Book-to-Market Components, Future Security Returns, and Errors in Expected Future Earnings

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ABSTRACT

This study investigates whether the ability of book-to-market to predict returns derives from systematic errors in the market’s expectation of future earnings. We extend Beaver and Ryan (1996; 2000) by decomposing book-to-market into a more persistent (bias) component and a delayed recognition (lag) component. We find that both components are related to analyst expectations of future earnings, but the lag component is the dominant factor across all forecast horizons. Similarly, we find that the lag component explains most of the inverse relation between book-to-market and future returns. Given that lag is constructed by regressing book-to-market ratios on lagged price changes, our results are consistent with the lag component capturing systematic stock price reversals. We find that the components have unique relations with subsequent earnings forecast revisions, and controlling for these relations substantially mitigates the components’ ability to predict returns. Our component-level analysis provides insight into how expected future earnings, summarized in book-to-market ratios help to explain this market anomaly.

1. Introduction

Prior research shows that the ratio of equity book value to market value is both negatively related to future book return on equity (ROE) (Penman

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and positively related to future stock returns (Fama and French [1992; 1995]). The former relation is consistent with market values anticipating future accounting earnings. The positive association with future stock returns is more ambiguous and could be evidence of either unspecified risk or market mispricing. While the book-to-market ratio may reflect market anticipation of future earnings, these expectations may not be completely rational, resulting in predictable stock returns (LaPorta [1996], Dechow and Sloan [1997], Frankel and Lee [1998], and Piotroski [2000]). This study provides insight by examining distinct components of the book-to-market ratio that are uniquely related to expected future earnings. Just as book-to-market components distinguish patterns in future earnings, we consider that these components may also distinguish unique errors in the market’s earnings expectation.

Following Beaver and Ryan [2000], we decompose book-to-market into a “lag” component and a “bias” component, which they attribute to delayed accounting recognition and persistently biased accounting recognition, respectively. They show that the relation between lag (bias) and future ROE decays (persists) over a five-year period. We begin our analysis by assessing whether the lag and bias components have unique relations with analyst earnings forecasts, thus extending the Beaver and Ryan results to expectations of future earnings. We further extend Beaver and Ryan [2000] by testing whether the bias and lag components correspond to systematic errors in analyst expectations as reflected in subsequent revisions of those expectations. Using analyst revisions as proxies for the market’s revisions, we then examine whether the ability of lag and bias to predict errors in expected earnings can explain their ability to predict future stock returns.

Consistent with Ryan [1995] and Beaver and Ryan [2000], we estimate the lag component by regressing the current book-to-market ratio on current and past changes in market value using a fixed effects model. The underlying assumption is that past price changes reflect value-relevant shocks prior to the accounting (book value) recognition. If the lag component reflects rational market expectations of future earnings, then lag should be associated with future ROE, but not with future stock returns as those earnings are recognized. In fact, Ryan [1995] conjectures that after removing the lag component, the remaining variation in book-to-market should better reflect cross-sectional differences in future stock returns. Alternatively, we conjecture that if the market’s expectations of future earnings are not fully rational, then the lag component would likely capture the market mispricing associated with systematic errors in expected earnings.

Beaver and Ryan [2000] show that lag dominates bias in predicting shorter horizon ROE, but not when predicting longer horizon ROE four to five years ahead. Thus, if analysts behave rationally, the explanatory power of lag (relative to bias) for forecasted earnings should diminish as the forecast horizon lengthens. Our results suggest that while both bias and lag are inversely associated with analyst forecasts of future earnings, the lag component dominates the bias component over all forecast horizons. Furthermore, we
show that the lag component is positively related to subsequent revisions in analysts’ long-term earnings growth projections. The ability of lag to predict forecast revisions suggests that past price changes summarized in the lag component do indeed reflect systematic errors also reflected in analysts’ long-term earnings growth forecasts.

When we examine the relations between book-to-market components and future stock returns, we find that the bias and lag components exhibit distinct positive relations with year-ahead stock returns. Further, we find that the lag component clearly captures most of the known relation between book-to-market and future returns. Given that the lag component is constructed by mapping past price changes into book-to-market, this is consistent with the lag component identifying systematic price reversals. Through book-to-market, we link past price changes with future price changes in the opposite direction.

Beaver and Ryan [1996] previously document strong positive relations between bias and lag and future size-adjusted returns. In particular, they find that the lag component predicts returns five years ahead. We extend their analysis by linking these return relations to errors in expected earnings. After controlling for the contemporaneous revisions in expected earnings, the lagged component’s relation with future returns decreases by about 40%, but remains significant. The bias component’s association with future returns becomes insignificant. Our findings are generally consistent with both components of book-to-market capturing investor expectations of future earnings that are subsequently revised, leading to predictable price changes. The lag component results are particularly interesting in that they appear to identify the reversal of past price changes. However, analyst forecasts of earnings do not fully explain the lag component’s predictive power for future returns.

The next section of our paper describes the Ryan [1995] and Beaver and Ryan [2000] models and develops our hypotheses. Section 3 discusses the details of our research design, and section 4 presents the results of our analysis, including a discussion of survivorship issues. Concluding remarks are included in section 5.

2. Background and Hypothesis Development

2.1 BOOK-TO-MARKET AND FUTURE ROE

Penman [1992; 1996], Fama and French [1995], and Bernard [1994] document a negative relation between the book-to-market ratio and future return on equity. Penman [1996] provides a theoretical basis for this relation using an abnormal earnings valuation model (Feltham and Ohlson [1995]). To the extent that market values efficiently impound value-relevant information beyond book value, the observed book-to-market ratio should be inversely related to future abnormal earnings or future ROE.

Consistent with this line of reasoning, Ryan [1995] models the difference in equity book value and market value arising from the accrual-based
smoothing of value-relevant events. He begins by expressing the current unrecorded goodwill of a firm’s assets, market value ($MV_t$) less book value ($BV_t$), as a moving average process of value-relevant shocks ($o_t$) over the life of those assets:

$$\text{Goodwill} = MV_t - BV_t = F(0)o_t + F(1)o_{t-1} + F(2)o_{t-2} + \cdots + F(K-2)o_{t-K+2}$$  \hspace{1cm} (1)

where $K$ designates the useful life of the oldest asset, acquired in year $t - K + 1$ and subject to a market value shock in its first year, $t - K + 2$. These shocks are assumed to be mean-zero market value innovations that are gradually included in book value through the earnings process. The earnings process smooths the value recognition because historical cost depreciation departs from economic depreciation over the asset life. The result is a slowly decaying pattern of future abnormal earnings. $F(s)$ represents the portion of the year $t - s$ market value shock that persists as unrecorded goodwill at time $t$. Under reasonable regularity conditions, the $F(s)$ parameters should monotonically decrease toward zero as $s$ increases, because more of the successively older shocks have been absorbed into book value.

Ryan [1995] transforms (1) into an equivalent expression describing the evolution of book-to-market and estimates that relation using a fixed-effects regression model. Beaver and Ryan [2000] further allow for a firm effect in their empirical model:

$$BTM_{it} = \alpha + \alpha_i + \alpha_t + \sum_{k=0}^{6} \beta_k R_{it-k} + e_{it}$$  \hspace{1cm} (2)

where $R_{it-k}$ is firm $i$’s raw stock return for year $t - k$. The benefit of the fixed effect estimation is that it decomposes the book-to-market ratio for firm $i$ in year $t$ (hereafter, $BTM$) into several distinct elements. The first term, $\alpha$, is simply the mean intercept of the model. The next two terms, $\alpha_i$ and $\alpha_t$, capture variation due to firm and year effects, respectively. These fixed effects are mean-zero, reflecting relative variation about $\alpha$. The fourth term captures the variation in current $BTM$ that results from lagged market value changes. Observable stock returns ($R_{it-k}$) are substituted for the unobservable market value shocks at lag $k$ relative to year $t$. Because $BTM$ replaces goodwill on the left-hand side, the $\beta_k$ coefficients should be negative and increasing toward zero as the lag length increases, consistent with an inverse relation.

