

What Drives Target Price Forecasts and Their Investment Value?

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Abstract: This paper examines the informativeness of analysts' target price forecasts by relating the investment value of target prices to their primary drivers. Decomposing target price forecasts into near-term earnings forecasts and price-to-earnings ratio forecasts, we show that target price revisions reflect information from both components. In addition, we also find that the relative importance of each component in target price revisions is related to firm characteristics. A portfolio based on target price implied expected returns delivers significant abnormal returns. More importantly, we find that the abnormal returns are associated with both earnings and price-to-earnings forecasts, which suggests that the informativeness of target price forecasts comes not only from analysts' ability to forecast short-term earnings but also from their ability to assess risk and long-term growth prospect implied in price-to-earnings forecasts.

Keywords: target prices, earnings forecasts, variance decomposition

1. INTRODUCTION

Target price forecasts are one of the key elements in equity analysts' research reports.¹ However, compared to the extensive literature on the roles of earnings forecasts and stock recommendations in price formation, there are relatively few studies on the investment value of target price forecasts.² These studies generally agree that target price forecasts are informative, while existing studies are mixed at best regarding the ability of analysts to accurately forecast target prices.³ Despite this seemingly

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1 A target price forecast issued by an analyst is her projected price level for a covered stock in the next 12 to 18 months. While almost all analyst reports include earnings forecasts and stock recommendations, not every analyst report contains target price forecasts. According to Asquith et al. (2005), while over 99% of Institutional Investor's All-America Research Team analysts report earnings forecasts and stock recommendations in their reports, about 73% of their reports include target price forecasts in the period 1997–1999.

2 A few exceptions include Brav and Lehavy (2003), Asquith et al. (2005), Da and Schaumburg (2011) and Gleason et al. (2013).

3 For example, Bonini et al. (2010) find that analysts' forecasting ability of target prices is limited. And Bradshaw et al. (2013) find no evidence of persistence in forecasting accuracy of target prices. However, in

conflicting evidence, little is known about the sources of target price forecasts through which analysts convey valuable information to investors. In this paper we attempt to fill this gap by identifying where the investment value of target price forecasts comes from. Specifically, we examine the informativeness of target price forecasts by relating their investment value to target price drivers.

A major obstacle to this empirical analysis is our lack of knowledge on analysts' target price forecasting process. To identify what drives target price forecasts, we need to know the valuation model each analyst uses so that we can infer the main inputs to the model in generating a specific target price forecast; however, analysts' valuation model use is not directly observable. Left to infer the valuation model, we adopt a parsimonious model of analysts' target price forecasts. In particular, we take a target price to be the product of two components: a forecast of 1-year-ahead earnings and a forecast of the trailing price-to-earnings (P/E) ratio. While the first component contains information about short-term profitability, the second component contains information about discount rates and long-term growth in profitability.⁴ Since analysts generally do not provide their P/E ratio forecasts, we infer them from target price forecasts and earnings forecasts.

Our choice of the parsimonious model as the basis of our empirical analysis is subject to the criticism that not all target price forecasts are based on the same valuation model.⁵ However, there are at least three reasons to believe that the parsimonious target price model well represents the actual valuation models in use. First, there is anecdotal evidence that sell-side analysts formulate a target price by multiplying their earnings projections by a price-to-earnings ratio "that's appropriate for the industry, or reasonable by the company's historical standards" (Wang, 2003). Second, Brav et al. (2005) document that Value Line target prices are indeed calculated as the product of a forecasted price-to-earnings ratio and forecasted earnings per share. Third, Asquith et al. (2005) report that 99% of *Institutional Investor's* All-America Research Team analysts cite earnings multiples as a basis for price targets, whereas only 13% mention the use of the discounted cash flow model or its many variations. Thus, given the limited knowledge on the actual target price model use, the parsimonious model seems a reasonable choice for our main tests. However, to gain further insight into the informativeness of target price forecasts, we also conduct analysis using alternative valuation models as a robustness check.

The decomposition of target prices into two distinct components allows us to explore our research questions regarding the formation and informativeness of target prices. First, what causes analysts to revise their target price forecasts? To address this question, we assess whether and to what extent variation in target price revisions is explained by variation in revisions of each target price component. This analysis can shed light on whether analysts actually exploit each information source when forming their target price forecasts as claimed (Wang, 2003; Brav et al., 2005). Second, are

a more recent study covering data from 16 countries, Bilinski et al. (2013) provide evidence that analysts have differential and persistent skill to issue accurate target price forecasts.

⁴ For a firm that pays out earnings as dividends, Gordon's (1962) constant-growth model shows that $P_0/E_0 = (1 + g)/(r - g)$, where r and g denote the discount rate and the earnings growth rate, respectively.

⁵ For example, Demirakos et al. (2004) study 104 analyst reports for 26 large UK firms from the beverages, electronics, and pharmaceuticals sectors, and find that analysts' choice of valuation methodology varies across industrial sectors. In a more recent study, Gleason et al. (2013) document that some analysts appear to rely on simple heuristics based on valuation multiples while others appear to use more rigorous models such as the residual income model.

certain information sources more relevant to target price forecasts for certain types of firms? Specifically, we ask whether the relative importance of the two components in target price revisions is related to underlying firm characteristics. This question is also motivated by previous research showing that analysts favor stocks with particular characteristics (Jegadeesh et al., 2004). Finally, we ask whether the investment value of target prices is mainly driven by analysts' ability to forecast short-term earnings. While there is ample evidence that analysts add value by providing accurate near-term earnings forecasts (Stickel, 1991; Chan et al., 1996; Gleason and Lee, 2003), little is known about their ability to forecast factors implicit in P/E ratio forecasts such as risk and growth prospect.⁶ To the extent that analysts' ability to forecast 1-year-ahead earnings exceeds their ability to forecast P/E ratios, we would expect target prices to be more informative when their revisions are caused by revisions in short-term earnings forecasts rather than revisions in P/E ratio forecasts.

Using a large sample of target price data from I/B/E/S for the period 1999–2011, we document that revisions in target price forecasts are driven by both short-term earnings forecast revisions and P/E ratio forecast revisions.^{7,8} For example, when each revision is measured over 3-month intervals, about 39% of the variation in target price revisions is explained by revisions in short-term earnings forecasts and the remaining 61% by revisions in P/E ratio forecasts. The relative importance of short-term earnings forecast revisions in explaining target price revisions increases with the revision horizon (i.e., the length of revision intervals). For example, at the 12-month revision horizon, more than 60% of the variation in target price revisions is explained by revisions in short-term earnings forecasts. This pattern is consistent with earlier studies documenting that in the long run, firm valuation ultimately depends on earnings (Easton et al., 1992; Vuolteenaho, 2002). We also document that, in our additional analysis, revisions in P/E ratio forecasts mainly contain information about discount rates; long-term growth rates barely explain revisions in P/E ratio forecasts.

We also find that, in the cross-section, the relative importance of short-term earnings forecasts over P/E ratio forecasts (or vice versa) in target price revisions is related to the underlying firm characteristics. For example, for stocks with smaller market capitalization, higher book-to-market ratios, slower sales growth, and lower past returns, short-term earnings forecast revisions explain variation in target price revisions to a greater extent than P/E ratio forecast revisions do.

Before turning to the analysis on the sources of the informativeness of target price forecasts, we first report that a long-short trading strategy based on the expected returns implied by analysts' target prices (TPER) generates a substantial four-factor alpha of 0.87% per month during our sample period. This finding is consistent with prior studies (Brav and Lehavy, 2003; Da and Schaumburg, 2011; Gleason et al.,

6 There are two notable exceptions. Lui et al. (2007) find that financial analysts are able to gather and process information about investment risk by analyzing risk ratings in a large sample of research reports issued by Salomon Smith Barney, now Citigroup, over the period of 1997 to 2003. More recently, Joos et al. (2013), using three state-contingent target price estimates from Morgan Stanley analyst reports issued between 2007 and 2010 for US firms, document that analysts are able to assess and identify the risk of firm fundamentals.

7 To determine the driving forces behind analysts' target prices, we focus on revisions in, instead of levels of, target prices.

8 In an earlier version of this paper, we use target price forecasts provided by First Call. However, First Call stopped collecting and publishing target price forecasts in March 2005. Due to the extended coverage to more firms and more recent periods, we switch our database to I/B/E/S. Our inferences are not sensitive to the choice of data sources.

