forward EPS growth rate, short-term forward EPS growth rate, current internal growth rate, long-term historical EPS growth trend, long-term historical SPS growth trend
CRSP	book-to-price, forward earnings-to-price, earnings-to-price, dividends-to-price, sales-to-price	forward long-term growth in EPS, forward short-term growth in EPS, 3-year historical growth in EPS, 3-year historical growth in SPS, investment-to-assets ratio, return on assets

Formulae are sourced from the respective index providers' websites.

Table 2.

Annualized alphas and associated t-statistics from monthly market model regressions using various combinations of Fama and French size and book-to-market portfolios for the full 1926-2015 period and selected sub-periods.

Sample Period		HML	HML BIG	HML SMALL	HMM BIG	LMM BIG	HMM SMALL	LMM SMALL
1926-2015	alpha	**3.52**	1.55	**5.53**	1.13	-0.42	1.35	**-3.98**
	t-statistic	***2.73***	*1.09*	***4.00***	*1.22*	*-0.44*	*1.59*	***-4.71***
1926-1962	alpha	1.32	0.14	2.50	0.58	0.44	1.03	-1.44
	t-statistic	*0.63*	*0.06*	*1.14*	*0.35*	*0.29*	*0.59*	*-1.24*
1963-1981*	alpha	**6.47**	**6.17**	**6.76**	**4.27**	-1.80	**3.15**	**-3.41**
	t-statistic	***3.15***	***2.52***	***3.15***	***2.49***	*-0.95*	***3.01***	***-2.28***
1982-2015	alpha	**5.21**	1.41	**9.15**	0.55	-0.85	1.09	**-7.43**
	t-statistic	***2.97***	*0.76*	***4.61***	*0.50*	*-0.60*	*1.34*	***-5.28***
2002-2015**	alpha	0.50	-1.63	2.68	-0.59	1.06	-0.25	-2.86
	t-statistic	*0.22*	*-0.66*	*1.06*	*-0.33*	*0.64*	*-0.18*	*-1.81*

*Original period during which research first documented a significant book-to-market premium in stock returns.

**The primary sample period used for subsequent tests in this study, spanning the months from April 2002 through March 2015.

Bold alphas are statistically significant at the 5% level.

BIG means large capitalization. SMALL means small capitalization. HML means high book-to-market minus low book-to-market. HMM means high book-to-market minus medium book-to-market. LMM means low book-to-market minus medium book-to-market.

Table 3.

Characteristics of size (BIG/SMALL) and book-to-market (HIGH/MEDIUM/LOW) portfolios, 2008–2015[*]

Panel A: Market Capitalization and Number of Securities

			Book-to-Market Group		
		Portfolio Characteristic	**HIGH**	**MEDIUM**	**LOW**
Size Group	**BIG**	% of Market Capitalization	15%	30%	45%
		Average Number of Securities	239	378	465
		Average Market Cap ($Millions)	11,543	14,265	16,877
	SMALL	% of Market Capitalization	3%	4%	3%
		Average Number of Securities	1,533	1,175	893
		Average Market Cap ($Millions)	346	553	593

Panel B: Average Estimated Loan Fee[**]

			Book-to-Market Group			
			HIGH	**MEDIUM**	**LOW**	**HML**
Size Group	**BIG**	Average Estimated Loan Fee	**0.5%**	**0.4%**	**0.5%**	0.0%
		t-statistic	***8.62***	***24.24***	***18.35***	*0.08*
	SMALL	Average Estimated Loan Fee	**1.8%**	**1.4%**	**2.8%**	**-1.0%**
		t-statistic	***32.31***	***24.67***	***29.51***	***-8.67***

[*] The sample period of 2008–2015 is based on the availability of data on securities lending from Markit. Data sourced from Factset and Wharton Research Data Services.

[**]We follow Blocher and Whaley (2016) in using the estimated simple average loan fee from Markit. Fees are measured as of the beginning of the portfolio formation period. For many securities, particularly in the early part of the sample period, Markit does not provide a simple average loan fee but does provide a "cost to borrow score" that is indicative of the fee. We thus computed an estimated loan fee by taking the average of the available loan fees for all securities having the corresponding cost to borrow score on the same date.

Bold coefficients are statistically significant at the 5% level.

Table 4.

Recent performance of broad indices versus value indices for major US index providers (all periods end in December 2015).