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1 Following Ryan [1995], the model pertains to a mature, going concern, and it is assumed that the firm holds assets of each possible age, 0 through $K - 1$. After $K$ years, the market value is assumed to equal zero. The moving average process is of order $K - 2$, because the first market value shock occurs in the first year of the oldest asset’s life.

2 Ryan [2000] estimates the model with ten lags of market value changes deflated by market value at time $t$. Beaver and Ryan [2000] use six lags and replace deflated market value changes with raw returns. They indicate that these differences do not qualitatively affect the estimation.
Beaver and Ryan [2000] focus on the accounting aspects of the lagged market component and the fixed firm effect of BTM. The lag component captures the more temporary differences between book and market values primarily due to untimely accounting. Conversely, they argue that the firm effect captures more permanent differences between book and market values. This bias component of BTM may result from persistently conservative accounting practices (e.g., immediate expensing of research and development expense) or economic factors (e.g., restraints on competition).

Beaver and Ryan then evaluate the relation between these unique components of BTM and future ROE. They find that the lag component exhibits a negative relation with future ROE that decays by 61% over a five-year period. The decaying pattern supports the claim that the lag portion of BTM reflects finite timing differences by which past market value shocks are gradually recognized as future abnormal earnings. Alternatively, they find that the bias component exhibits a negative association with ROE over an indefinite horizon, consistent with it reflecting more persistent departures between book and market values. Thus, the decomposition of BTM into bias and lag components appears to identify distinct patterns in future ROE, which improve ROE prediction.

One question that naturally follows from the Beaver and Ryan result is whether decomposing book-to-market into bias and lag also enhances the explanatory power for expected earnings. If analysts behave rationally, we expect that the relative explanatory power of lag for forecasted earnings should diminish as their forecast horizon lengthens. Deviations from this pattern may point to potential errors in earnings expectations.

2.2 BOOK-TO-MARKET AND FUTURE STOCK RETURNS

The negative relation between the BTM components and future ROE observed by Beaver and Ryan [2000] conforms to an efficient market hypothesis. However, several studies, most notably Fama and French [1992], also document a positive relation between book-to-market and future returns. The role of book-to-market in that context is not well understood.3 In general, rational explanations for the return association have not fully dispelled claims of market inefficiency.4

Several of the market mispricing studies have argued that prices reflect errors in expected earnings growth. Specifically, Lakonishok, Shleifer, and Vishny [1994] contend that the market naively extrapolates past growth and

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3 Possible explanations include expected returns, or risk (Fama and French [1995], Bernard, Thomas, and Wahlen [1997]), market mispricing (Lakonishok, Shleifer, and Vishny [1994], LaPorta [1996], Dechow and Sloan [1997], Frankel and Lee [1998], and Piotroski [2000]), and research design bias (Kothari, Shanken, and Sloan [1995]).

find positive returns to a contrarian strategy. LaPorta [1996] and Dechow and Sloan [1997] argue that investors rely on analyst forecasts of earnings growth that are systematically biased. In either case, errors in expected earnings would be reflected in the market portion of BTM. Eventually, predictable returns would be observed when the expected earnings fail to materialize and prices correct. Thus, in addition to BTM reflecting expected earnings that have not yet been recognized, it could also reflect market mispricing that has not yet been corrected.5

The Ryan [1995] and Beaver and Ryan [2000] decomposition of BTM allows for a more direct test of this mispricing explanation. Although the initial model by Ryan is premised on market prices leading the accounting recognition of value-relevant shocks, it does not preclude some market inefficiency. If market values depart from book values at least in part due to mispricing, then Ryan’s model for the evolution of BTM could also capture the evolution of market mispricing.

Specifically, if BTM reflects errors in the market’s expectation of future earnings, then those errors would be embedded in past price changes, as well. Therefore, the lag component of BTM, which is the projection of BTM on lagged price changes, should best capture the market’s earnings expectation errors. Assuming a gradual correction of past mispricing (Dichev [1998]), errors reflected in more (less) recent price changes are less (more) likely to have been corrected. This pattern is also consistent with the decaying coefficients on lagged price changes that Ryan [1995] and Beaver and Ryan [2000] observe in estimating the lag component. To the extent that analyst earnings forecasts proxy for the market’s earnings expectations, we would further expect that the lag component is positively correlated with subsequent earnings forecast revisions.6

The mispricing argument presented above suggests that stock returns similarly reflect the correction of past errors in expected earnings. Thus, an ability to identify errors in expected earnings would imply an ability to predict stock returns. Accordingly, if the lag component is positively correlated with forecast revisions, we would also expect that it is positively correlated with future returns. However, this relation alone would not necessarily imply market mispricing. For example, the lag component might also reflect an unspecified risk factor.7 A more compelling case for mispricing could be made if the return relation is mitigated after controlling for earnings

5 Other studies suggesting that the implications of current earnings, or its components, for future earnings are not fully priced include Bernard and Thomas [1989], Sloan [1996], and Abarbanell and Bushee [1998].

6 Considerable literature suggests that analyst forecasts are a reasonable proxy for the market’s earnings expectation (see Schipper [1991] and Brown [1993], for reviews of this literature). Relevant to this study, Liu and Thomas [2000] document stock return relations with forecast revisions over multiple horizons.

7 The lag component of BTM could capture risk if past price changes reflect changes in investor perception about the risk of the firm. For example, if stock prices previously increased when investors perceived less risk, we could observe a “high” market value relative to book value. Future returns for this low-BTM firm would likely be lower than average assuming a risk-return relation.
forecast revisions made during the return accumulation period. Although Beaver and Ryan [1996] document a persistent relation between lag and future returns, they do not link that relation to changes in expected earnings.

3. Components of Book-to-Market

3.1 FIXED-EFFECTS ESTIMATION

The decomposition of $\text{BTM}$ is achieved via fixed-effects estimation of equation (2). The fixed-effects approach begins by adjusting the dependent and independent variables of each observation for the mean time, firm, and overall effects. Like Beaver and Ryan [2000], the independent variables consist of deflated market value changes for year $t$ and six years prior to year $t$. Pooled OLS estimation, without an intercept, is performed on the centered data as follows:

$$\text{BTM}_{it} - \text{BTM}_{i.} - \text{BTM}_{t} + \text{BTM}_{.} = \sum_{k=0}^{6} \beta_k (\Delta M\text{V}_{kiti} - \Delta M\text{V}_{ki.} - \Delta M\text{V}_{k,t} + \Delta M\text{V}_{k..}) + \eta_{it} \quad (3)$$