2013). We next use our target price decomposition to disentangle the sources of the investment value of target price forecasts. If the investment value of target prices comes solely from analysts' superior ability to forecast short-term earnings, we would expect the TPER strategy to be profitable for stocks whose target price revisions are due to revisions in short-term earnings forecasts but not for stocks whose target price revisions are due to P/E ratio forecast revisions. Instead we find that the TPER strategy yields significant risk-adjusted returns for both groups of stocks. This finding suggests that target price forecasts provide valuable information through analysts' ability to assess risk and long-term growth as well as their ability to forecast short-term earnings. We also confirm that this result holds in cross-section regressions where we control for other firm-level characteristics including analysts' recommendation revisions. This result is consistent with prior research suggesting that analysts' target price forecasts provide information not already reflected in their prevailing earnings forecasts and recommendations (Brav and Lehavy, 2003; Asquith et al., 2005; Da and Schaumburg, 2011).

The contribution of this paper is twofold. First, our results provide further insight into how analysts generate target price forecasts. While Bandyopadhyay et al. (1995), Bradshaw (2002), and Asquith et al. (2005) present evidence that earnings forecasts are an important element of target price formation, their focus is limited to the role of earnings forecasts in target price forecasts. Instead we aim explicitly to investigate target price formation and employ the parsimonious but well-represented valuation model to decompose target price forecasts into near-term earnings forecasts and P/E ratio forecasts. An advantage of our approach is that we can disentangle and assess the importance of each component as a target price driver.

Second, our work complements recent literature on the sources of the informativeness of analysts. Most closely related to our study, Kecskes et al. (2015) provide evidence suggesting that earnings are a more important source of informative recommendations than information unrelated to earnings. Our work differs from theirs in that our interest is in target prices while they focus on stock recommendations. To the extent that the informativeness of one measure is not subsumed by the other, the two studies complement each other. More recent work by Dechow and You (2015) also investigates the usefulness of target prices by decomposing target price implied returns. Our paper is in the same spirit, but we directly decompose target prices, which enables us to focus on analysts' target price formation and assess their ability to forecast each component of target prices.

The remainder of the paper is structured as follows. In section 2 we discuss related literature. We describe our data and discuss the research methodology in section 3. In section 4 we present our main empirical results. In section 5 we examine the robustness of our results. We conclude in section 6.

2. RELATED LITERATURE

One of our goals in this paper is to better understand target price formation process. In this regard, our paper is related to Bandyopadhyay et al. (1995), Bradshaw (2002) and Asquith et al. (2005). These papers suggest that earnings forecasts are an important component of models used to forecast target prices. For example, using a sample of analyst reports for 114 Canadian firms from 1983 to 1988, Bandyopadhyay et al. (1995) find that variation in short-term (long-term) earnings forecasts explains about 30% (60%) of the variation in target prices. Like Bandyopadhyay et al., Bradshaw

(2002) and Asquith et al. (2005) rely on a relatively small sample of analyst reports: 103 reports in the period 1996–1999 and 1,126 reports in the period 1997–1999, respectively. In contrast, our sample utilizes a large sample of target price forecasts available from I/B/E/S for the period 1999–2011. Moreover, contrary to our work, these papers only focus on earnings forecasts, but do not consider the role of other components in target price formation. Using a simple valuation model where target prices can be decomposed into the component of short-term earnings forecasts and the component of P/E ratio forecasts, we examine whether and to what extent target price forecasts are attributable to each component. We add to this literature by using a more extensive dataset than in earlier studies and by explicitly considering the role of P/E ratio forecasts in target price formation.

Our paper is also related to prior research documenting that sell-side equity analysts favor firms with certain characteristics. For example, using both levels of and changes in recommendations, Jegadeesh et al. (2004) show that analysts tilt their opinions toward firms with favorable characteristics such as high value and positive momentum. Motivated by this evidence, we examine how firm characteristics affect the relative importance of each target price component in explaining target price revisions. In this effort, we focus on several firm characteristics known to affect analysts' stock valuation: accruals, book-to-market ratio, capital expenditures, sales growth, firm size and momentum. If a firm exhibits characteristics indicating a high level of earnings persistence or a greater proportion of assets in place relative to growth opportunities, we expect revisions in 1-year-ahead earnings forecasts to be a main driver of target price revisions for this firm. In contrast, if a firm exhibits characteristics indicating a high level of uncertainty about future earnings or the prospect of a high level of growth in the future, we expect that revisions in P/E ratio forecasts should have more impact on target price revisions for this firm than revisions in near-term earnings forecasts do.

This paper connects to work on the informativeness of analysts' target price forecasts. Using target prices issued for more than 6,500 firms over the period 1997–1999, Brav and Lehavy (2003) document incremental abnormal returns around target price revisions, beyond stock recommendations and earnings forecast revisions. Asquith et al. (2005) confirm the finding of Brav and Lehavy by showing that earnings forecasts, stock recommendations and target prices all provide independent valuation information to investors. Da and Schaumburg (2011) analyze the performance of a sector-neutral long-short portfolio of S&P 500 stocks based on target price implied expected returns over the 1999 to 2004 period and find that the portfolio earns a substantial abnormal return of 203 bp per month. We follow the trading strategy of Da and Schaumburg for our analysis on the informativeness of target price forecasts.

Several recent papers relate the informativeness of analyst research to its potential driving forces. Our effort to explore the sources of the investment value of target prices is especially close to this line of research. Gleason et al. (2013) document that the 12-month holding period abnormal returns of portfolios constructed from target prices are greater when analysts appear to rely on more rigorous valuation techniques rather than simple heuristics.⁹ While they focus on analysts' choice of alternative valuation models, we stick to the parsimonious valuation model as the basis of our main

9 In a related study, Demirakos et al. (2010) examine whether the choice of valuation models affects the accuracy of target prices using analysts' research reports covering 94 UK firms over the period 2002–2004. They find mixed evidence documenting that their results are sensitive to the definition of target price accuracy.

analysis and investigate the impact of model inputs on the investment value of target prices. In a recent study on the sources of the investment value of stock recommendations, Kecskes et al. (2015) document that earnings-based recommendation changes are more informative than non-earnings-based recommendation changes. Our work differs from theirs by focusing on target prices, a finer and more granular summary measure than stock recommendations. Our results are also different because we find weak evidence of differential impact of target price drivers on the informativeness of target prices.

Finally, our paper complements interesting recent work by Dechow and You (2015), closest to ours in terms of focus, on the determinants and usefulness of analysts' target price forecasts. Their study is similar to our study in a sense that they employ a decomposition approach. However, they decompose target price implied returns while we directly decompose target prices. An advantage of our approach is that it enables us to assess analysts' ability to forecast each component as a driving force behind the investment value of their target price forecasts.

3. DATA AND METHODOLOGY

(i) Data

We obtain data on target prices, earnings forecasts and long-term growth rates from I/B/E/S, stock prices and returns from CRSP, and fundamentals data from Compustat. For each month from 1999 through 2011, we include stocks for which there is at least one target price announcement and one FYI earnings forecast during the month. Table 1 presents a summary of the sample. For each stock, there are on average 2.93 target price forecasts and 5.79 earnings forecasts per month. On average, our sample covers more than 89% of the CRSP stock universe in terms of market capitalization. The median market capitalization of stocks in our sample, averaged over the sample period, is US\$ 1.35 billion – much larger than that of all Nasdaq stocks (US\$ 85 million) and even larger than that of all NYSE stocks (US\$ 963 million).

A key variable of interest is the target price implied expected return (TPER), which is defined as the split-adjusted consensus target price divided by end-of-month stock price minus one. The consensus target price is the simple average of all target prices issued during the month; we do not use analyst identities in constructing the consensus forecast because prior studies (Bonini et al., 2010); and Bradshaw et al., 2013) fail to find evidence of systematic differences in target price forecasting ability across analysts.

The mean and median values of TPER are 26.0% and 18.3%, respectively, in our sample period, reaching as high as 53.1% and 34.0%, respectively, in 2000 during the final stages of the NASDAQ bubble. These levels are substantially higher than one would expect to earn from the market as a whole, indicating that analysts tend to forecast overly high target prices. One possible explanation for this is that analysts are more likely to issue target price forecasts for their favored stocks.

Following Da and Schaumburg (2011), we separate the sample into sectors according to the first two digits of Standard & Poor's GICS (Global Industry Classification Standard) codes. Using I/B/E/S data, Boni and Womack (2006) show that GICS sector and industry definitions are in accordance with the areas of expertise of most analysts as defined by the set of stocks that analysts cover. GICS codes are therefore a natural basis for sector definitions in our analysis of analysts' target prices.