	10 Years			5 Years			1 Year		
	Annualized Return	Annualized Risk	Sharpe Ratio*	Annualized Return	Annualized Risk	Sharpe Ratio*	Annualized Return	Annualized Risk	Sharpe Ratio*
S&P 500	7.31%	15.10%	0.43	12.57%	11.70%	1.02	1.39%	13.67%	0.099
S&P 500 Value	6.08%	16.26%	0.32	11.55%	12.19%	0.90	-0.56%	12.85%	-0.046
Russell 3000	7.36%	15.60%	0.42	12.18%	12.08%	0.95	0.47%	13.29%	0.034
Russell 3000 Value	6.11%	16.13%	0.33	10.98%	12.27%	0.85	-4.14%	12.77%	-0.333
MSCI USA	7.32%	15.13%	0.43	12.42%	11.76%	1.00	0.84%	13.58%	0.060
MSCI USA Value	6.16%	15.36%	0.35	11.20%	11.65%	0.91	-1.94%	13.23%	-0.150
CRSP US Large Cap Index	7.43%	15.02%	0.44	12.28%	11.76%	0.99	1.11%	13.50%	0.080
CRSP US Large Cap Value Index	6.62%	15.17%	0.38	12.13%	11.45%	1.00	-0.86%	13.00%	-0.068

Performance statistics are computed by us and are based on monthly return data sourced from the respective index providers' websites.

*Sharpe Ratios are computed using excess returns relative to the 4-week US Treasury bill rate.

Table 5.

Fama-MacBeth regressions of future log stock returns on book-to-market ranking and future change in log book value ranking. Annual regressions from 2002-2014. Book-to-market ratios and future changes in log book values are transformed into decile ranks and scaled to range from 0 to 1 so that the coefficients can be interpreted as the estimated hedge portfolio returns from going long in an equal-weighted portfolio of the top decile observations and short in an equal-weighted portfolio of the bottom decile observations.

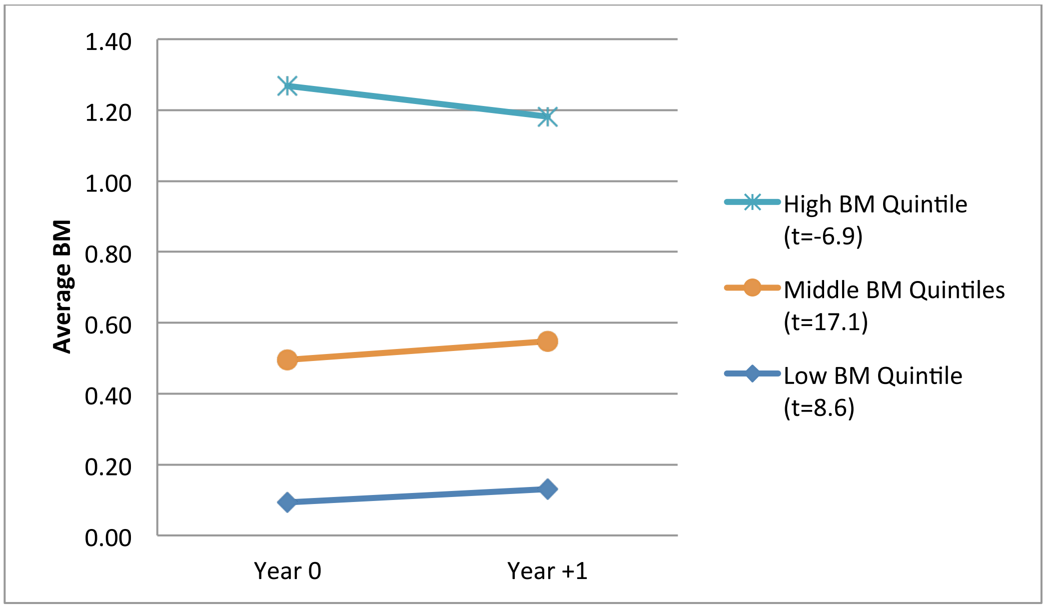
	Intercept	B/M Ranking	Future Change in Log Book Value Ranking	R-Squared
mean coefficient	-0.029	0.041		0.008
t-statistic	*-0.332*	*1.006*		
mean coefficient	-0.189		**0.361**	0.065
t-statistic	*-1.720*		***5.298***	
mean coefficient	**-0.311**	**0.178**	**0.426**	0.086
t-statistic	***-3.091***	***3.658***	***6.066***	

Bold coefficients are statistically significant at the 5% level.