where $\text{BTM}_{it}$ is the book-to-market ratio for firm $i$ measured at the end of fiscal year $t$, and $\Delta M\text{V}_{kiti}$ is defined as the percentage change in market value for lag $k$ relative to year $t$ (i.e., year $t - k$). The subscripts $k_i$, $k_t$, and $k..$ respectively designate the firm, year, and grand mean of the lag $k$ change in market value. The firm and time means are removed, and the grand mean is added back to center the data on zero. The estimated coefficients from this model ($\beta_k$) are equivalent to the parameters specified in the “dummy variable” form of the model, equation (2). Thus, we construct the lag component of $\text{BTM}$ by multiplying the $\beta_k$ coefficients and the lagged market value changes:

$$\text{LAG}_{it} = \sum_{k=0}^{6} \beta_k \Delta M\text{V}_{kiti} \quad (4)$$

The firm and time effects and the intercept specified in (2) are constructed as follows:

$$\text{FIRMT} = \alpha_t = (\text{BTM}_{i} - \text{BTM}_{..}) - \sum_{k=0}^{6} \beta_k (\Delta M\text{V}_{k.i} - \Delta M\text{V}_{k..}) \quad (5)$$

$$\text{TIMET} = \alpha_t = (\text{BTM}_{t} - \text{BTM}_{..}) - \sum_{k=0}^{6} \beta_k (\Delta M\text{V}_{k,t} - \Delta M\text{V}_{k..}) \quad (6)$$

$$\text{INT} = \alpha = \text{BTM}_{..} - \sum_{k=0}^{6} \beta_k (\Delta M\text{V}_{k..}) \quad (7)$$

$$\text{RES}_{it} = \epsilon_{it} = \text{BTM}_{it} - \text{INT} - \text{TIMET} - \text{FIRMT} - \text{LAG}_{it} \quad (8)$$

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8 See Judge, Griffiths, Hill, and Lee [1980] for a more complete development of the fixed effects model.
We estimate equation (3) in an iterative fashion using successive five-year panels of data. This research design imparts a survivorship effect on the study that we consider when interpreting our results.

From the panel estimation of (3), we construct the BTM components using equations (4) through (8). The five-year panel of data is shifted forward one year at a time, and the components are re-estimated. For example, we first estimate equation (3) using BTM data for the years 1977–1981. Using the estimated $\beta_k$ coefficients, we then calculate the components of BTM for the year 1981, the last year of that panel.10 This process is repeated fifteen times on successive five-year panels, such that the last panel estimation of (3) is for the period 1991–1995. The result is a time-series of estimated BTM components for the years 1981–1995.

3.2 DATA AND ESTIMATION RESULTS

Each panel of data used to estimate equation (3) includes those firms with complete data for that particular five-year period (i.e., five years of BTM ratios and the corresponding scaled market value changes, years $t$ through $t-6$, for each of the five BTM ratios). Book value of common equity (Data item # 60) is obtained from the 1996 Compustat Annual Industrial or Research files, and price and share data (to compute market values) is obtained from the 1997 CRSP file. Similar to Beaver and Ryan [2000], we winsorize BTM at 0.0 and 4.0 and $\Delta MV$ at 3.0 to mitigate the effect of outliers. This impacts less than one percent of our observations.

In addition, we pre-screen the sample used to estimate the fixed-effects model to ensure that selected observations meet the minimum data requirements for subsequent analysis. As discussed in the following sections, these restrictions include I/B/E/S earnings forecast data and CRSP monthly return data. These data restrictions yield an average of 4,030 firm-year observations for estimating each five-year panel.

The mean coefficients from the fifteen annual regressions of (3) are reported in panel A of table 1. Reported t-statistics are based on the time-series mean and standard error. Our results are quite similar to the results of Beaver and Ryan [2000]. The coefficients on lagged market value changes are significantly negative and monotonically increase toward zero as the lag.

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9 Beaver and Ryan [2000] estimate panels of four, eight, and thirteen years beginning in 1981. Their lag coefficients exhibit a similar pattern across models. However, the explanatory power is greatest in the shorter panel period. As discussed later, we also assess the sensitivity of our results to a seven-year panel.

10 The FIRM and INT components are constant across the five-year block, whereas the LAG, TIME, and RES components are year-specific and are therefore computed for the last year of each estimation panel.

11 Earnings forecasts, forecast revisions, and monthly returns are later regressed on lagged BTM components. Since the BTM components are constructed from the final year of each panel, these additional data restrictions only apply to the last year of each panel. Earnings forecasts and revisions are also winsorized at their upper and lower 1% values to minimize the effect of outliers.
TABLE 1

Panel A: Summary Statistics for Annual Fixed-Effects Regressions

\[
BTM_{it} - BTM_i = \beta_0 + \sum_{k=0}^{6} \beta_k (\Delta MV_{k,t} - \Delta MV_{k,t_i}) + v_{it}
\]

<table>
<thead>
<tr>
<th>Mean coeff.</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>-0.371</td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(-21.50)</td>
</tr>
</tbody>
</table>


\[
BTM_{it} = INT_t + TIME_t + FIRM_t + LAG_{it} + RES_{it}
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTM</td>
<td>0.724</td>
<td>0.48</td>
<td>0.641</td>
</tr>
<tr>
<td>INT</td>
<td>1.015</td>
<td>0.16</td>
<td>0.954</td>
</tr>
<tr>
<td>TIME</td>
<td>-0.063</td>
<td>0.05</td>
<td>-0.061</td>
</tr>
<tr>
<td>FIRM</td>
<td>0.000</td>
<td>0.43</td>
<td>-0.047</td>
</tr>
<tr>
<td>LAG</td>
<td>-0.229</td>
<td>0.23</td>
<td>-0.188</td>
</tr>
<tr>
<td>RES</td>
<td>0.000</td>
<td>0.18</td>
<td>-0.001</td>
</tr>
</tbody>
</table>

The mean coefficients and t-statistics in panel A are from estimating fixed effects models for fifteen panels of firm data beginning with the years \( t = 1977–1981 \) and ending with the years \( t = 1992–1995 \) averaging 4,030 firm-year observations per panel. T-statistics in parentheses are calculated as the mean coefficient \( \div \) the standard error of the coefficients. \( \Delta MV_{kt} \) is the percentage change in market value of lag \( k \) relative to year \( t \). Descriptive data for book-to-market (BTM) and its components pertain to the final year of each panel estimation. INT, TIME, FIRM, LAG, and RES represent the intercept, year-specific effect, firm-specific effect, lagged-market effect, and residual components of BTM, respectively.

\[
INT_t = \alpha_t = BTM_t - \sum_{k=0}^{L} \beta_k (\Delta MV_{k,t})
\]

\[
TIME_t = \alpha_t = (BTM_t - BTM_i) - \sum_{k=0}^{L} \beta_k (\Delta MV_{k,t} - \Delta MV_t)
\]

\[
FIRM_t = \alpha_t = (BTM_t - BTM_i) - \sum_{k=0}^{L} \beta_k (\Delta MV_{k,t} - \Delta MV_t)
\]

\[
LAG_{it} = \sum_{k=0}^{L} \beta_k \Delta MV_{k,t}
\]

\[
RES_{it} = \epsilon_{it} = BTM_{it} - INT_t - TIME_t - FIRM_t - LAG_{it}
\]

Critical values for a one-tailed t-test with fourteen degrees of freedom are 2.624 (0.01 level), 1.761 (0.05 level), and 1.345 (0.10 level).

length increases. Also, the mean adjusted \( R^2 \) from estimating (3) is over 41%, which compares favorably with Beaver and Ryan [2000]. Therefore, our fixed-effects estimation appears to capture the same decaying relation reported in Ryan [1995] and Beaver and Ryan [2000].