Table 1
Descriptive Statistics of Analysts' Target Price Forecasts and Earnings Forecasts

Year	Num of TP/month	Num of EF/month	Num of Stocks/month	Mean Mktcap (in mill \$)	Median Mktcap (in mill \$)	Mean TPER	Median TPER	Mktcap %
1999	2.02	5.18	1,151	8,297	1,156	37.28%	27.76%	88.00%
2000	2.16	4.93	1,288	9,142	1,378	53.07%	34.03%	89.48%
2001	2.60	5.74	1,225	7,861	1,277	37.02%	23.67%	89.28%
2002	2.84	5.45	1,235	6,649	1,147	29.19%	20.63%	88.98%
2003	2.75	5.34	1,395	6,270	1,121	16.60%	12.63%	88.50%
2004	2.74	5.53	1,569	6,591	1,239	17.65%	12.99%	89.11%
2005	2.69	5.56	1,650	6,789	1,309	17.02%	13.00%	88.68%
2006	2.74	5.55	1,734	7,321	1,429	16.61%	12.64%	89.37%
2007	2.89	5.61	1,782	7,848	1,491	19.49%	14.07%	88.24%
2008	3.39	6.18	1,721	7,037	1,340	30.17%	20.00%	89.20%
2009	3.63	6.61	1,593	6,077	1,280	19.77%	14.47%	90.21%
2010	3.64	6.64	1,749	6,746	1,572	20.60%	16.07%	89.56%
2011	3.97	6.92	1,783	7,728	1,811	22.90%	15.56%	91.83%
Mean	2.93	5.79	1,529	7,258	1,350	25.95%	18.27%	89.26%

Notes:

The table reports descriptive statistics of individual target price forecasts and earnings forecasts (the union set of two forecasts) available at the IBES database over the sample period from 1999 through 2011. The sample includes forecasts made by brokerage houses that provide both target price and earnings forecast. Variables are defined as follows. *TP* is the target price forecast; *EF* is the earnings forecast; *Mktcap* is the market capitalization of sample firms; *TPER* is the target price implied return, calculated by subtracting one from the ratio of target price and the current stock price; *Mktcap %* is the proportion of the sample firms' market capitalization to the total market value of the CRSP population.

(ii) Target Price Decomposition

Our parsimonious valuation model decomposes a target price forecast (TP) into two components: a forecast of 1-year-ahead earnings (EF) and a forecast of the trailing P/E ratio (PE) as:

$$TP_t = EF_t \times PE_t.$$

While analysts' target price forecasts and 1-year-ahead earnings forecasts are directly observable, their P/E ratio forecasts are not. We thus compute the "implied" forecasts of the P/E ratio as $PE_t = TP_t / EF_t$. The first decomposition component (EF) reflects information about short-term earnings and the second component (PE) contains information about discount rates and long-term earnings growth.

It is well known that the level of earnings forecasts can be contaminated by analyst biases. As biases are more likely to persist over short horizons, revisions in analysts' forecasts are less affected by biases and hence more informative about changes in firms' fundamentals. Taking the logarithm of the variables, we can decompose revisions in target prices into revisions in earnings forecasts and revisions in the implied P/E ratio forecasts. Letting small letters stand for the logarithms of the variables, we have:

$$\Delta tp_t = \Delta ef_t + \Delta pe_t. \quad (1)$$

It is worthwhile to note that our decomposition differs from return decomposition used in finance literature (Vuolteenaho, 2002); and Chen et al., 2013) in the nature of components. The latter breaks down returns into news about future cash flows (including both short- and long-term cash flows) and news about discount rates; our decomposition yields the component associated with news about "short-term" earnings and the component associated with both news about discount rates and "long-term" earnings.

Besides offering the convenience of directly utilizing the parsimonious valuation model, the use of our approach focusing on short-term earnings instead of all future cash flows is also supported by recent literature. Da and Warachka (2011) indicate that analysts' career concerns and limited attention impede their ability to immediately process all information relevant to long-term earnings. Given this evidence, our decomposition allows us to focus on analysts' core competence in forecasting short-term earnings as the key information source of target price revision. More recent work by Penman and Yehuda (2015) suggests that the typical return decomposition employed in finance research is not consistent with accounting conservatism. Specifically, they point out that due to the deferral of earnings recognition, the expected earnings growth beyond the reported earnings conveys information about discount rates rather than future cash flows. Thus our approach of separating long-term earnings news from short-term earnings news and combining it with discount rate news is consistent with their insights.

To measure the relative importance of each component in target price revisions, we use a variance decomposition approach. Equation (1) implies:

$$Var(\Delta tp_t) = Cov(\Delta tp_t, \Delta ef_t) + Cov(\Delta tp_t, \Delta pe_t). \quad (2)$$

Dividing both sides of equation (2) by $\text{Var}(\Delta tp_t)$, we obtain:

$$1 = \frac{\text{Cov}(\Delta tp_t, \Delta ef_t)}{\text{Var}(\Delta tp_t)} + \frac{\text{Cov}(\Delta tp_t, \Delta pe_t)}{\text{Var}(\Delta tp_t)}. \quad (3)$$

Each term on the right-hand side of equation (3) can be estimated by regressing Δef_t and Δpe_t , respectively, on Δtp_t . The slope coefficient of the first regression, β_{EF} , thus measures the proportion of the total variation in target price revisions that is explained by variation in short-term earnings forecast revisions. Likewise, the slope coefficient of the second regression, β_{PE} , measures the portion of the total variation in target price revisions that is explained by variation in P/E ratio forecast revisions. By construction, β_{EF} and β_{PE} sum to one. An important caveat is that β_{PE} is likely to overestimate the importance of P/E ratio forecasts in target price revisions because our estimate of PE captures other information as well; again, PE is not observable and hence is derived from TP and EF .

Note that the coefficients β_{EF} and β_{PE} are conceptually firm-specific variables and thus should be estimated at the firm level using past time-series data, which we actually do in most of our analyses. However, before we exploit the feature that the relative importance of each component in target price revisions varies across firm characteristics, we estimate β_{EF} and β_{PE} in the cross-section of our broad universe of stocks to provide an overall picture of whether and to what extent each component contributes to target price revisions. In this case, the estimates of β_{EF} and β_{PE} should be interpreted as the average of the corresponding firm-specific measures across firms.

4. EMPIRICAL RESULTS

(i) Variance Decomposition of Target Price Revisions

To measure the relative importance of each component in driving target price revisions, we perform variance decomposition tests. Specifically, at the end of each year over the sample period, we regress the revision in log short-term earnings forecasts (Δef) on the revision in log target price forecasts (Δtp) in the cross-section. The resulting slope coefficient (β_{EF}) represents the portion of the variation in target price revisions that is explained by revisions in short-term earnings forecasts. Similarly, we can estimate β_{PE} by regressing the revision in log P/E ratio forecasts (Δpe) on the revision in log target price forecasts (Δtp) in the cross-section. Alternatively, since $\beta_{EF} + \beta_{PE} = 1$ by construction, we can simply compute β_{PE} as $1 - \beta_{EF}$. Note that, in this particular part of our analysis, β_{EF} and β_{PE} each measures the fraction of the *cross-sectional* variation in target price revisions that is explained by the corresponding component. If the revisions in target price forecasts were driven entirely by the revision in earnings forecasts, we would not expect to see statistically significant coefficients on β_{PE} .