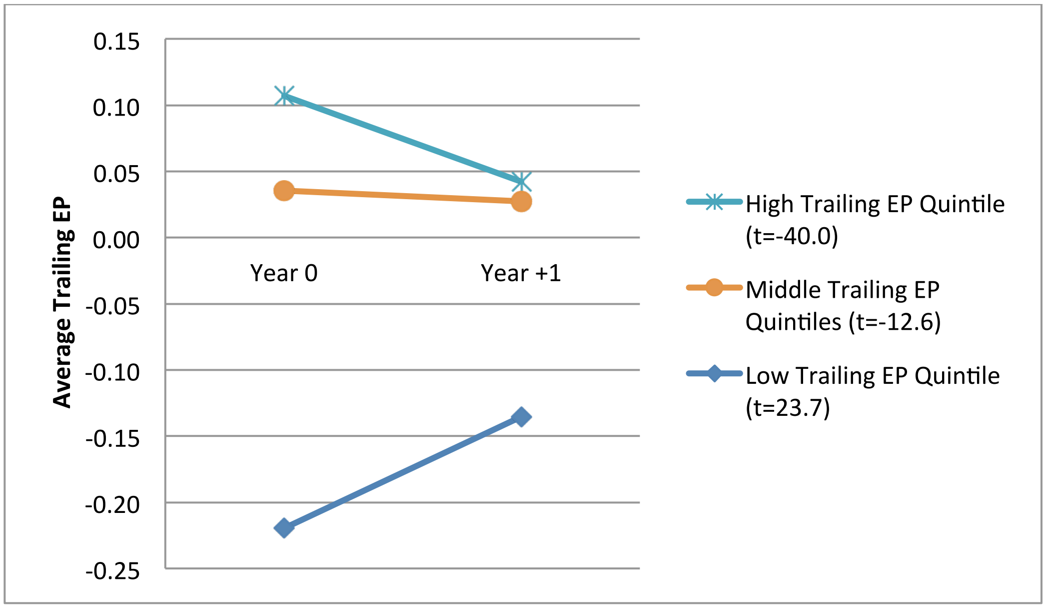
Figure 1.

This figure illustrates rates of mean reversion for fundamental-to-price ratios that are commonly used to construct formulaic value strategies. Each April from 2002 to 2014, all stocks in the Russell 3000 are sorted into quintiles based on the respective ratio. The figure plots the mean value of the ratio for various quintiles for both the sorting year (Year 0) and the subsequent year (Year +1). The t-statistics reported in the legend test the difference in means between Year +1 and Year 0.

Panel A: Average Book-to-Market Ratios for Quintiles Sorted on Book-to-Market in Year 0



Panel B: Average Trailing Earnings-to-Price Ratios for Quintiles Sorted on Trailing Earnings-to-Price in Year 0



Panel C: Average Forward Earnings-to-Price Ratios for Quintiles Sorted on Forward Earnings-to-Price in Year 0