12 The reported adjusted \( R^2 \) is based on the lagged market value changes only. It does not reflect the explanatory power of the fixed effects. Without the fixed effects, Beaver and Ryan [2000] report an adjusted \( R^2 \) of 36% for a four-year estimation panel (1981–1984).
As described above, we use the estimated coefficients from the fifteen iterations of equation (3) to decompose BTM in the last year of each panel. This process encompasses 12,090 BTM ratios for the years 1981–1995 and results in a sample of INT, FIRM, TIME, LAG, and RES observations used throughout the subsequent analysis. Panel B of table 1 reports descriptive statistics regarding the 12,090 firm-year observations of BTM and its component variables.

As expected, the mean BTM for our sample (0.724) is less than one. Consistent with other book-to-market research, we note that the ratio decreases over our sample period (0.792 average in the first eight years, and 0.652 average in the last seven years). By definition, the estimated components for a given observation must sum to its BTM. The mean intercept of the BTM models approximates one, and past price changes captured by LAG account for the average BTM value less than one. TIME, FIRM, and RES are all constructed to have a mean of zero across each panel of data. RES is the least squares residual, while TIME (FIRM) represents the relative effect of a specific year (firm) compared to the other years (firms) in that panel of data.

4. Interrelation of BTM, Expected Earnings, and Future Stock Returns

4.1 BTM Components and Expected Earnings

Beaver and Ryan [2000] relate the components of BTM to actual ROE over a five-year horizon and find that the FIRM and LAG exhibit unique relations. Our analysis begins by directly linking the BTM components to expectations of future earnings over short, medium, and long-term horizons. Specifically, we investigate whether the BTM components relate to analyst forecasts of year-ahead earnings \((t + 1)\), two-year-ahead earnings \((t + 2)\), and long-term earnings growth \((ltg)\) consistent with their relations to actual ROE. We use median consensus forecasts available from I/B/E/S in the middle of the fourth month after the end of year \(t\). The earnings per share forecasts for \(t + 1\) and \(t + 2\) are scaled by book value of equity per share at the end of year \(t\); the long-term growth forecast is stated as a percentage, and further scaling is unnecessary. We perform annual cross-sectional estimation of the following model and base statistical tests on the mean intertemporal coefficients and standard errors (Fama and MacBeth [1973]).

\[
FOR_{ht}^h = \gamma_0 + \gamma_1 FIRM_{it} + \gamma_2 LAG_{it} + \gamma_3 RES_{it} + \epsilon_{it} \tag{9}
\]

\(FOR_{ht}^h\) represents the earnings forecast made four months after year \(t\) for forecast horizon \(h\), where \(h\) equals \(t + 1\), \(t + 2\), and \(ltg\). INT and TIME

---


14 Across any given five-year panel, the time effect is mean-zero. However, we use components from the final year of each panel. The mean of those “final-year” values reported in table 1 departs from zero.
are omitted from the model because they would be constant across all observations in each annual cross-sectional regression. Their effects are included in $\gamma_0$.

We expect that market values at time $t$ impound the information in analyst forecasts for each of the three horizons, resulting in a negative relation between the forecasts and $BTM$. To the extent that the information in these forecasts is also reflected in the components of $BTM$, we expect negative values for the $\gamma$ coefficients in (9). This extension of Beaver and Ryan [2000] should provide insight into the market’s expectation of earnings reflected in $BTM$.

In table 2, we report the mean results of the annual cross-sectional regressions of equation (9) using $FOR_{t+1}^{+1}$, $FOR_{t+2}^{+2}$, and $FOR_{t+g}^{tg}$ as the dependent

<table>
<thead>
<tr>
<th>TABLE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regressions of I/B/E/S Analysts’ Earnings Forecasts on Book-to-Market Components ($N = 12,090$)</td>
</tr>
</tbody>
</table>

$FOR_{t+1}^{+1} = \gamma_0 + \gamma_1 FIRM_i + \gamma_2 LAG_{it} + \gamma_3 RES_{it} + \epsilon_{it}$

Dependent Variables = One-year-ahead forecast ($FOR_{t+1}^{+1}$)

<table>
<thead>
<tr>
<th>Mean</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>FIRM</td>
</tr>
<tr>
<td>0.107</td>
<td>-0.071</td>
</tr>
<tr>
<td>(35.99)</td>
<td>(-26.98)</td>
</tr>
</tbody>
</table>

Dependent Variable = Two-year-ahead forecast ($FOR_{t+2}^{+2}$)

<table>
<thead>
<tr>
<th>Mean</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>FIRM</td>
</tr>
<tr>
<td>0.129</td>
<td>-0.085</td>
</tr>
<tr>
<td>(58.01)</td>
<td>(-32.47)</td>
</tr>
</tbody>
</table>

Dependent Variable = Long-term growth forecast ($FOR_{t+g}^{tg}$)

<table>
<thead>
<tr>
<th>Mean</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>FIRM</td>
</tr>
<tr>
<td>0.092</td>
<td>-0.029</td>
</tr>
<tr>
<td>(88.18)</td>
<td>(-15.75)</td>
</tr>
</tbody>
</table>

$t$-statistics (in parentheses) are calculated as the mean coefficient $\div$ the standard error of the coefficients for the years 1981–1995. $FIRM_i$, $LAG_{it}$, and $RES_{it}$ represent the firm-specific effect, lagged-market effect, and residual components of $BTM$, respectively.

$FIRM_i = \alpha_i = (\bar{BTM}_i - \bar{BTM}_c) - \frac{1}{6} \sum_{k=0}^{6} \beta_k (\bar{MV}_{k,i} - \bar{MV}_{k,c})$

$LAG_{it} = \sum_{k=0}^{6} \beta_k \Delta MV_{it}$

$RES_{it} = \epsilon_{it} = BTM_{it} - INT - TIME_i - FIRM_i - LAG_{it}$

FOR_{t+1}^{+1}, FOR_{t+2}^{+2}, and FOR_{t+g}^{tg} are the I/B/E/S analysts’ median forecasts of $t+1$ and $t+2$ earnings (scaled by book value per share at the end of year $t$), and long-term earnings growth forecasts, respectively, four months after the end of fiscal year $t$.

Critical values for a one-tailed $t$-test with fourteen degrees of freedom are 2.624 (0.01 level), 1.761 (0.05 level), and 1.345 (0.10 level).
variables. Each model has an average explanatory power of more than 25%. Consistent with prior studies that show a negative relation between BTM and expected future earnings (Frankel and Lee [1998]), the BTM components are negatively correlated with all three forecasts. Only RES in the FOR\textsubscript{tg} model is not significantly negative. While FIRM and LAG are both strongly associated with the earnings forecasts, we find that LAG is consistently the dominant element across all three forecast horizons.\textsuperscript{15}

Although Beaver and Ryan [2000] find that the relation between FIRM (LAG) and future ROE persists (decays) over a five-year horizon, we find that the significance of LAG actually increases as the forecast horizon increases, and both components are strongly related to expected long-term earnings growth.\textsuperscript{16} The persistent LAG relation could reflect unrealistic expectations of future earnings. Documenting these relations between the components and expected earnings provides a basis for subsequent tests of their relations with errors in expected earnings.

4.2 BTM COMPONENTS AND FUTURE STOCK RETURNS

The remainder of our analysis attempts to reconcile the expected earnings relations documented above with the ability of BTM to predict security returns. Prior research has demonstrated a positive relation between BTM and future stock returns, and Beaver and Ryan [1996] previously found a positive relation between the BTM components and future size-adjusted returns. As a precursor to investigating an earnings-based explanation for this anomaly, we first document a return relation with our sample.