Table 2 reports the results for the cross-sectional regressions when each revision is measured over 3-month intervals, 6-month intervals, and 12-month intervals in Panels A, B, and C, respectively. The time-series average coefficients on β_{EF} (β_{PE}) range from 0.39 (0.61) to 0.63 (0.37) across revision horizons, indicating that both earnings forecasts and P/E ratio forecasts are important determinants of target price revisions. We also find that the relative importance of each component in target price revisions varies over time. For example, short-term earnings forecasts play a relatively limited

Table 2
Variance Decomposition of Target Price Revisions

Panel A: Three-Month Revision Horizon				Panel B: Six-Month Revision Horizon				Panel C: 12-Month Revision Horizon			
Year	β_{EF}	β_{PE}	Obs	Year	β_{EF}	β_{PE}	Obs	Year	β_{EF}	β_{PE}	Obs
1999	0.28	0.72	6,444	1999	0.34	0.66	3,619	1999	0.50	0.50	8,134
2000	0.30	0.70	10,169	2000	0.40	0.60	9,996	2000	0.55	0.45	9,050
2001	0.39	0.61	10,108	2001	0.50	0.50	9,710	2001	0.60	0.40	9,544
2002	0.38	0.62	10,856	2002	0.47	0.53	10,388	2002	0.57	0.43	11,276
2003	0.25	0.75	12,654	2003	0.39	0.61	12,050	2003	0.59	0.41	13,002
2004	0.41	0.59	14,713	2004	0.50	0.50	14,278	2004	0.71	0.29	14,420
2005	0.40	0.60	15,706	2005	0.58	0.42	15,247	2005	0.75	0.25	15,303
2006	0.41	0.59	16,505	2006	0.60	0.40	16,267	2006	0.72	0.28	15,829
2007	0.44	0.56	16,968	2007	0.57	0.43	16,675	2007	0.64	0.36	16,178
2008	0.37	0.63	16,992	2008	0.53	0.47	16,744	2008	0.61	0.39	14,348
2009	0.51	0.49	14,900	2009	0.53	0.47	14,503	2009	0.63	0.37	14,975
2010	0.40	0.60	16,803	2010	0.59	0.41	16,333	2010	0.70	0.30	16,446
2011	0.48	0.52	17,698	2011	0.60	0.40	17,314	2011	0.63	0.37	13,209
Mean	0.39	0.61	14,506	Mean	0.52	0.48	14,125	Mean	0.63	0.37	13,209

Notes:

The table reports the extent to which variation in target price forecasts (TP) is explained by variation in earnings forecasts (EF) and variation in price-to-earnings ratio (PE) in a variance decomposition framework. Each panel reports slope coefficients from two simple regressions each year: β_{EF} and β_{PE} . β_{EF} is the proportion of the variation in TP revisions that is explained by variation in EF revisions and is estimated by the slope coefficient of regressing log earnings forecast revisions on log target price revisions. β_{PE} is the proportion of the variation in TP revisions that is explained by variation in PE revisions and is estimated by the slope coefficient of regressing log price-to-earnings ratio revisions on log target price revisions. Revisions in log TP , log EF and log PE are calculated over three horizons: at 3-month (Panel A), 6-month (Panel B), and 12-month (Panel C) intervals. Obs in Panels A, B and C are the total firm-month observations used in each regression. Observations with a top and bottom 1% of PE are excluded from the sample.

role in determining target prices during the 1999 to 2000 period surrounding the peak of the technology bubble.

Table 2 also shows that the relative importance of short-term earnings forecast revisions in target price revisions increases with the revision horizon. At the 3-month revision horizon, on average 39% of the variation in target price revisions is driven by revisions in short-term earnings forecasts. This proportion increases to 52% and 63% at the 6-month horizon and at the 12-month horizon, respectively. This finding is consistent with the notion that although price variation in the short term can be driven by sentiment or other factors unrelated to firm fundamentals, over longer horizons it is still tied to the expected change in future earnings.¹⁰

(ii) Variance Decomposition and Firm Characteristics

We next relate the relative importance of each component in target price revisions to various characteristics of the underlying firm. In this effort, we examine seven characteristics following Jegadeesh et al. (2004). Total accruals (*TAC*) are computed as earnings before extraordinary items minus cash flows from operating income at each quarter-end, scaled by the average total assets of years $t - 1$ and t . Sales growth (*SG*) is computed as the percentage change in sales from year $t - 1$ to year t on a quarterly rolling basis. Annual total capital expenditures (*CapExp*) are calculated on a quarterly rolling basis scaled by the average total assets of years $t - 1$ and t . Book-to-market ratio (*BM*) is the ratio of the book value of equity to market capitalization at each quarter-end. Market capitalization (*MktCap*) is the logarithm of market capitalization at quarter-end. Past stock returns are captured in two variables: *Ret1* is the 6-month return from month $m - 6$ to month $m - 1$ and *Ret2* is the 6-month return from month $m - 12$ to month $m - 7$.

At the end of each month over the sample period, we sort stocks into quintiles on the basis of each characteristic and perform the variance decomposition exercise for each of the resulting 35 quintile portfolios. Table 3 reports the estimates of β_{EF} for each quintile and their difference between the top and bottom quintiles of each characteristic at 3-month, 6-month, and 12-month revision horizons in Panels A, B, and C, respectively. We do not separately report the estimates of β_{PE} because $\beta_{PE} = 1 - \beta_{EF}$. We also do not report statistical significance of coefficient estimates because all estimates are highly significant with associated *t*-statistics higher than 10. This high level of significance should not be surprising because the underlying structure is a mathematical identity.

Table 3 shows that, across all three horizons, the relative importance of short-term earnings forecasts in target price revisions is significantly related to total accruals, sales growth, book-to-market ratio, market capitalization and past returns. The estimates of β_{EF} for stocks in the bottom (low) quintiles of total accruals are 0.438, 0.557, and 0.675 at 3-month, 6-month, and 12-month revision horizons, respectively, which are larger than the corresponding estimated values (0.380, 0.505, and 0.619, respectively) for stocks in the top (high) quintile of accruals. This finding is in line with the intuition that news about short-term earnings should play a larger role as an information source for firms reporting sustainable earnings. Not surprisingly, the estimate of β_{EF} is smaller

10 This result is also consistent with evidence in Easton et al. (1992) that the explanatory power of earnings for returns increases monotonically from 4% to 60% as the return interval increases from 1 to 10 years.

Table 3
Variance Decomposition of Target Price Revision and Firm Characteristics

<i>Portfolio</i>	<i>TAC</i>	<i>SG</i>	<i>BM</i>	<i>CapExp</i>	<i>MktCap</i>	<i>Ret1</i>	<i>Ret2</i>
Panel A: Variance Decomposition by Firm Characteristics: 3-Month Revision Horizon							
1 (Low)	0.438	0.444	0.308	0.395	0.465	0.392	0.413
2	0.373	0.381	0.329	0.370	0.412	0.290	0.373
3	0.355	0.342	0.378	0.376	0.371	0.244	0.358
4	0.361	0.344	0.373	0.376	0.329	0.278	0.350
5 (High)	0.380	0.403	0.457	0.400	0.309	0.338	0.378
5 - 1	-0.058	-0.041	0.149	0.005	-0.156	-0.054	-0.035
[t-stats]	[-4.12]	[-2.59]	[5.03]	[0.26]	[-6.14]	[-2.70]	[-2.38]
Panel B: Variance Decomposition by Firm Characteristics: 6-Month Revision Horizon							
1 (Low)	0.557	0.583	0.413	0.514	0.616	0.510	0.528
2	0.501	0.513	0.438	0.508	0.521	0.371	0.497
3	0.487	0.474	0.488	0.517	0.487	0.347	0.475
4	0.480	0.454	0.513	0.495	0.449	0.357	0.452
5 (High)	0.505	0.498	0.574	0.505	0.446	0.469	0.489
5 - 1	-0.052	-0.085	0.161	-0.009	-0.170	-0.041	-0.038
[t-stats]	[-3.75]	[-4.80]	[6.50]	[-0.33]	[-8.91]	[-1.22]	[-1.68]
Panel C: Variance Decomposition by Firm Characteristics: 12-Month Revision Horizon							
1 (Low)	0.675	0.685	0.518	0.640	0.727	0.690	0.623
2	0.643	0.578	0.565	0.615	0.663	0.613	0.539
3	0.609	0.542	0.605	0.620	0.626	0.608	0.502
4	0.602	0.530	0.625	0.622	0.589	0.611	0.482
5 (High)	0.618	0.571	0.694	0.644	0.542	0.656	0.548
5 - 1	-0.057	-0.114	0.176	0.004	-0.185	-0.034	-0.075
[t-stats]	[-2.82]	[-3.75]	[9.82]	[0.16]	[-6.95]	[-1.03]	[-3.75]

Notes:

The table reports the extent to which variation in earnings forecasts (*EF*) explains variation in target price forecasts (*TP*) in a variance decomposition framework by each of seven firm characteristics. Each panel reports slope coefficients from a simple regression. β_{EF} is the proportion of the variation in *TP* revisions that is explained by variation in *EF* revisions and is estimated by the slope coefficient of regressing log earnings forecast revisions on log target price revisions. Revisions in log *TP* and log *EF* are calculated over three horizons: at 3-month (Panel A), 6-month (Panel B) and 12-month (Panel C) intervals. Within each sector classified by Standard & Poor's GICS, all sample stocks are divided into five groups based on firm characteristics (1 with the lowest and 5 with the highest). Firm characteristics are defined as follows. *TAC* is total accruals, computed as earnings before extraordinary income minus cash flow from operating income, scaled by the average total assets of year $t-1$ and year t at each quarter-end. *SG* is sales growth defined as the percent change in total sales from year $t-1$ to year t on a quarterly rolling basis. *CapExp* is an annual total capital expenditure on a quarterly rolling basis scaled by the average total assets of year $t-1$ and year t . *BM* is a book-to-market ratio, defined as the ratio of book value of equity to the market capitalization at each quarter end. *MktCap* is the logarithm of market capitalization at quarter-end. *Ret1* is a 6-month size-adjusted return from month $m-6$ to month $m-1$. *Ret2* is a 6-month size-adjusted return from month $m-12$ to month $m-7$. Observations with a top and bottom 1% of *PE* are excluded from the sample. Average *t*-statistics from the annual OLS regressions are reported in brackets.

for firms with high sales growth than for firms with low growth; analysts incorporate growth expectations in their P/E ratio forecasts.

