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An Empirical Analysis of Analysts' Target Prices: Short-term Informativeness and Long-term Dynamics

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ABSTRACT

Using a large database of analysts' target prices issued over the period 1997–1999, we examine short-term market reactions to target price revisions and long-term comovement of target and stock prices. We find a significant market reaction to the information contained in analysts' target prices, both unconditionally and conditional on contemporaneously issued stock recommendation and earnings forecast revisions. Using a cointegration approach, we analyze the long-term behavior of market and target prices. We find that, on average, the one-year-ahead target price is 28 percent higher than the current market price.

ACADEMICS, PRACTITIONERS, AND INDIVIDUAL INVESTORS have long been interested in understanding the value and usefulness of sell-side analysts' equity reports. In recent years, security analysts have been increasingly disclosing target prices in these reports, along with their stock recommendations and earnings forecasts. These target prices provide market participants with analysts' most concise and explicit statement on the magnitude of the firm's expected value. Despite the increasing prominence of target prices, their role in conveying information to market participants and their contribution to the formation of equity prices have remained largely unexplored.[1] This paper provides new evidence on these issues.

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[1] Bradshaw (2002) studies a sample of 103 analysts' reports and documents the frequency with which analysts employ target prices to justify their choice of recommendations. Using a sample of 114 Canadian firms, Bandyopadhyay, Brown, and Richardson (1995) also find that forecasted earnings explain a large proportion of the variation in price forecasts.

Understanding the role of target prices in capital markets is important for several reasons. First, because target prices are often computed as the product of forecasted earnings and a financial ratio such as an earnings yield (Fernandez (2001) and Asquith, Mikhail, and Au (2002)), evidence that target prices are informative in the presence of earnings forecasts supports the argument that market participants consider price formation via multiples to be useful. Second, evidence that market participants react to the information conveyed in analyst target prices is relevant for the recent controversy regarding the value of analyst research reports (see U.S. House of Representatives (2001)). Such evidence should therefore be considered when assessing the implications of potential biases in analysts' opinions on the informativeness of their reports. Third, if target prices are incrementally informative, that would suggest that results in prior research on analysts' stock recommendations and earnings forecasts might be partially attributed to the value that investors assign to price targets. Finally, an investigation into the role of target prices enables us to evaluate the view that target prices provide little or no value to market participants.[2] Specifically, it may be argued that recommendations and earnings forecasts may completely subsume the information in target prices, since the latter are determined after the stock recommendation and earnings forecast have been set. It may also be argued that target prices are uninformative and serve as a mere vehicle to enhance an individual analyst's stature, or that they may not be easily interpreted by investors as they are not necessarily associated with an "end date." The view that target prices provide little or no value to market participants provides for a natural null hypothesis in this paper.

We begin our analysis with an examination of stock price reactions both associated with and subsequent to target price revisions. If capital market participants perceive analyst price targets as valuable, we should observe significant price reactions around their announcements. If larger upward (downward) revisions in target prices represent more (less) favorable news, we expect market reactions around target price revisions to increase in the favorableness of the revision. Since target prices are generally issued in conjunction with stock recommendations and earnings forecasts, we also ask whether target prices are *incrementally* informative. Given the discreteness of stock recommendations, we expect target prices to be informative in the presence of stock recommendations.

Using a large database of analyst target prices, we document significant abnormal returns around target price revisions and show that the abnormal returns are increasing in the favorableness of the target price revision. We also show that

[2] O'Brien (2001) reflects on the controversy regarding the value of price targets: "Price targets, at their worst, can be used to exploit unsophisticated investors…. Now that some of the dust has settled, market professionals are seeing some marginal value in price targets, if only in interpreting the vernacular of Wall Street." Vickers and Weiss (2000) assert that "…analysts are increasingly lobbing 'absurdly extreme' calls that attract big-media attention and encourage momentum investing."

target prices are incrementally informative, conditional on contemporaneously issued stock recommendations and earnings forecast revisions. Motivated by evidence in prior research of a price "drift" subsequent to recommendation and earnings forecast revisions (e.g., Stickel (1995), Womack (1996)), we examine postevent abnormal returns. We find that target price revisions contain information regarding future abnormal returns above and beyond that which is conveyed in stock recommendations. This finding reinforces the view that target prices do contain valuable information.