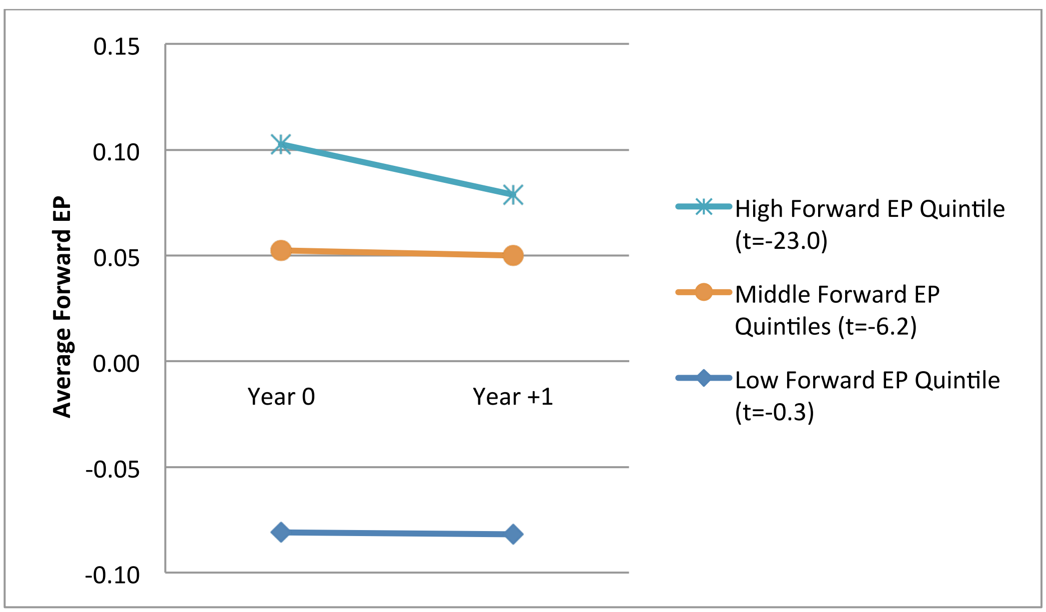
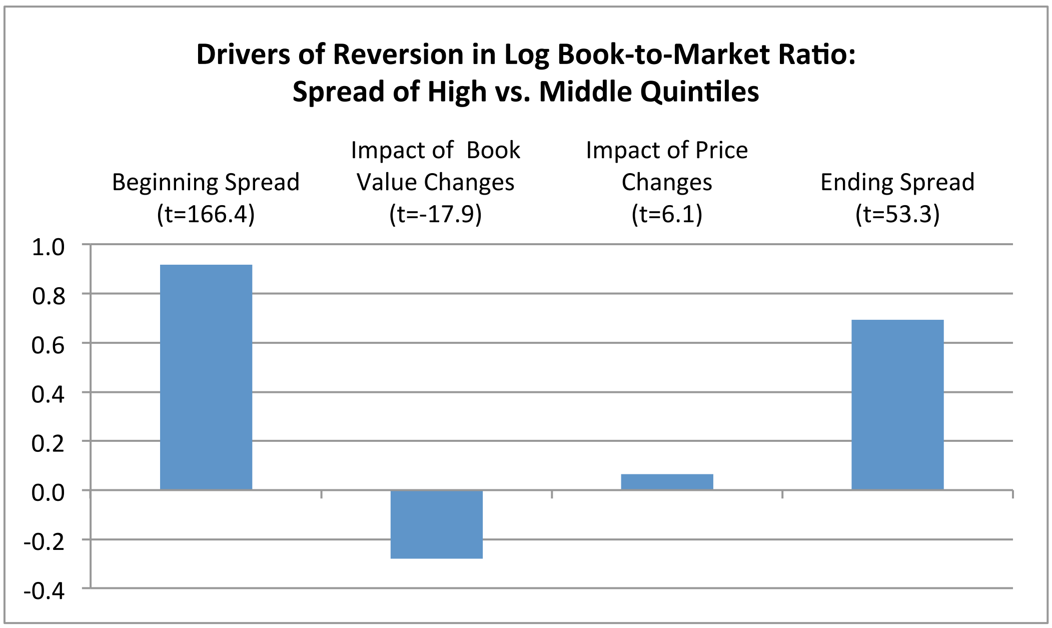


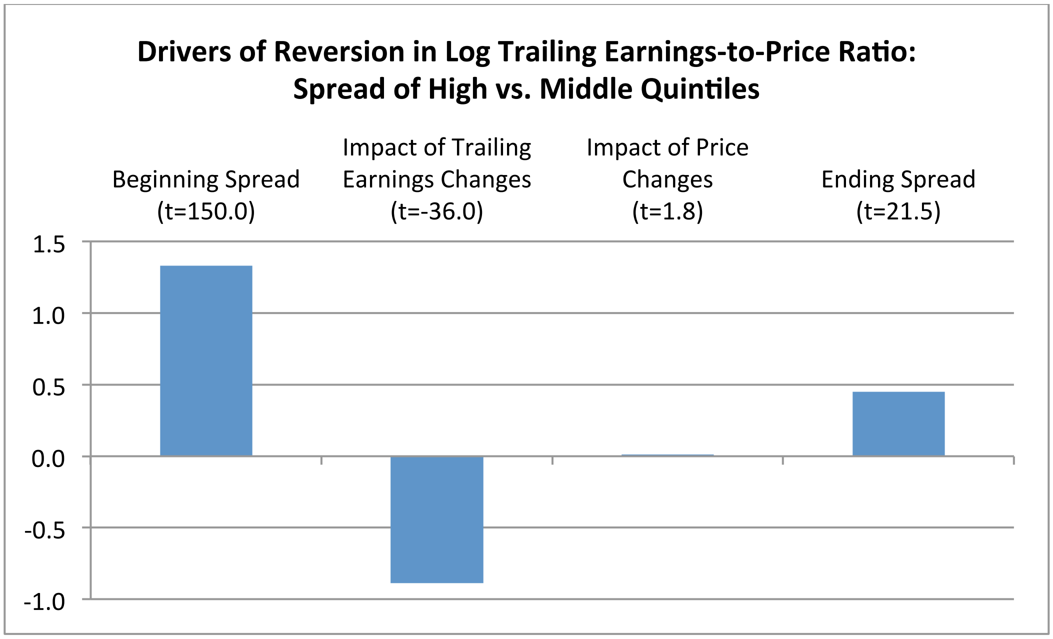
Figure 2.