Accordingly, we accumulate monthly stock returns, beginning five months after the end of fiscal year \( t \), for a period of twelve months (\( \text{RET}_{t+1} \)).\textsuperscript{17} We then regress the year-ahead returns on BTM using annual cross-sectional models. We also include the log of market value of equity at the end of year \( t \) (LMVE\textsubscript{t}) to control for any size effect in cross-sectional returns (Fama and

\textsuperscript{15} Note that the dependent variable FOR\textsubscript{tg} is the percentage forecast, while FOR\textsubscript{t+1} and FOR\textsubscript{t+2} are per share forecasts deflated by book value. Thus, we do not compare coefficients across all three models.

\textsuperscript{16} Because our sample is more restricted than Beaver and Ryan [2000], we also examine the components’ relations with future ROE. The Pearson correlations between FIRM and future ROE are fairly stable (\(-0.19 \) with ROE\textsubscript{t+1} and \(-0.15 \) with ROE\textsubscript{t+3}), whereas the correlations between LAG and future ROE decay and become insignificant (\(-0.32 \) with ROE\textsubscript{t+1} and \(0.01 \) with ROE\textsubscript{t+3}). We observe similar relations in a multivariate regression that controls for current ROE. Thus, sample differences do not appear to explain the differential component relations with actual ROE and analyst forecasts.

\textsuperscript{17} We sum the natural logs of one plus the monthly returns to construct RET\textsubscript{t+1}. In addition to reflecting continuous compounding, the log form reduces skewness in the cumulative raw return data. We obtain similar results throughout the analysis by summing or compounding monthly raw returns. If a firm delists during this period, we use available returns including their delisting return. If the delisting return is missing and the firm delists due to liquidation or an enforcement action, we assume a delisting return of \(-100\%\).
### Table 3
Regressions of Future Stock Returns on Book-to-Market and Book-to-Market Components (N = 12,090)

**Panel A:** $RET_{it+1} = \delta_0 + \delta_1 LMVE_{it} + \delta_2 BTM_{it} + \epsilon_{it}$

<table>
<thead>
<tr>
<th>Intercept</th>
<th>LMVE</th>
<th>BTM</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean coeff.</td>
<td>0.045</td>
<td>0.008</td>
<td>0.028</td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(0.87)</td>
<td>(1.45)</td>
<td>(1.93)</td>
</tr>
</tbody>
</table>

**Panel B:** $RET_{it+1} = \delta_0 + \delta_1 LMVE_{it} + \delta_2 FIRM_i + \delta_3 LAG_{it} + \delta_4 RES_{it} + \epsilon_{it}$

<table>
<thead>
<tr>
<th>Intercept</th>
<th>LMVE</th>
<th>FIRM</th>
<th>LAG</th>
<th>RES</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean coeff.</td>
<td>0.076</td>
<td>0.007</td>
<td>0.018</td>
<td></td>
<td>0.017</td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.28)</td>
<td>(1.12)</td>
<td>(1.65)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intercept</th>
<th>LMVE</th>
<th>FIRM</th>
<th>LAG</th>
<th>RES</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean coeff.</td>
<td>0.109</td>
<td>0.005</td>
<td>0.081</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.66)</td>
<td>(0.75)</td>
<td>(2.67)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intercept</th>
<th>LMVE</th>
<th>FIRM</th>
<th>LAG</th>
<th>RES</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean coeff.</td>
<td>0.089</td>
<td>0.005</td>
<td>0.081</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.48)</td>
<td>(0.82)</td>
<td>(2.67)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intercept</th>
<th>LMVE</th>
<th>FIRM</th>
<th>LAG</th>
<th>RES</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean coeff.</td>
<td>0.102</td>
<td>0.007</td>
<td>0.081</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.67)</td>
<td>(1.01)</td>
<td>(2.67)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

T-statistics (in parentheses) are calculated as the mean coefficient $\div$ the standard error of the coefficients across the years 1981–1995. $RET_{it+1}$ is the continuously compounded annual stock return for the twelve-month period beginning five months after the start of fiscal year $t + 1$. $BTM_{it}$ is the ratio of book equity to market equity at the end of year $t$. $LMVE_{it}$ is the log of market value of equity at the end of year $t$. $FIRM_i$, $LAG_{it}$, and $RES_{it}$ represent the firm-specific effect, lagged-market effect, and residual components of $BTM$.

$$FIRM_i = \alpha_i = (BTM_i - \overline{BTM}_i) - \sum_{k=0}^{6} \beta_k (\Delta MV_{ki} - \overline{\Delta MV}_{ki})$$

$$LAG_{it} = \sum_{k=0}^{6} \beta_k \Delta MV_{kit}$$

$$RES_{it} = \epsilon_{it} = BTM_{it} - INT - TIME_t - FIRM_i - LAG_{it}$$

Critical values for a one-tailed t-test with fourteen degrees of freedom are 2.624 (0.01 level), 1.761 (0.05 level), and 1.345 (0.10 level).

French [1992]).

$$RET_{it+1} = \delta_0 + \delta_1 LMVE_{it} + \delta_2 BTM_{it} + \epsilon_{it} \quad (10)$$

We then replace $BTM$ with the $BTM$ components and evaluate whether each is uniquely related to returns.

The mean estimation results from the fifteen regressions are reported in table 3. One-tailed tests are performed on each of the coefficients. Consistent with prior literature, panel A reports a positive coefficient on $BTM$ (0.028), significant at a 0.05 level. Also consistent with some prior studies (LaPorta [1996] and Dichev [1998]), $LMVE$ does not exhibit significant explanatory power in our linear model of returns. The average explanatory power of 2.5% is in line with other studies, and we conclude that our sample reflects the well-known $BTM$-return anomaly.

Panel B reports the results from our analysis of the $BTM$ component relations with future returns. We regress $RET$ on each component individually.
and collectively while controlling for firm size. Consistent with the positive coefficient on total BTM, we perform one-tailed tests on the components of BTM. Our results indicate that both FIRM and LAG are positively associated with future returns, but LAG clearly exhibits a stronger relation. In the individual regressions, the mean coefficient on LAG (0.081) is more than four times the mean coefficient on FIRM (0.018), which is marginally significant at a 0.06 level. In addition, the average adjusted $R^2$ of the LAG model exceeds that of the composite BTM model in panel A. Unexpectedly, the mean coefficient on the BTM residual, RES, is negative.