Further evidence on the properties of analyst price targets is provided by an analysis of the long-term comovement of both stock and target prices. Because target prices are forward looking, we argue that, much like stock prices, they ought to be linked to the underlying fundamental value of the firm. Therefore, using a cointegration framework, we examine the long-term dynamics that link target and market prices. The ratio of target price to the underlying stock price provides a measure of analysts' beliefs regarding the firm's expected return. The cointegration analysis allows us to estimate the mean of this ratio, which we interpret as the long-term relation of the two price series.

The long-term analysis also enables us both to provide evidence on how the system of target and stock prices reacts to deviations from this long-term relation and to quantify the *speed* and *magnitude* of adjustment of each price series back toward this long-term relation. We ask whether analysts react to deviations from the long-term relation by adjusting their target prices, or whether stock prices contribute towards most of the long-term adjustments. Given our finding of postevent excess returns, the long-term analysis is of particular interest because it provides evidence as to the relative magnitude by which analysts (investors) adjust target (stock) prices toward the long-run target-to-stock price ratio. The long-term analysis, conducted on a subset of 900 firms with a continuous target price record, reveals that, on average, target prices are 28 percent higher than concurrent market prices and, moreover, this ratio is inversely related to firm size. We also find that once the ratio of target-to-market price is higher (lower) than the estimated long-run ratio, it is primarily analysts who revise their targets down (up) such that the ratio reverts back to its long-run value. Market prices, in contrast, barely contribute to this correction phase.

In our final analysis we combine the short- and long-term analyses by examining whether investors understand the properties of the long-term dynamics that we document. Specifically, for each target price revision, we construct an estimate of the expected and unexpected component of the revision, and examine investors' reactions to each component. We find that average abnormal returns are significantly associated with the proxy for the unexpected revision in the target price but not for the expected component. This finding supports the view that investors understand the long-term dynamics that we document.

Our examination of the informativeness of analysts' target prices contributes to extant research on the information content of analysts' two other signals: stock recommendations and earnings forecasts. This research generally finds significant positive (negative) price reaction to recommendation upgrades (downgrades; e.g., Elton, Gruber, and Grossman (1986), Stickel (1995), Womack (1996)).

Recommendations have also been shown to contain information that is generally orthogonal to the information in other variables known to have predictive power for stock returns (Jegadeesh et al. (2001)). Francis and Soffer (1997) focus on the relative informativeness of analyst earnings forecast revisions and stock recommendations and find that each signal is informative in the presence of the other, while Stickel (1999) and Bradshaw (2000) examine the consistency between consensus recommendations and consensus earnings forecast revisions. We add to this research by examining the value and properties of analysts' target prices. Our combined evidence indicates that target price revisions are informative and provide significant incremental information over and above that contained in stock recommendations and earnings forecasts.

The paper proceeds as follows. Section I describes the data. We examine the information content of target prices in Section II. Section III describes our cointegration approach to modeling the long-term comovement of target and stock prices. We combine the insights from the short- and long-term analyses in Section IV. Conclusions are offered in Section V.

I. Data and Variable Descriptions

A. Data Description

The target price, stock recommendation, and earnings forecast databases are provided by First Call.[3] We report descriptive statistics in Table I for firms with available data on the Center for Research in Security Prices (CRSP) database. Panel A of that table provides information on the target price database. The year 1997 is the first year with complete target price data (coverage begins in November 1996, with 3,862 target price reports for that year). Coverage increases substantially over time, from 49,134 target price reports in 1997 to 93,946 reports in 1999. The average number of price targets per covered firm (column 3) also increases from 10 in 1997 to 18 in 1999. The target price database is quite comprehensive and includes reports for 6,544 distinct firms. The number of participating brokerage houses remains fairly constant over the years, with an increase from 123 in 1997 to 149 in 1999 (column 5), with 190 distinct brokerage houses issuing target price reports across all years. Each firm in the sample is covered, on average, by six brokerage houses. Finally, we find that these firms account for approximately 93 percent of the total market value of all securities on CRSP.