Table 3 also shows that difference in β_{EF} estimates between the top and bottom book-to-market ratio quintiles is positive and significant at all three revision intervals,

equal to 0.149, 0.161, and 0.176 at 3-month, 6-month, and 12-month revision horizons, respectively. This finding does not come as a surprise given that firms with higher book-to-market ratios tend to have a greater portion of assets in place and limited growth opportunities; we would expect news about short-term earnings to be a more important driver of target price revisions for such firms. Compared to small firms, large firms have smaller coefficient estimates of β_{EF} at all revision horizons. One possible explanation for this finding is diversification effect (Vuolteenaho, 2002): large firms are able to diversify earnings news to a greater extent than small firms by investing in a variety of projects. If so, earnings news would account for a smaller fraction of the total variation in target price revisions. Finally, Johnson (2002) argues that higher past returns are indicative of higher future growth. Consistent with this argument, the estimates of β_{EF} for firms with high past returns are lower than the estimated values for firms with low past returns.

In sum, the analysis of variance decomposition by firm characteristics finds evidence that, compared to news about discount rates and long-term growth, short-term earnings news is a more important information source of analysts' target price forecasts for firms with lower accruals, slower sales growth, higher book-to-market ratios, smaller market capitalization and lower past returns.

(iii) Sources of the Informativeness of Target Price Forecasts

Prior research on analysts' target prices suggests that analysts provide value-relevant information to investors through their target price forecasts (Brav and Lehavy, 2003; Da and Schaumburg, 2011). In this section, we use our target price decomposition to examine where the investment value of target price forecasts comes from. Specifically, based on our evidence from variance decomposition, we examine whether the investment value of target prices comes from analysts' ability to forecast short-term earnings, P/E ratios, or both.

Following Da and Schaumburg (2011), we use target price implied expected returns (TPER) as an investment signal and implement a sector-neutral TPER strategy. TPER is defined as the consensus target price divided by month-end stock price minus one. At the end of each month over the sample period, we compute TPER for each stock and, within each sector defined by the two-digit GICS codes, sort stocks into quintiles on the basis of their TPER. We then combine each quintile's stocks across sectors to construct equal-weighted quintile portfolios. We hold the portfolios for a month before rebalancing.

To account for the fact that stocks with different levels of TPER are associated with different sources of risk, we compute risk-adjusted returns of the TPER-based portfolios using a four-factor model that includes the Fama and French (1993) three factors and the Carhart (1997) momentum factor. To account for the possibility that factor loadings are time-varying, we also compute characteristic-adjusted returns of the TPER-based portfolios (Daniel et al., 1997), which measure the returns in excess of those of a benchmark portfolio with similar characteristics in terms of size, book-to-market ratio and past returns.

Our empirical strategy in the attempt to identify the sources of the investment value of target prices is to link the performance of the TPER strategy to each decomposition component. To this end, we need a firm-level proxy to measure the extent to which each component is put to use in projecting target price forecasts. This proxy can be

interpreted as the relative importance of each component as analysts' information source of their target price forecasts for the specific firm. This approach enables us to relate the investment value of target prices to analysts' ability to forecast each component and thus assess the relative contribution of each component as a source of target price informativeness. Since our decomposition is binary, the two components are redundant in their role of revealing the relative importance of one component over the other in target price formation; for empirical implementations, we pick the earnings forecast component since forecasting short-term earnings is one of the most important tasks analysts perform.

To build the proxy for the relative importance of each component as the information source of target prices, for every firm-month pair, we estimate firm-specific β_{EF} by running a time-series regression of log 1-year-ahead earnings forecast revisions on log target price revisions using monthly data from past 24 months. We require a minimum of eight observations for each regression. We then sort stocks on the basis of β_{EF} into two sub-samples of equal size. The sub-sample with above-median (below-median) β_{EF} estimates, called the high (low) EF-beta sample, comprises stocks for which time variation in target price revisions is attributable to time variation in earnings forecast revisions (P/E ratio forecast revisions) to a greater extent relative to our stock universe. We then examine the performance of the TPER strategy within each sub-sample. If the investment value of target prices is solely attributable to analysts' ability to forecast short-term earnings, we would expect the TPER strategy to be profitable in the high EF-beta sample but not in the low EF-beta sample. Otherwise, if analysts also exhibit superior P/E ratio forecasting ability, we would expect the TPER strategy to be also profitable in the low EF-beta sample.

Table 4 reports the risk-adjusted returns of the TPER-based quintile portfolios and the return differences between the top and bottom TPER quintiles with the corresponding *t*-statistics for the full sample and the two sub-samples based on the estimates of β_{EF} . Panel A, Panel B and Panel C report results when β_{EF} estimation is based on target price revisions over 3-month, 6-month, and 12-month intervals, respectively. The table shows that, for the full sample across all panels, the TPER-based portfolios' risk-adjusted returns are increasing in TPER with a strong monotonic pattern; one exception in monotonicity occurs between the top two TPER quintiles in Panel C. As a result, we observe significant return spreads between the top and bottom TPER quintiles in all panels. For example, at the 3-month revision horizon (Panel A), the TPER long-short strategy earns a substantial four-factor alpha of 0.87% per month for the full sample. The alpha is also statistically significant with a *t*-statistic of 2.86. Similar in magnitude, the corresponding characteristic-adjusted returns are 0.89% per month with a *t*-statistic of 3.27. At longer revision horizons (Panels B and C), the TPER strategy remains profitable. Our results in Table 4 based on the full sample confirm the finding in Da and Schaumburg (2011).

We next turn to results for the two sub-samples based on the estimates of β_{EF} . We find similar results across TPER quintile portfolios to those for the full sample. Table 4 shows that, for both sub-samples across all panels, the TPER-based portfolios' risk-adjusted returns are increasing in TPER with a monotonic pattern; again, one exception in monotonicity occurs between the top two TPER quintiles in Panel C. This monotonic pattern leads to significant returns of the TPER strategy in both sub-samples. For example, Panel A of Table 4 reports that, in the high EF-beta sample, the TPER strategy produces a four-factor alpha of 1.03% per month (with a *t*-statistic

Table 4
 Risk-Adjusted Returns of Portfolios Sorted on TPER-Full Sample and High/Low
 EF-beta Samples