When we include all components in the returns model, we find that the individual relations hold. In fact, both the FIRM and LAG coefficients increase in magnitude and significance, and the adjusted $R^2$ increases to 0.039. Consistent with Beaver and Ryan [1996], each component exhibits a unique positive relation with future returns. We test the equality of the FIRM and LAG coefficients from the annual regressions and find that they are significantly different (p-value of 0.017) in a two-tailed t-test (untabulated).18

We conclude from these results that the decomposition of BTM into the FIRM, LAG, and RES components is extremely insightful in that it strengthens and clarifies the unexplained link between BTM and future returns. In short, the portion of BTM that can be explained by past returns is also the portion most strongly associated with future returns. Our results suggest that LAG captures more than the delayed accounting recognition of previously priced market value shocks as assumed in the Ryan [1995] model. The results in table 3 are consistent with LAG capturing previous mispricing that is subsequently corrected. The incremental, albeit weaker, ability of FIRM to predict returns suggests that more persistent differences between book and market values also may be associated with expected returns or market mispricing.19

4.3 BTM COMPONENTS AND REVISIONS IN EXPECTED EARNINGS

We next investigate whether the BTM-return relations documented in the previous section arise from systematic errors in the market’s expectation of future earnings, which are embedded in the denominator of BTM. We earlier demonstrated that the BTM components were highly correlated with analyst forecasts of earnings, but these expectations, shared by the market,
may not be fully rational. In order to identify systematic errors in our forecast measures, $FORD$, we first obtain actual earnings or updated forecasts twelve months after the initial forecast date. We then compute an earnings expectation revision, labeled $REV^h$, for each of the three forecast horizons. For the $t+1$ forecast, actual earnings are available, and $REV^{t+1}$ is defined as the forecast error (actual minus forecast). $REV^{t+2}$ and $REV^{t+g}$ are the revisions in the $t+2$ and long-term growth forecasts based on I/B/E/S consensus forecasts sixteen months after fiscal year $t$.20 These measures reflect the changes in analyst expectations across multiple horizons concurrent with our one-year-ahead return accumulation period.21

We model the interrelation of these variables as a system of equations in which the $BTM$ components are treated as exogenous variables for year-ahead forecast revisions and stock returns.

\[
REV^h_{it+1} = \gamma_0 + \gamma_1 \Delta EPS_{it} + \gamma_2 FIRM_{it} + \gamma_3 LAG_{it} + \gamma_4 RES_{it} + \nu_{it} \tag{11}
\]

\[
RETI_{it+1} = \delta_0 + \delta_1 LMVE_{it} + \delta_2 FIRM_{it} + \delta_3 LAG_{it} + \delta_4 RES_{it} + \delta_5 REV^h_{it+1} + \nu_{it} \tag{12}
\]

We include the change in year $t$ earnings ($\Delta EPS$) in (11) to control for any analyst inefficiency concerning the persistence of earnings (Mendenhall [1991] and Francis and Philbrick [1993]).

The system above models a uni-directional flow of information, such that forecast revisions in expected earnings contribute to price changes, but price changes do not have a feedback effect on forecast revisions. Hausman [1978] proposes a specification test to assess whether $REV^h$ can be considered predetermined in this triangular system such that OLS is the asymptotically efficient estimator.22 We perform the Hausman test on an annual cross-sectional basis with each $REV^h$ measure and fail to reject the null that OLS is asymptotically efficient. The structural equations (11) and (12) are thus modeled as recursive, and OLS on each equation is the optimal estimator (Hausman [1983]).

We first separately regress the three forecast revision measures on the components of $BTM$ to complement their relations with future returns reported in table 3. A positive relation between a $BTM$ component and a

---

20 Each $REV^h$ has a mean less than zero, consistent with analyst overoptimism for the average firm.

21 Unlike the other revision metrics, $REV^{t+g}$ also reflects a one-year shift in the long-term forecast horizon. However, we believe that it reasonably captures changes in expectations over that twelve-month period rather than growth rate changes that were previously anticipated. LaPorta [1996] uses a similar revision metric for changes in expected earnings growth.

22 The Hausman test essentially tests whether OLS is inconsistent relative to an instrumental variable estimate. It is implemented in our context by regressing each $REV^h$ on all exogenous variables in the system and including those residuals on the right-hand side of (12). Under the null hypothesis that OLS is consistent, the coefficient on the first stage residuals should be zero because $\nu_{it}$ is uncorrelated with $\nu_{it}$. 

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TABLE 4

Regressions of I/B/E/S Analysts’ Earnings Forecasts Revisions on Book-to-Market Component (N = 12,090)

\[ REV_{it}^1 = \gamma_0 + \gamma_1 \Delta EPS_{it} + \gamma_2 FIRM_{it} + \gamma_3 LAG_{it} + \gamma_4 RES_{it} + \varepsilon_{it} \]

<table>
<thead>
<tr>
<th>Dependent Variables = One-year-ahead forecast error (REV1)</th>
<th>Mean</th>
<th>Adj. R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.026</td>
<td>0.025</td>
</tr>
<tr>
<td>( \Delta EPS )</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>FIRM</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>LAG</td>
<td>-0.002</td>
<td></td>
</tr>
<tr>
<td>RES</td>
<td>-0.006</td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>(−8.78)</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.93)</td>
<td></td>
</tr>
<tr>
<td>(0.41)</td>
<td>(−0.39)</td>
<td></td>
</tr>
<tr>
<td>(−1.06)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variable = Two-year-ahead forecast revision (REV2)</th>
<th>Mean</th>
<th>Adj. R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.015</td>
<td>0.025</td>
</tr>
<tr>
<td>( \Delta EPS )</td>
<td>0.011</td>
<td></td>
</tr>
<tr>
<td>FIRM</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>LAG</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>RES</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>(−7.06)</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.81)</td>
<td></td>
</tr>
<tr>
<td>(4.66)</td>
<td>(1.33)</td>
<td></td>
</tr>
<tr>
<td>(0.90)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variable = Long-term growth forecast error (REV)</th>
<th>Mean</th>
<th>Adj. R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.000</td>
<td>0.023</td>
</tr>
<tr>
<td>( \Delta EPS )</td>
<td>-0.003</td>
<td></td>
</tr>
<tr>
<td>FIRM</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>LAG</td>
<td>0.011</td>
<td></td>
</tr>
<tr>
<td>RES</td>
<td>-0.006</td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>(0.54)</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(−0.74)</td>
<td></td>
</tr>
<tr>
<td>(2.24)</td>
<td>(4.60)</td>
<td></td>
</tr>
<tr>
<td>(−2.45)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** T-statistics (in parentheses) are calculated as the mean coefficient ÷ the standard error of the coefficients for the years 1981–1995. FIRM, LAG, and RES represent the firm-specific effect, lagged-market effect, and residual components of BTM, respectively.

Forecast revision would be consistent with that component predicting the subsequent correction of extreme earnings forecasts. Table 4 presents the mean results of annual cross-sectional regressions of equation (11). Although all of the components were significantly related to the one-year-ahead earnings forecast, none of the components is significantly related to the resulting forecast error. This is consistent with the Frankel and Lee [1998] study based on BTM. When we substitute the two-year-ahead forecast revision (REV2) as the dependent variable, we find that FIRM has a significantly positive coefficient of 0.006. The LAG parameter is also positive.
(0.008), but not quite significant. The final model in panel A uses $REV_{itg}^{ht}$ as the dependent variable. Revised earnings expectations for this long-term horizon are most strongly related to $LAG$. The coefficient on $FIRM$ (0.002) is also significant, but the $LAG$ coefficient (0.011) is almost six times larger and more significant. These relations with forecast revisions generally match the components’ relations with one-year-ahead returns, supporting an errors in earnings expectation hypothesis. The results also confirm the Beaver and Ryan [1996] findings that the relation between $LAG$ and future returns grows stronger as the return horizon lengthens.

Overall, our results are consistent with prior research (e.g., Frankel and Lee [1998], Laporta [1996], and Dechow and Sloan [1994]) that finds (1) an inverse relation between total $BTM$ and long-term growth forecasts, and (2) a positive relation between $BTM$ and errors in those expectations. We contribute to this research by documenting a differential relation for the separate $BTM$ components across multiple forecast horizons. Our results suggest that past price changes, as reflected in the $LAG$ portion of $BTM$, impound systematic errors in analyst long-term growth forecasts of earnings. The more persistent departures between book and market values, as captured by $FIRM$, exhibit some of the same characteristics, but the relation is concentrated in the two-year-ahead forecast horizon. The unsystematic variation in $BTM$, reflected in $RES$, is negatively associated with long-term growth revisions, which is consistent with the negative relation between $RES$ and future returns. We further investigate this inverse relation later in the paper.