[3] First Call has been a major supplier of analyst data to both practitioners and academics. First Call maintains that its data collection procedures place great importance on ensuring accuracy, especially with respect to the timing of the reports. Consequently, a distinguishing feature of the First Call database is that it codes the source of each analyst's report as either "real-time" or "batch." Real-time refers to reports that are received from live feeds such as the broker notes and that are dated as the date that the report was published. Batch reports are generated from a weekly batch file from the brokerage house, and, hence, their precise publication dates are unknown. With technological improvements in First Call's data collection procedures, by 1999 the overwhelming majority of reports were being coded as real-time. To ensure accurate dating of analysts' reports, our empirical analyses include only observations coded as real-time.

Panel B of Table I provides a description of the recommendation database. In 1997, the database includes 32,295 recommendations for 5,572 distinct firms. By 1999, the number of recommendations reaches 42,014 for 5,929 distinct firms. The

Table I

Descriptive Statistics on Analysts' Target Prices, Stock Recommendations, and Earnings Forecast Revisions, 1997–1999

This table reports statistics on the First Call target price (Panel A), stock recommendations (Panel B), and earnings forecasts (Panel C) databases, as well as a transition matrix of analyst stock recommendations and target prices (Panel D) for firms with available data on CRSP. To ensure accurate dating of analysts' reports, we include only observations coded as "real-time" (i.e., reports received from live feeds such as the broker note and that are dated as the date that the report was published). Panels A through C present, by year, the number of observations, the average number of reports per firm, the number of firms, the number of brokerage houses issuing reports, and the average number of brokerage houses per firm. The last row in each panel A–C presents statistics for the three-year sample period. Panel D presents the number of analyst stock recommendations (top number) and the percentage of those recommendations issued with a target price (bottom number), by changes in or reiterations of stock recommendations.

Panel A: Target Prices

	Price Targets			Brokers	
Year	*N*	Avg. No. Per Firm	Number of Firms	*N*	Avg. No. Per Firm
(1)	(2)	(3)	(4)	(5)	(6)
1997	49,134	10	4,694	123	4
1998	79,936	16	4,997	136	5
1999	93,946	18	5,165	149	5
Overall	223,016	14	6,544	190	6

Panel B: Stock Recommendations

	Recommendations			Brokers	
Year	*N*	Avg. No. Per Firm	Number of Firms	*N*	Avg. No. Per Firm
1997	32,295	6	5,572	211	4
1998	42,805	7	5,871	222	5
1999	42,014	7	5,929	210	5
Overall	117,114	6	8,673	325	7

Panel C: Earnings Forecasts

	Earnings Forecasts			Brokers	
Year	*N*	Avg. No. Per Firm	Number of Firms	*N*	Avg. No. Per Firm
1997	39,736	6	6,474	204	5
1998	42,228	7	6,203	233	5
1999	42,322	7	6,106	246	5
Overall	124,286	7	9,167	282	7

Table I (*continued*)

Panel D: Number of Stock Recommendations and Percentage Issued with Target Price

	To Recommendation			
From Recommendation	Strong Buy	Buy	Hold	Sell/Strong Sell
Strong Buy	45,671 99%	5,692 52%	3,297 36%	77 39%
Buy	6,108 60%	36,823 99%	5,186 35%	114 40%
Hold	2,485 71%	4,315 70%	12,579 98%	427 42%
Sell/Strong Sell	63 56%	86 60%	424 41%	527 92%
No prior recommendation	16,374 82%	15,194 79%	8,622 49%	510 53%
Overall	70,701 91%	62,110 88%	30,108 66%	1,655 61%

number of brokerage houses remains fairly constant over the years, with overall 325 distinct brokerage houses included in the database. Consistent with claims made by several analysts that certain brokerage houses that issue recommendations have either a formal or an informal policy barring issuance of price targets, the number of brokerage houses issuing recommendations is higher than those issuing price targets.[4]

Panel C of Table I provides a description of the earnings forecast revision database. The database includes 124,286 earnings forecasts for the period from 1997 to 1999. These forecasts are distributed, on average, as seven forecasts per firm and pertain to 9,167 distinct firms. These forecast revisions are issued by 282 distinct brokerage houses, with an average of seven brokers per covered firm.