This figure identifies the drivers of mean reversion in log fundamental-to-price ratios. Each bar shows the average spread between stocks in the highest quintile and stocks in the middle three quintiles. The first bar shows the spread in the ratio at the time stocks are initially selected using the ratio. The second bar shows the subsequent annual change in the spread due to changes in the fundamental used in the numerator of the ratio. The third bar shows the subsequent annual change in the spread due to changes in stock price. The fourth bar shows the spread remaining at the end of the year. All stocks in the Russell 3000 are sorted annually into quintiles each April from 2002 to 2014 based on the respective ratio. The t-statistics reported above each bar test the average spread against a null of zero.

Panel A: Book-to-Market



Panel B: Trailing Earnings-to-Price



Panel C: Forward Earnings-to-Price

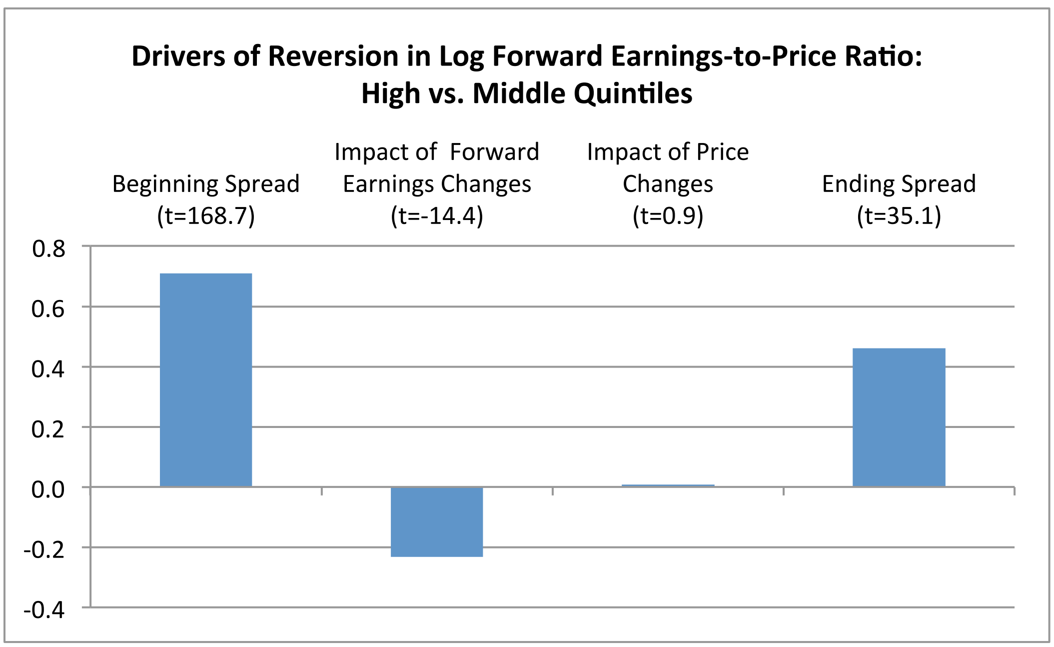
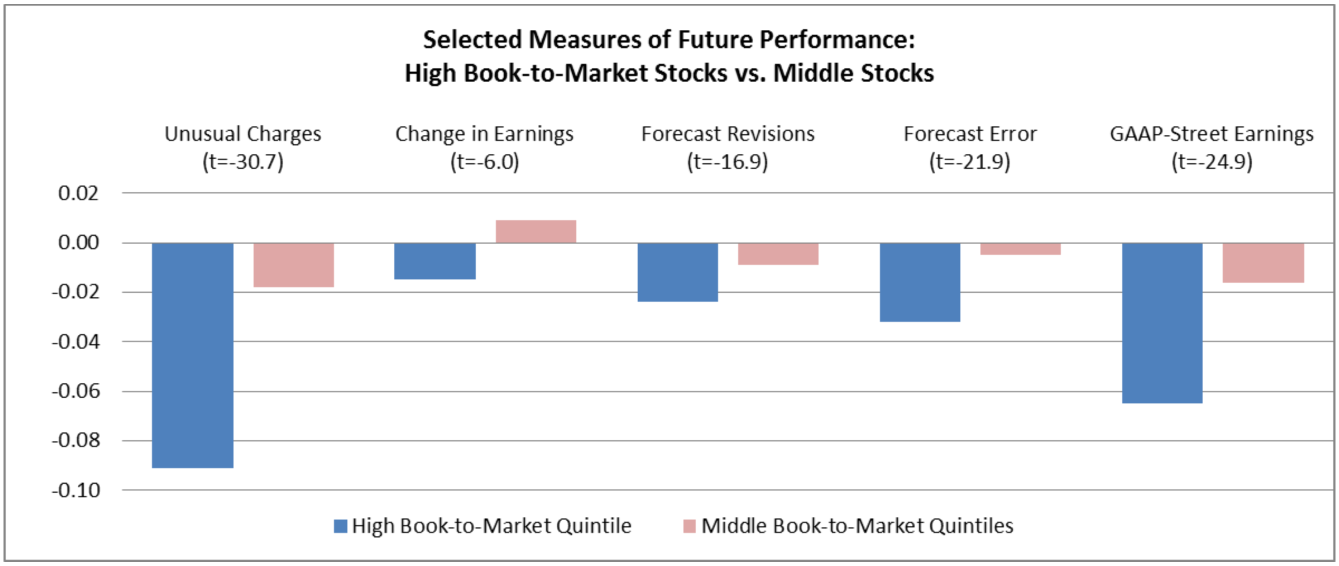