TPER portfolio	Four-Factor Alpha			DGTW Excess Return		
	Full Sample	EF-beta		Full Sample	EF-beta	
		Low	High		Low	High
Panel A: 3-Month Revision Horizon						
1 (Low)	0.25% [0.57]	0.38% [0.91]	0.13% [0.27]	-0.13% [-1.35]	-0.01% [-0.11]	-0.25% [-1.75]
2	0.46% [1.02]	0.45% [1.10]	0.46% [0.92]	0.14% [1.86]	0.09% [0.98]	0.19% [1.57]
3	0.76% [1.54]	0.76% [1.69]	0.76% [1.38]	0.39% [4.01]	0.35% [3.04]	0.43% [2.95]
4	0.90% [1.68]	1.04% [2.04]	0.76% [1.31]	0.49% [3.52]	0.65% [4.26]	0.33% [1.83]
5 (High)	1.12% [1.65]	1.08% [1.75]	1.16% [1.55]	0.76% [3.02]	0.70% [3.29]	0.81% [2.56]
5 - 1	0.87% [2.86]	0.70% [2.39]	1.03% [2.79]	0.89% [3.27]	0.71% [2.75]	1.06% [3.11]
Panel B: 6-Month Revision Horizon						
1 (Low)	0.25% [0.55]	0.28% [0.69]	0.22% [0.43]	-0.09% [-0.92]	-0.09% [-0.77]	-0.09% [-0.66]
2	0.43% [0.95]	0.43% [1.04]	0.43% [0.85]	0.14% [1.91]	0.06% [0.66]	0.23% [1.83]
3	0.71% [1.45]	0.70% [1.56]	0.71% [1.30]	0.36% [3.62]	0.31% [2.75]	0.41% [2.58]
4	0.78% [1.48]	0.82% [1.69]	0.75% [1.27]	0.43% [3.20]	0.46% [3.42]	0.39% [2.10]
5 (High)	1.06% [1.56]	0.91% [1.46]	1.21% [1.60]	0.67% [2.72]	0.51% [2.41]	0.84% [2.60]
5 - 1	0.80% [2.70]	0.62% [2.20]	0.99% [2.78]	0.76% [2.89]	0.60% [2.39]	0.92% [2.96]
Panel C: 12-Month Revision Horizon						
1 (Low)	0.21% [0.44]	0.27% [0.63]	0.16% [0.29]	-0.15% [-1.78]	-0.10% [-0.92]	-0.21% [-1.66]
2	0.42% [0.91]	0.37% [0.90]	0.47% [0.89]	0.10% [1.41]	0.04% [0.48]	0.16% [1.40]
3	0.65% [1.29]	0.56% [1.20]	0.75% [1.34]	0.30% [3.32]	0.19% [1.94]	0.42% [3.01]
4	0.78% [1.47]	0.74% [1.57]	0.82% [1.35]	0.41% [3.40]	0.37% [3.18]	0.44% [2.53]
5 (High)	0.77% [1.12]	0.56% [0.89]	0.97% [1.29]	0.43% [1.82]	0.26% [1.23]	0.60% [2.04]
5 - 1	0.56% [1.99]	0.30% [1.07]	0.82% [2.45]	0.58% [2.31]	0.35% [1.49]	0.81% [2.59]

Notes:

The table reports average monthly risk-adjusted *alphas* using a four-factor model and characteristic-based benchmark portfolio adjusted returns during the first month after portfolio formation for portfolios sorted

(Continued)

Table 4
Continued

by target price implied rate of return (TPER). The results are also presented for subsets of stocks sorted by the extent to which variation in target price (TP) revisions is explained by variation in earnings forecast (EF) revisions. When the TP revision is explained more by the EF revision [PE revision], the firm is placed in the high [low] EF-beta sample. The sensitivity of TP revisions to EF revisions is measured by the magnitude of regression coefficients (β_{EF}), a slope coefficient of the time series regression of monthly log EF revision on log TP revision previous 24-month TP revisions and EF revisions, with a minimum of eight observations at each month-end. Stocks with β_{EF} value above [below] median are placed in high [low] EF-beta sample. TP and EF revisions are measured at three intervals: 3-month (Panel A), 6-month (Panel B) and 12-month (Panel C) intervals. TPER is a target price implied rate of return, calculated by subtracting one from the ratio of target price and the current stock price. The four factors are the Fama–French three factors and a momentum factor. For each stock, the post-formation first month factor-adjusted excess return is computed, and the excess returns in each portfolio are equally weighted to compute monthly portfolio returns. The characteristic-based benchmark portfolio is based on 125 portfolios of size, book-to-market and momentum following Daniel et al. (1997) (DGTW). At the end of each month from 2000 through 2011 and within each sector, all sample stocks are classified into one of five portfolios by the current month TPER (1 as the lowest TPER and 5 as the highest TPER). Corresponding t -statistics are reported in brackets.

of 2.79) and a characteristic-adjusted return of 1.06% per month (with a t -statistic of 3.11). This finding is consistent with the notion that analysts' superior ability to forecast 1-year-ahead earnings is the primary source of the investment value of their target prices. More interestingly, in the low EF-beta sample, the TPER strategy produces a four-factor alpha of 0.70% per month (with a t -statistic of 2.39) and a characteristic-adjusted return of 0.71% per month (with a t -statistic of 2.75). While the returns for the low EF-beta sample are lower in magnitude than those for the high EF-beta sample, we do not find any significant difference between the two (not reported). This result for the low EF-beta sample suggests that the investment value of target price forecasts could arise from analysts' skilful processing of information about risk and long-term growth reflected in their P/E ratio forecasts. The findings at longer revision horizons in Panels B and C are similar to those in Panel A: the TPER strategy proves to be profitable in both high and low EF-beta samples, and the difference in returns is not significant between the two sub-samples.

In sum, the results in Table 4 provide suggestive evidence that the investment value of analysts' target prices is driven not only by their ability to forecast 1-year-ahead earnings but also by their ability to assess risk and long-term growth prospect.¹¹

(iv) Controlling for Recommendation Revisions

Since analysts often issue target price forecasts and stock recommendations at the same time, it is possible that the investment value of target prices reported in the previous section is simply driven by information impounded in analysts' stock recommendations (Asquith et al., 2005; Brav and Lehavy, 2003; Da and Schaumburg, 2011). To address this issue, we examine whether the TPER strategy still yields excess returns after controlling for recommendation revisions.

11 In our expanded analysis, we further decompose price-to-earnings forecasts into 1) growth rate, and 2) discount rate forecasts to tease out the source of target price informativeness. After partitioning the sample based on risk-sensitivity (or discount rate sensitivity), we test a similar trading strategy as discussed in section 4 (iii), and find evidence that the informativeness of target price also comes from analysts' ability to assess a firm's risk as well as their superior ability to forecast earnings (not reported).

To this end, we use Fama–MacBeth (1973) regressions of 1-month stock returns on the quintile rank of sector-demeaned target price implied returns (*TPER*), the revision in stock recommendations (ΔREC), and other characteristics known to affect returns, including total accruals (*TAC*), sales growth (*SG*), book-to-market ratios (*BM*), capital expenditures (*CAPEXP*), the logarithm of market capitalization (*SIZE*), and the past 6-month returns (*MOMTUM*). ΔREC is measured over 6-month intervals and takes the value of 1 for upgrades, 0 for reiterations, and -1 for downgrades.¹² We perform the regressions for the two sub-samples based on the estimates of β_{EF} as well as for all firms.

Table 5 reports the results of Fama–MacBeth regressions for the full sample and for the two sub-samples. The main focus of our interest is on the coefficient of *TPER*, which measures the 1-month return created by going long in the top quintile *TPER* portfolio and short in the bottom quintile *TPER* portfolio. The baseline specification (Model 1) confirms that target prices are indeed a valuable information source to investors. This result survives upon inclusion of the revision in recommendations, which surprisingly enters not significantly (Model 2). For example, in the full sample, the coefficient on *TPER* is 60 basis points with a *t*-statistic of 4.09 after controlling for recommendation revisions. More importantly, the *TPER* coefficient is significantly positive in the low EF-beta sample (50 basis points with a *t*-statistic of 3.52) as well as in the high EF-beta sample (64 basis points with a *t*-statistic of 3.66). In sum, the results in Table 5 suggest that the value of analysts' target price forecasts is not simply driven by revisions in stock recommendations.

5. EXTENSIONS

(i) Negative Earnings Forecasts

Thus far our analysis excludes firms with negative earnings forecasts (comprising about 9% of our stock-month observations) because earnings forecasts are log-transformed. In this subsection, we conduct two exercises of variance decomposition to include firms with negative earnings forecasts in the analysis. First, we aggregate earnings forecasts across all firms and perform variance decomposition using the aggregate variables; aggregate earnings forecasts are almost always positive. Second, we approximate $\Delta e f_i$ with $(EF_t - EF_{t-1})/|EF_{t-1}|$ and perform variance decomposition of target prices. Panel A of Table 6 reports the decomposition results at the aggregate market level and Panel B reports the results based on the approximated value of $\Delta e f_i$. The results are similar to those of the firm-level variance decomposition reported in Table 2. Both revisions in short-term earnings forecasts and revisions in P/E ratio forecasts are important determinants of target price revisions at all revision horizons. The relative importance of earnings forecasts in target price formation increases with the revision horizon. Our results are thus robust to the inclusion of firms with negative earnings forecasts.

(ii) Alternative Target Price Model Specifications

According to Gordon's (1962) constant growth model, P/E ratios incorporate information about discount rates and growth rates. In this subsection, we examine

¹² Our results are robust to measuring recommendation revisions over 3-month or 12-month intervals.