Finally, while analyst reports always include a recommendation, they do not necessarily include a target price. In our sample, 135 of 325 brokerage houses do not issue any target price. Recommendations issued by these 135 brokerage houses, however, account for about five percent of all recommendations.[5] Panel

[4] In unreported results, we find that the majority of stock recommendations are issued as either buy or strong buy (68 percent), while only 29 percent are issued as a hold and three percent as a sell or strong sell. The median number of days between revisions is 59 days for target prices, 141 days for stock recommendations, and 92 days for earnings forecasts.

[5] While we do not study the analyst's decision to include a target price, we conjecture several possible reasons. First, according to conversations with analysts, some brokerage houses have an explicit policy prohibiting their analysts from issuing target prices. Second, analysts may choose to withhold the target price in circumstances where their cost of providing an ex post incorrect price target exceeds the potential benefits from issuing it. For example, if analyst compensation is related to the trading commissions generated in recommending securities for purchase and if incorrect target prices were ex post costly, then analysts would tend to issue target prices mainly with buy rather than with sell recommendations.

D of Table I provides information on the frequency of inclusion of target prices in brokerage houses' reports. The panel provides a transition matrix of brokerage house stock recommendations (the number at the top of each cell) and the percentage of these recommendations issued with price targets (the number at the bottom of each cell).[6] Several interesting regularities are observed in this panel. First, price targets are overall more likely to be issued along with strong buy or buy recommendations (91 percent and 88 percent, respectively) than with hold (66 percent) or sell/strong sell (61 percent) recommendations. This is consistent with findings in Bradshaw (2002). Second, within recommendation categories, recommendation upgrades (lower-left cells) are more likely to be accompanied by a target price than are recommendation downgrades (upper-right cells). For example, price targets are included in 70 percent of the upgrade reports from hold to buy recommendations but only in 35 percent of the downgrade reports from buy to hold recommendations. This evidence is consistent with the common claim that analysts are biased toward issuing favorable news and withholding (or minimizing the amount of) bad news. The statistics on the diagonal indicate that virtually all recommendation reiterations include a target price, suggesting that analysts convey new and perhaps more subtle information that does not necessitate a recommendation revision via target price revisions.

Finally, the statistics in Panel D indicate that analysts are more likely to initiate or resume coverage with a strong buy or a buy recommendation (see McNichols and O'Brien (1997), Barber et al. (2001)) and are also more likely to include a target price in these recommendations than with other cases.

B. Variable Descriptions

We construct two alternative measures for the information content of analysts' target prices. The first, denoted TP/P, is the ratio of the announced target price to the stock price outstanding two days prior to the announcement (all prices are converted to the same split-adjusted basis). Since more than 90 percent of the

[6] In computing these statistics, we employ the following procedures: (1) All recommendations outstanding in the database for more than one year are assumed invalid; (2) The most recent brokerage house recommendation is assumed to have been reiterated for target price reports that were not accompanied by a corresponding recommendation observation in First Call's recommendation database. The validity of this procedure was confirmed with an official at First Call who indicated that since target price revisions are issued more frequently than recommendation revisions, many target price revisions are recorded only in the target price database and, as long as the corresponding recommendation remains unchanged, First Call does not reiterate the existing recommendation in the recommendation database (see also Jegadeesh et al. (2001)); (3) Sell and strong sell recommendations were combined because of their relative rarity in the data; (4) Since some brokerage houses do not issue target price reports, we include only brokerage house/firm combinations with at least one target price report. While results are qualitatively similar, removing the latter restriction reduces the off-diagonal percentages. Note also that the transition matrix excludes recommendations marked by First Call as revisions from valid to "dropped." This accounts for the different number of observations between Panel D and Panel A in Table I.

target price reports in the database are coded as one-year-ahead prices, this ratio may be interpreted as the analysts' stated estimate of the firm's annual expected return. The second measure attempts to capture whether investors react to information in the announced target price relative to the brokerage house's prior target price. This measure, denoted $\Delta TP/P$, is the difference between the current and prior target price issued by the same brokerage house, deflated by stock price outstanding two days prior to the announcement.[7]