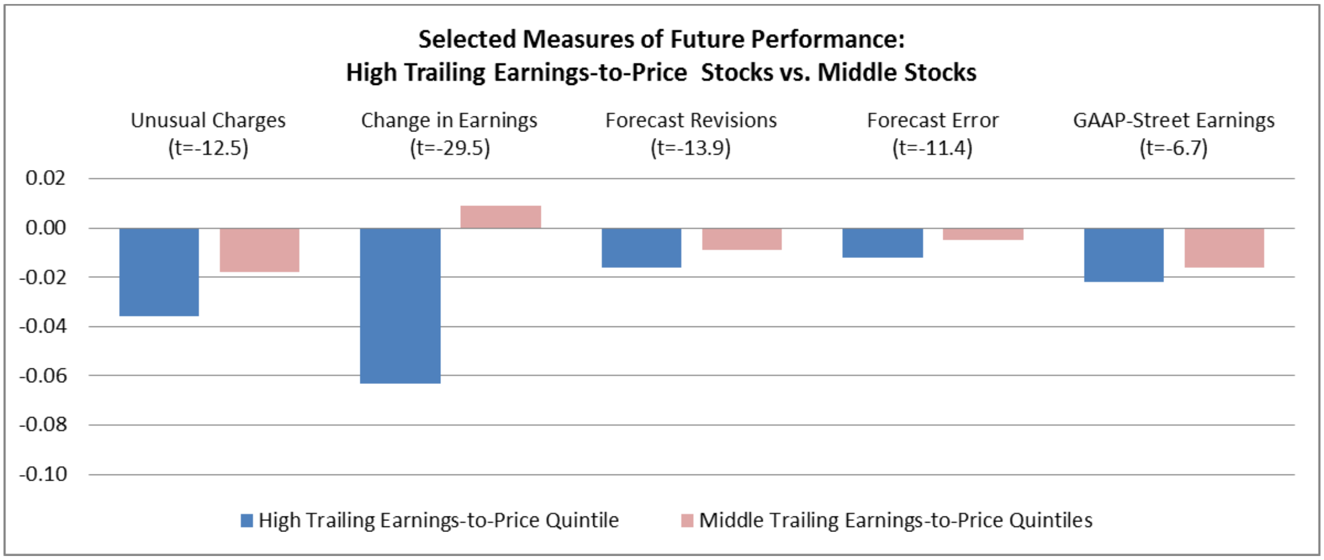
Figure 3.