Table 5
Cross-sectional Regressions of Returns on TPER and Recommendation Revisions

Variable	Full sample		Low EF-beta sample		High EF-beta sample	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept	0.0060 [1.30]	0.0059 [1.27]	0.0071 [1.57]	0.0071 [1.58]	0.0054 [1.08]	0.0051 [1.03]
TPER	0.0058*** [4.05]	0.0060*** [4.09]	0.0049*** [3.44]	0.0050*** [3.52]	0.0062*** [3.62]	0.0064*** [3.66]
TAC	-0.0028*** [-6.11]	-0.0029*** [-6.17]	-0.0028*** [-4.87]	-0.0029*** [-4.89]	-0.0027*** [-5.50]	-0.0028*** [-5.62]
SG	0.0000 [0.03]	-0.0000 [-0.00]	-0.0000 [-0.03]	-0.0000 [-0.05]	-0.0001 [-0.09]	-0.0001 [-0.10]
BM	0.0010 [1.02]	0.0010 [1.02]	0.0017* [1.69]	0.0017* [1.69]	0.0012 [0.91]	0.0012 [0.90]
CAPEXP	-0.0003 [-0.44]	-0.0003 [-0.48]	-0.0005 [-0.75]	-0.0005 [-0.78]	0.0000 [0.03]	0.0000 [0.00]
SIZE	-0.0017** [-2.12]	-0.0017** [-2.13]	-0.0013* [-1.69]	-0.0013 [-1.65]	-0.0018** [-2.07]	-0.0018** [-2.05]
MOMTUM	0.0010 [0.87]	0.0011 [0.94]	0.0002 [0.17]	0.0002 [0.18]	0.0014 [1.06]	0.0015 [1.16]
ΔREC		-0.0004 [-1.18]		-0.0002 [-0.43]		-0.0007 [-1.61]
Adj. R ²	0.076	0.077	0.072	0.073	0.080	0.081
Obs	132,424		66,197		66,277	

Notes:

The table reports the time series average of slope coefficients from monthly cross-sectional Fama–MacBeth (1973) regressions from 2000 through 2011: *TPER* is a quintile rank of target price implied rate of return, calculated by subtracting one from the ratio of target price and the current stock price. *TAC* is total accruals, computed as earnings before extraordinary income minus cash flow from operating income, scaled by the average total assets of year $t-1$ and year t at each quarter-end. *SG* is sales growth defined as the percent change in total sales from year $t-1$ to year t on a quarterly rolling basis. *BM* is a book-to-market ratio, defined as the ratio of book value of equity to the market capitalization at each quarter end. *CapExp* is an annual total capital expenditure on a quarterly rolling basis scaled by the average total assets of year $t-1$ and year t . *SIZE* is the logarithm of market capitalization at the quarter end. *MOMTUM* is a 6-month size adjusted return. ΔREC represents stock recommendation revisions over 6-month intervals and takes the value of 1 for upgrades; 0 for reiterations; and -1 for downgrades. All firm-month stocks are sorted based on the sensitivity of target price revisions to earnings forecast revisions (β_{EF}). If β_{EF} is above [below] the median of all β_{EF} each year, the firm is placed in the high [low] EF-beta sample. *TP* and *EF* revisions are measured at 6-month intervals. All independent variables are winsorized at 1% and 99%. To correct for autocorrelations among the resulting slope coefficients, the t -statistics for the time-series means are computed according to the Newey–West (1987) with six lags (reported in brackets).

the relative importance of each component implied in the P/E ratio forecasts as a determinant of target price revisions; we attempt to further decompose revisions in P/E ratio forecasts into discount rate news and growth rate news. As our base model in equation (1) does not provide a functional specification of P/E ratios in terms of discount rates and growth rates, we need to adopt a more general valuation model which allows us to decompose target prices into three components: short-term earnings forecasts, discount rate forecasts, and growth rate forecasts. To this end, we employ the residual income model (RIM), which Gleason et al. (2013) opt for as analysts' rigorous valuation technique. In the Appendix, we provide a detailed account of the variance decomposition based on the RIM.

Table 6
Variance Decomposition of Target Price Revisions – Extensions

Panel A: Variance Decomposition at the Aggregate Market Level											
<i>Revision Horizon: 3 months</i>				<i>Revision Horizon: 6 months</i>				<i>Revision Horizon: 12 Months</i>			
β_{EF}	β_{PE}	<i>Obs</i>		β_{EF}	β_{PE}	<i>Obs</i>		β_{EF}	β_{PE}	<i>Obs</i>	
0.38	0.62	150		0.52	0.48	147		0.63	0.37	141	
Panel B: Variance Decomposition Including Negative Earnings Forecasts											
<i>Revision Horizon: Three months</i>				<i>Revision Horizon: Six months</i>				<i>Revision Horizon: 12 Months</i>			
β_{EF}	β_{PE}	<i>Obs</i>		β_{EF}	β_{PE}	<i>Obs</i>		β_{EF}	β_{PE}	<i>Obs</i>	
0.42	0.58	201,714		0.57	0.43	194,622		0.70	0.30	178,741	
Panel C: Variance Decomposition with Earnings, Discount Rate, and Earnings Growth Rate Forecasts											
<i>Revision Horizon: Three months</i>				<i>Revision Horizon: Six months</i>				<i>Revision Horizon: 12 Months</i>			
β_{EF}	β_G	β_R	<i>Obs</i>	β_{EF}	β_G	β_R	<i>Obs</i>	β_{EF}	β_G	β_R	<i>Obs</i>
0.44	0.05	0.51	141,459	0.54	0.08	0.38	136,334	0.62	0.08	0.30	126,936
Panel D: Variance Decomposition with Zero Earnings Growth Rate ($\Delta g = 0$)											
<i>Revision Horizon: Three months</i>				<i>Revision Horizon: Six months</i>				<i>Revision Horizon: 12 Months</i>			
β_{EF}	β_{PE}	<i>Obs</i>		β_{EF}	β_{PE}	<i>Obs</i>		β_{EF}	β_{PE}	<i>Obs</i>	
0.37	0.63	77,701		0.48	0.52	50,498		0.61	0.39	33,506	

Notes:

The table reports how much earnings forecasts (*EF*) and price-to-earnings ratio (*PE*) explain the variation in target price forecasts (*TP*) in a variance decomposition framework using variables at the aggregate market level (Panel A), at the firm level with the inclusion of negative earnings forecasts (Panel B), with a residual income model to include earnings, discount rate and growth rate forecasts (Panel C), and with no changes in earnings growth rate (Panel D). Each panel (A, B & D) reports slope coefficients from two simple regressions: β_{EF} and β_{PE} . β_{EF} (β_{PE}) is the percentage of variations in *EF* (*PE*) revisions that explains variation in *TP* revisions estimated by the slope coefficient of regressing *EF* (*PE*) revisions on revisions in *TP*. In Panel A, each month all target prices and earnings forecasts are aggregated, and these log revisions in the aggregated *TP* and *EF* (*PE*) are used to compute β_{EF} (β_{PE}). In Panel B, a revision in *EF* is computed as $\log((EF_t - EF_{t-1})/|EF_{t-1}| + 1)$. In Panel C, β_{EF} , β_G and β_R are computed by revisions in $\log(TP)$, $\log(\text{growth rate})$, and $\log(\text{discount rate})$ as discussed in the Appendix. In Panel D, β_{EF} (β_{PE}) are computed by revisions in $\log(TP)$, $\log(EF)$ and $\log(PE)$. All revisions are calculated in three time horizons: at 3-month, 6-month and 12-month intervals. Observations with a top and bottom 1% of *PE* are excluded from the sample.

Panel C of Table 6 reports the RIM-based decomposition results, which indicate that the power of implied P/E ratio forecasts in accounting for variation in target price revisions is driven mainly by variation in discount rate forecasts rather than variation in long-term growth rate forecasts. As discussed in the Appendix, the coefficient β_G (β_R) measures the proportion of the total variation in target price revisions that is explained by variation in revisions of growth rate forecasts (discount rate forecasts). The coefficient estimates of β_G reveal that, across all revision horizons, revisions in growth rate forecasts explain only about 5% to 8% of the variation in target price

revisions.¹³ This finding is consistent with the finding of Kecskes et al. (2015) that growth rate estimates have no incremental effect on the market reaction to analysts' recommendations. In contrast, the coefficient estimates of β_R show that revisions in discount rate forecasts explain a greater proportion (30% to 51%) of the variation in target price revisions, suggesting that analysts make use of discount rate forecasts as well as short-term earnings forecasts when generating target prices.