Equation (11) documents the relations between the $BTM$ components and errors in expected earnings, as proxied by $REV^h_i$. In equation (12), we provide more direct evidence about whether these relations account for the relation between the components and stock returns documented in table 3. Specifically, if the components predict returns because they identify systematic errors in the market’s expectation of future earnings, then controlling for $REV^h_i$ in equation (12) should attenuate the return relation. We recognize that this result further depends on how well analyst forecast revisions proxy for the market’s revision of expected earnings. Therefore, we first document the relations between $RET$ and $REV^h_i$ without the $BTM$ components.

Panel A of table 5 documents the return relations with $REV^{t+1}_i$, $REV^{t+2}_i$, and $REV_{itg}^{ht}$ while controlling for firm size ($LMVE$). Consistent with Liu and Thomas [2000], each variable has a significant positive relation with $RET$. Although many studies focus on the current forecast error or changes in long-term growth forecasts, we find that the strongest relation with year $t + 1$

---

23 Frankel and Lee [1998] examine the relation between $BTM$ and the two-year-ahead forecast error as opposed to the two-year-ahead forecast revision during year $t + 1$. They find a significant negative relation between $BTM$ and the two-year-ahead forecast error.
TABLE 5

Regressions of Future Stock Returns on Book-to-Market Components and I/B/E/S Analysts’ Forecast Errors and Revisions (N= 12,090)

\[
\text{Model: } R_{t+1} = \gamma_0 + \gamma_1 LMVE_{it} + \gamma_2 FIRM_{it} + \gamma_3 LAG_{it} + \gamma_4 RES_{it} + \\
\gamma_5 FE_{it}^{t+1} + \gamma_6 REV_{it}^{t+2} + \gamma_7 REV'_{it}^{lg} + e_{t+1}
\]

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Mean</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Excluding book-to-market components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.185</td>
<td>-0.002</td>
<td>1.618</td>
<td>0.134</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(3.00)</td>
<td>(-0.46)</td>
<td>(12.88)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.177</td>
<td>0.000</td>
<td>2.875</td>
<td>0.245</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(2.98)</td>
<td>(0.03)</td>
<td>(15.23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.096</td>
<td>0.005</td>
<td>2.351</td>
<td>0.061</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.64)</td>
<td>(0.88)</td>
<td>(10.40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel B: Including book-to-market components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.102</td>
<td>0.007</td>
<td>0.023</td>
<td>0.096</td>
<td>-0.057</td>
<td>0.039</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.67)</td>
<td>(1.10)</td>
<td>(2.00)</td>
<td>(3.30)</td>
<td>(-1.85)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.202</td>
<td>-0.002</td>
<td>0.015</td>
<td>0.095</td>
<td>-0.055</td>
<td>1.582</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(3.39)</td>
<td>(-0.30)</td>
<td>(1.32)</td>
<td>(3.20)</td>
<td>(-2.08)</td>
<td>(13.58)</td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.193</td>
<td>0.000</td>
<td>0.001</td>
<td>0.069</td>
<td>-0.078</td>
<td>2.881</td>
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</tr>
<tr>
<td>(t-statistic)</td>
<td>(3.55)</td>
<td>(0.07)</td>
<td>(0.08)</td>
<td>(2.35)</td>
<td>(-2.85)</td>
<td>(15.60)</td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.104</td>
<td>0.007</td>
<td>0.019</td>
<td>0.069</td>
<td>-0.042</td>
<td>2.238</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(1.87)</td>
<td>(1.19)</td>
<td>(1.62)</td>
<td>(2.36)</td>
<td>(-1.52)</td>
<td>(9.85)</td>
<td></td>
</tr>
<tr>
<td>Mean coeff.</td>
<td>0.200</td>
<td>-0.001</td>
<td>0.001</td>
<td>0.059</td>
<td>-0.067</td>
<td>0.208</td>
<td></td>
</tr>
<tr>
<td>(t-statistic)</td>
<td>(3.84)</td>
<td>(-0.13)</td>
<td>(0.08)</td>
<td>(2.02)</td>
<td>(-2.67)</td>
<td>(13.89)</td>
<td></td>
</tr>
</tbody>
</table>

T-statistics (in parentheses) are calculated as the mean coefficient \( \div \) the standard error of the coefficients across the years 1981–1996. \( R_{t+1} \) is the continuously compounded annual stock return for the twelve-month period beginning five months after the start of fiscal year \( t + 1 \). \( LMVE_{it} \) is the log of market value of equity at the end of year \( t \). \( FIRM_{it} \), \( LAG_{it} \), and \( RES_{it} \) represent the firm-specific effect, lagged-market effect, and residual components of BTM, respectively.

\[
FIRM_{it} = a_i = \left( BTM_i - BTM \right) - \sum_{k=0}^{6} \beta_k (\Delta MV_{kt} - \Delta MV_{kt})
\]

\[
LAG_{it} = \sum_{k=0}^{6} \beta_k \Delta MV_{kit}
\]

\[
RES_{it} = \epsilon_{it} = BTM_{it} - INT - TIME_i - FIRM_{it} - LAG_{it}
\]

\( RE^{t+1} \) is the forecast error measured as the difference between actual earnings for year \( t + 1 \) and \( FOR_{it}^{t+1} \). \( RES_{it}^{lg} \) is the forecast revision for year \( t + 2 \) earnings, measured as the difference between the \( t + 2 \) earnings forecasts four months after the end of fiscal year \( t + 1 \) and four months after the end of fiscal year \( t(FO^{t+2}) \). \( REV_{it}^{lg} \) is the forecast revision for long-term earnings growth, measured as the difference between the long-term earnings growth forecasts four months after the end of fiscal year \( t + 1 \) and four months after the end of fiscal year \( t(FO^{t+2}) \). These revision periods correspond to the return accumulation period. Critical values for a one-tailed t-test with fourteen degrees of freedom are 2.624 (0.01 levels), 1.761 (0.05 level), and 1.345 (0.10 level).
returns is exhibited by REV\textsuperscript{t+2} and not REV\textsuperscript{t+1} or REV\textsuperscript{t+3} (adjusted R\textsuperscript{2} of 0.25, 0.13, and 0.06, respectively). We next evaluate whether the BTM components have incremental explanatory power beyond the forecast errors/revisions to systematically predict future returns.

Panel B of table 5 reports the mean regression results of equation (12) based on the three REV\textsuperscript{h} measures. To facilitate comparisons, we reproduce from table 3 the baseline model regressing RET on the BTM components. When we include REV\textsuperscript{t+1} with the BTM components, the adjusted R\textsuperscript{2} increases to 0.158, but only the FIRM coefficient (0.015) markedly decreases relative to the baseline model and becomes insignificant. On the other hand, when we add REV\textsuperscript{t+2} to the components, we find that both the FIRM and LAG relations diminish. The LAG coefficient (0.069) remains significant, while the FIRM coefficient (0.001) is insignificant after controlling for REV\textsuperscript{t+2}. When we include REV\textsuperscript{t+3} in the model, the LAG coefficient is similarly attenuated, although it remains significant.