This figure plots average fundamental performance metrics over the subsequent year for stocks sorted on the basis of fundamental-to-price ratios. All stocks in the Russell 3000 are sorted annually into quintiles each April from 2002 to 2014 based on the respective ratio. The t-statistics reported above each bar test the difference in means between the high quintile and the middle quintiles.

Panel A: Book-to-Market



Panel B: Trailing Earnings-to-Price



Panel C: Forward Earnings-to-Price

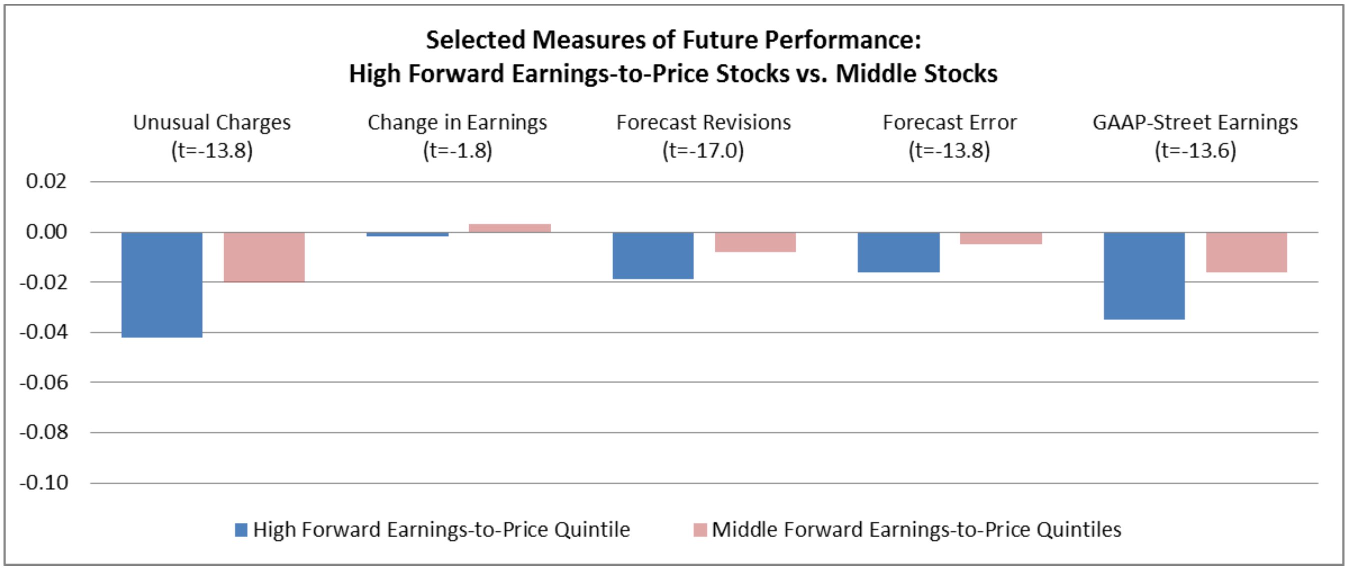
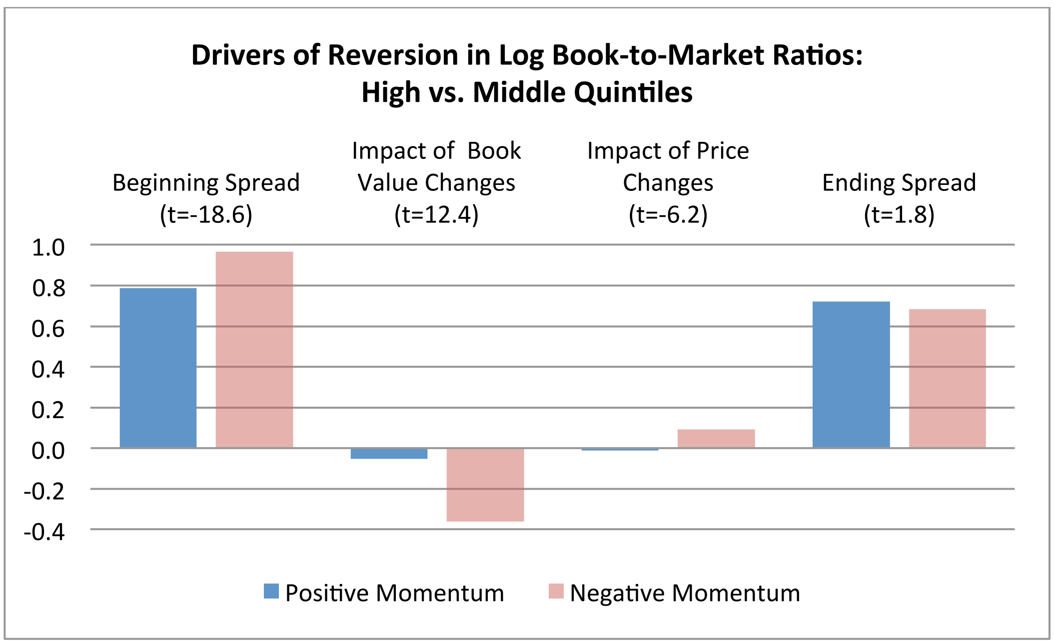