We also conduct the three-component variance decomposition based on the abnormal earnings growth model (AGM) and find the results (not reported) to be similar to those based on the RIM.¹⁴

(iii) Limiting to Firms with Constant Growth Prospect

To confirm the finding in Panel C of Table 6 that long-term growth rate forecasts contribute little to target price revisions, we repeat the base two-component variance decomposition but by restricting our sample to firms with constant growth prospect over revision intervals. For these firms, revisions in P/E ratio forecasts should be driven primarily by discount rate news and little by growth rate news. We use firms whose IBES growth rate forecasts stay the same over revision intervals as a proxy for firms with constant growth prospect. Panel D of Table 6 reports the results of variance decomposition with the restricted sample of firms with constant growth rate forecasts over revision intervals. The estimates of β_{PE} for this restricted sample are similar to those for the full sample, suggesting that growth rate forecasts play a limited role in revising target price forecasts. For example, at the 6-month revision horizon, the coefficients of β_{PE} are 0.52 and 0.48 for the restricted sample of firms and for the full sample (shown in Table 2), respectively. Overall, the results reported in Panels C and D of Table 6 provide evidence that the portion of the variation in target price revisions attributable to variation in implied P/E ratio forecast revisions is largely due to information about discount rates and not to information about long-term growth rates.

6. CONCLUSIONS

While literature generally agrees that analysts' target prices are informative, the evidence on their ability to accurately forecast target prices is mixed at best. Despite this seemingly conflicting evidence, little is known about the sources of target price forecasts through which analysts convey valuable information. We attempt to fill this gap by examining where the investment value of target prices comes from. To do so, we decompose analysts' target price forecasts into short-term earnings forecasts and implied P/E ratio forecasts based on a simple but well-represented valuation

13 We should note one caveat associated with our inference on the relative importance of revisions in growth rate forecasts in target price revisions. It is possible that our inference is biased by the fact that the time-series variation of growth rate forecasts is small relative to that of 1-year-ahead earnings forecasts. For example, in our analysis with the 12-month revision horizon, the median absolute change in IBES long-term growth rate forecasts is about 1.5 percentage points. And the median absolute change in the perpetual growth rates (10-year government bond rate less 3%) we use for the terminal value calculation is only 0.4 percentage points.

14 The AGM, developed by Ohlson and Juettner-Nauroth (2005), links the value of a firm to its earnings, abnormal earnings, growth in abnormal earnings and discount rate.

model. Using the variance decomposition approach, we first document that both short-term earnings forecasts and P/E ratio forecasts are important drivers of target price revisions. Further, we find that the relative importance of each component in target price revisions is related to firm characteristics. For example, for stocks with smaller market capitalization, higher book-to-market ratios, slower sales growth, and lower past returns, short-term earnings forecasts explain a larger fraction of the variation in target price revisions than P/E ratio forecasts.

A long-short trading strategy based on the expected returns implied by target prices generates substantial abnormal returns, indicating that target price forecasts are generally informative. To link the investment value of target prices to their sources, we divide the sample into two subgroups based on the extent to which variation in target price revisions is explained by variation in short-term earnings forecast revisions, and investigate the profitability of the trading strategy within each subgroup. In this subsample analysis, we find that the TPER-based trading strategy remains profitable in both subgroups. This evidence suggests that analysts' superior ability to forecast short-term earnings alone cannot explain the investment value of target price forecasts. Instead, it appears that the informativeness of target prices is also partly driven by analysts' ability to assess risk and long-term growth prospect captured in their P/E ratio forecasts.

APPENDIX

We describe the variance decomposition of target price revisions based on the residual income model (RIM). The tractable finite T -horizon RIM specification for a target price forecast at time t (TP_t) is given by:

$$TP_t = BVPS_t + \sum_{i=1}^T \frac{E_t(RI_{t+i})}{(1+R)^i} + \frac{E_t(TV)}{(1+R)^T}$$

where $BVPS_t$ is the book value of equity per share at time t , RI_{t+i} is the residual income for period $t+i$ computed as $EPS_{t+i} - R * BVPS_{t+i-1}$, where EPS_{t+i} is earnings per share for period $t+i$, TV is the terminal value, and R is the discount rate.

We closely follow Claus and Thomas (2001) to explicitly forecast future earnings per share up to year $t+5$ and compute the terminal value that captures all residual incomes beyond year $t+5$ assuming that those residual incomes grow at the 10-year government bond yield less 3%. In alternative specifications whose results are not reported in this paper, we also explore (1) using the 10-year finite horizon, and (2) mean-reverting the earnings growth rate to the long-run nominal GDP growth rate by year $t+T+2$ (as in Pastor et al., 2008). Our results are robust to alternative specifications.¹⁵

15 We would like to note that since growth and risk can be correlated, the use of the same growth rate for all firms can be problematic, especially in the early stage of a firm's life cycle. However, we believe the correlation will be weaker in the long run because a firm cannot grow faster than its peers in a competitive market in the long run. Therefore, a firm's growth rate will eventually mean-revert to the market average growth rate. We would like to thank the referee for bringing out this point.

We use FY1 and FY2 earnings forecasts from I/B/E/S for EPS_{t+1} and EPS_{t+2} , and apply I/B/E/S long-term growth forecasts (G) to EPS_{t+2} to determine earnings per share beyond year $t + 2$ as follows:

$$EPS_{t+i} = EPS_{t+i-1} \times (1 + G_t) \text{ for } i = 3, 4, \& 5.$$

Since target price forecasts, 1-year-ahead earnings forecasts, and long-term growth forecasts are all available from I/B/E/S, we are able to estimate the implied discount rate following prior studies (e.g., Gebhardt et al., 2001; Pastor et al., 2008; Chen et al., 2013). Then we can express a target price forecast (TP) as a function of the 1-year-ahead earnings forecast (EF), the long-term earnings growth rate forecast (G), and the implied discount rate forecast (R): $TP_t = f(EF_t, G_t, R_t)$.

Following Chen et al. (2013), who decompose changes in stock prices into changes due to cash flow news and changes due to discount rate news, we decompose revisions in target prices into revisions in the three components: 1-year-ahead earnings forecasts, growth rate forecasts and discount rate forecasts:

$$\Delta tp_{t,t+j} = \Delta(ef)_{t,t+j} + \Delta(g)_{t,t+j} + \Delta(r)_{t,t+j} \quad (\text{A1})$$

where:

$$\begin{aligned} \Delta(ef)_{t,t+j} &= \ln[f(EF_{t+j}, G_t, R_t)] - \ln[f(EF_t, G_t, R_t)] \\ \Delta(g)_{t,t+j} &= \ln[f(EF_{t+j}, G_{t+j}, R_t)] - \ln[f(EF_{t+j}, G_t, R_t)] \\ \Delta(r)_{t,t+j} &= \ln[f(EF_{t+j}, G_{t+j}, R_{t+j})] - \ln[f(EF_{t+j}, G_{t+j}, R_t)]. \end{aligned}$$

It is important to note that $\Delta(x)_{t,t+j}$ does not denote the change in variable x from t to $t + j$; it denotes the revision in log target prices from t to $t + j$ that is attributed to the revision in component x over the same time horizon. This approach enables us to estimate the revision in target prices due to the revision in one component by allowing the component to vary over time while holding the other two components fixed.

The decomposition equation (A1) provides a convenient way to express the variance of target price revisions as the sum of the three covariances:

$$\text{Var}(\Delta tp) = \text{Cov}[\Delta tp, \Delta(ef)] + \text{Cov}[\Delta tp, \Delta(g)] + \text{Cov}[\Delta tp, \Delta(r)]. \quad (\text{A2})$$

Dividing both sides of equation (A2) by $\text{Var}(\Delta tp)$, we obtain:

$$1 = \frac{\text{Cov}[\Delta tp, \Delta(ef)]}{\text{Var}(\Delta tp)} + \frac{\text{Cov}[\Delta tp, \Delta(g)]}{\text{Var}(\Delta tp)} + \frac{\text{Cov}[\Delta tp, \Delta(r)]}{\text{Var}(\Delta tp)}. \quad (\text{A3})$$

Each term on the right-hand side of equation (A3) can be estimated by regressing $\Delta(ef)$, $\Delta(g)$ and $\Delta(r)$, respectively, on Δtp . The slope coefficient of each regression is labeled as β_{EF} , β_G and β_R , respectively. Each coefficient is interpreted as the proportion of the total variation in target price revisions that is explained by variation in revisions of each component. By construction, β_{EF} , β_G and β_R sum to one.

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