Consistent with table 4, each of these forecast revisions appears to capture something different in the components’ relations with future returns.

Finally, we add all three revisions to the model and report the results in the last line of table 5. The combination of all three variables mitigates the FIRM and LAG relations considerably. The FIRM component, with a coefficient of 0.001, has no incremental explanatory power for future returns. The coefficient on the LAG component (0.059) is about 40% lower than its original value, although it remains significant at a 0.05 level. Interestingly, the negative coefficient on RES persists in this comprehensive model.\textsuperscript{24}

In summary, our results are generally consistent with a market mispricing explanation for the return relation documented in table 3. We find that the ability of FIRM to predict future returns is fully explained by its association with systematic errors in earnings forecast data. The LAG relation with year-ahead returns is similarly reduced, but unlike FIRM, it has some explanatory power incremental to the forecast revisions. One explanation for this result is that the I/B/E/S forecast data is an incomplete proxy for the market’s earnings expectations, and a better proxy for revisions in the market’s expectations could explain away the incremental effect of LAG.\textsuperscript{25} Alternatively, the remaining explanatory power of LAG may be attributable to some other phenomenon beyond the market mispricing argument presented here. Finally, the negative relation between RET and RES appears resilient throughout the analysis. After removing the systematic variation in BTM, which is positively associated with future returns, the unsystematic component, RES, exhibits a unique negative relation with future returns.

\textsuperscript{24} When we use monthly compounded returns or summed monthly returns, FIRM and LAG are insignificant after controlling for all three forecast revisions. Also, RES is negative but insignificant in a two-tailed test.

\textsuperscript{25} In support of this possibility, we find that when we dichotomize the sample by size, LAG remains significant only for the larger firms, which are more likely to have a richer information environment for expected earnings beyond analyst forecasts.
4.4 EX-POST ANALYSIS OF RES

The results reported above indicate that RES inversely captures something about revisions in expected earnings growth that partially explains its negative relation with future returns. This could indicate that RES proxies for risk or growth factors that are embedded in BTM. In an effort to provide additional insight into the RES relations, we examine its association with measures of risk and growth.

In untabulated regressions we find that RES is uncorrelated with a market-model beta, and that it is positively related to the mean square error of raw returns (two-tailed p-value of .08). Both risk proxies are estimated over 36 months ending in year t. The weak positive relation with mean square error cannot explain the negative relation with RET. Thus, we find no indication that RES captures traditional measures of market risk.

We next investigate how RES relates to past growth. Following Beaver and Ryan [2000], we construct a measure of growth by multiplying the average growth in sales by the average earnings retention rate (one minus the dividend payout ratio), both of which are measured over the past three years. We find that RES is positively correlated with past growth, in sharp contrast to its negative relation with subsequent growth forecast revisions and contemporaneous stock returns. As an additional test, we interact RES with past growth and add this variable to the year-ahead return regression. The coefficient on RES is not significantly different from zero, while the interaction term fully captures the negative relation documented earlier. Thus, the inverse relation between RES and returns appears to be conditioned on past growth.26 Our results suggest that RES and LAG uniquely partition the manner in which past growth is reflected in BTM. Both analysts and investors appear to overestimate this momentum. Although the role of growth in this context requires further research, we believe that the decomposition of BTM may help future research disentangle competing factors that explain future returns.

4.5 SURVIVORSHIP ISSUES

Our research design for the estimation of BTM components clearly favors the selection of larger, surviving firms. Though the relations with future stock returns include firms that subsequently discontinue trading and a delisting return is assumed, we consider the possibility that a survivorship bias influences our results. Kothari, Shanken, and Sloan [1995] argue that the BTM relation with future returns may be inflated because (1) the Compustat database excludes firms experiencing distress, particularly among smaller firms, and (2) when a firm is added by Compustat (because it eventually

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26 We also find that LAG is negatively correlated with past growth, yet positively correlated with revisions in expected growth and returns. When we similarly include the interaction of LAG and past growth in the return regression, that interaction term is significantly positive, while LAG alone becomes insignificant. These results provide further evidence consistent with LAG reflecting an overreaction to past growth.
proves successful) historical data is backfilled. These factors could induce an association of low market value, high BTM firms available on Compustat with higher than average future returns. We believe that several aspects of our study help to mitigate these potential problems.

First, we predict returns using BTM ratios beginning in 1981. This is subsequent to Compustat’s major database expansion project undertaken in 1978, although the database has continued to gradually expand. Second, our fixed effects model requires each firm to have five years of Compustat data prior to predicting returns. These features reduce the likelihood that we rely on backfilled data in the Compustat database to predict returns (La Porta [1996] and Fama and French [1993]).

Given that the potential Compustat selection bias is most acute among smaller firms (Kothari et al. [1995]), we note that only 0.8% of our sample comes from the smallest CRSP market capitalization decile. Furthermore, when we partition our sample based on the median market capitalization of the sample, we find similar results for our BTM components across the two partitions. If a Compustat selection bias inflated our results, we would expect the smaller firms in our sample to exhibit a stronger relation. Breen and Korajczyk [1995] also find that the ability of selection bias to explain the BTM-return relation is not significant among NYSE/AMEX firms. Ninety percent of our sample is NYSE/AMEX firms. Finally, we use the Compustat research file in our sample selection process to avoid dropping valid observations for firms that subsequently terminated. The research file yields 16.8% of our 12,090 observations. In summary, certain aspects of our research design make our results less susceptible to specific survivorship biases identified in previous return anomaly studies. However, we recognize that the research design also restricts our analysis to surviving firms with analyst coverage and, hence, limits the generalizability of our results.

5. Conclusion

This study follows the work of Ryan [1995] and Beaver and Ryan [2000] by decomposing book-to-market into a more persistent fixed firm effect and a more transitory component attributable to prior price changes. They characterize these components as biased accounting recognition and delayed accounting recognition of the firm’s underlying market value. Using the Beaver and Ryan framework, we examine the relations between book-to-market components and future returns. Furthermore, we include financial analyst forecast data in the analysis to provide additional insight into the return relations first documented in Beaver and Ryan [1996]. Although Beaver and Ryan [2000] suggest that the book-to-market components help to identify the rational pricing of expected ROE, our results based on the book-to-market components help us to understand the predictability of returns.

We find that the variation in book-to-market attributable to past price changes is the primary factor in its ability to predict future returns.
Furthermore, this lagged return component of book-to-market is similarly associated with revisions in long-term earnings growth forecasts. The more persistent firm effect is also associated with future returns and future earnings forecast revisions, but the relations are comparatively weaker. Most interestingly, when we control for the future earnings forecast revisions, the explanatory power of these book-to-market components for future returns is drastically reduced. The lagged return component retains some ability to predict future stock returns, suggesting that our use of analyst earnings forecast revisions cannot fully explain this market anomaly. It is unclear whether this points to some other explanation or simply indicates a limitation in our proxies.

We contribute to existing literature by providing direct evidence of these book-to-market relations at a component level. Our use of three distinct forecast horizons with the orthogonal partitions of book-to-market provides added insight into how book-to-market reflects expected future earnings. Our results suggest that the market’s anticipation of future earnings reflected in current book-to-market are not fully rational and predictable errors in those expectations result in predictable stock returns. In particular, we show that a systematic mapping of past price changes into the book-to-market ratio predicts both future earnings forecast revisions and future price reversals. These insights should help other researchers investigating the relation between expected earnings and firm value.

REFERENCES