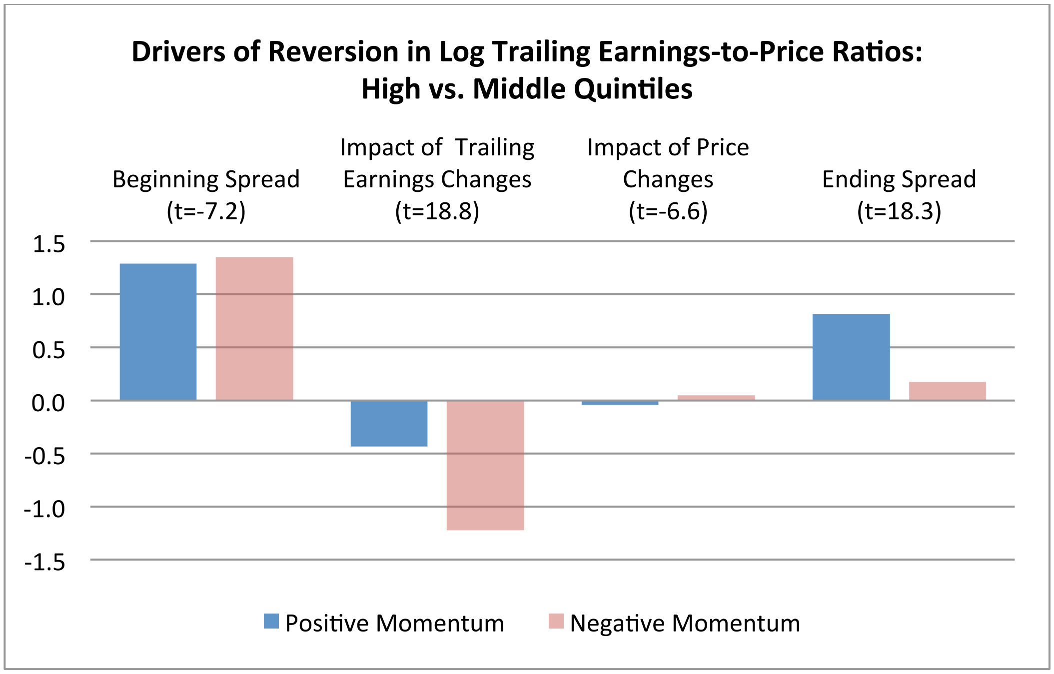
Figure 4.

This figure identifies the drivers of mean reversion in log fundamental-to-price ratios for stocks with positive and negative momentum. Each bar shows the average spread between stocks in the highest quintile (with either positive or negative momentum respectively) versus stocks in the middle three quintiles (as a combined group). The first bar shows the spread at the time stocks are initially selected on the ratio. The second bar shows the subsequent annual reduction in the spread due to changes in the fundamental used in the numerator of the ratio. The third bar shows the subsequent annual changes in the spread due to changes in stock price. The fourth bar shows the spread remaining at the end of the year. All stocks in the Russell 3000 are sorted annually into quintiles each April from 2002 to 2014 based on the respective ratio. The t-statistic reported above each set of bars tests the difference in means between the high quintile stocks with positive momentum versus the high quintile stocks with negative momentum.

Panel A: Book-to-Market



Panel B: Trailing Earnings-to-Price



Panel C: Forward Earnings-to-Price