Panel A of Table II presents statistics on the two information measures as well as on the target price and earnings forecast revisions. We winsorize these variables at the 1st and 99th percentiles to mitigate the possible effect of extreme observations. The statistics indicate that the distributions of both measures are right skewed. The average (median) target price is higher by 32.9 (25.5) percent relative to the preannouncement stock price. As a percentage of stock price, individual brokerage houses' target prices are 0.8 percent higher than the previous target price.[8] The third column presents additional information on the change in the brokerage house target price, scaling it in this case by the brokerage house previous target price, $\Delta TP/TP_{-1}$. The average (median) percentage change in target price is 5.3 (0) percent. Finally, in the fourth column we report summary statistics for the earnings forecast revision measured as the change in the analyst forecast of earnings for the current fiscal year deflated by the stock price two days prior to the announcement. The mean (median) forecast revision is -0.41 (-0.03) percent.

Panels B and C of Table II present additional information both for the level and change in target prices conditioned on the associated recommendation revision. In Panel B we report average target prices scaled by preannouncement stock price, TP/P. In general, the magnitude of the scaled target prices is consistent with the direction of the recommendation changes. For example, upgrades are generally associated with higher TP/P ratios than downgrades. Next, in Panel C we report for each recommendation revision averages of $\Delta TP/TP_{-1}$ as well as average price appreciation over the same period (since the issuance of the preceding target price). It can be seen that the average $\Delta TP/TP_{-1}$ and the stock price appreciation are consistently positive for upgrades and nearly always negative for downgrades. For example, an upgrade from a buy to a strong buy recommendation is associated with an average upward revision in $\Delta TP/TP_{-1}$ of 12.7 percent, whereas a downgrade from a buy to a hold recommendation is associated

[7] We have also considered additional measures. The first is the difference between a brokerage house's target price and the outstanding consensus target price immediately prior to the announcement. Consensus target price was calculated as the average target price outstanding over the previous 90 days across all brokerage houses. Other information measures are constructed by scaling each of the previous target price revisions by the prior-price standard deviation, measured over the 90 days preceding the event. We find qualitatively similar results in Section II with all of these information measures.

[8] In unreported results, we find that only about five percent of target price reports are issued below the concurrent stock price, approximately 25 percent of target price reports reflect a downward revision from brokerage houses' prior reports, and nearly 43 percent of target price reports reflect a downward revision from the outstanding consensus target price.

with a downward revision of −4.5 percent on average. Similarly, the average price appreciation over the period preceding the announcement is also consistent with the direction of the recommendation and target price revisions. For the upgrade from a buy to a strong buy recommendation, the associated stock price appreciation is 5.1 percent, whereas for the downgrade from a buy to a hold

Table II

Statistics on Target Prices by Analyst Stock Recommendations

This table provides descriptive statistics on the target price information measures. Panel A provides general distributional statistics on (a) the ratio of target price to preannouncement stock price (stock price outstanding two days prior to the announcement of the target price), denoted (TP/P), (b) the change in the individual brokerage house target price scaled by preannouncement stock price, denoted ($\Delta TP/P$), (c) the percentage change in the brokerage house target price, denoted ($\Delta TP/TP_{-1}$), and (d) earnings forecast revision, computed as the difference in the brokerage house current and prior annual earnings forecast scaled by preannouncement stock price. Panel B provides information on the average TP/P conditional on stock recommendation revisions. Panel C reports, for each recommendation revision, averages of $\Delta TP/TP_{-1}$ as well as average price appreciation measured over the same period (since the issuance of the preceding target price). All prices and earnings are converted to the same split-adjusted basis.

Panel A: Descriptive Statistics on Measures of the Information Content of Target Price

	Target Price to Stock Price Ratio (TP/P)	Change in Brokerage House Target Price ($\Delta TP/P$)	Change in Brokerage House Target Price ($\Delta TP/TP_{-1}$)	Forecast Revision
Mean	1.329	0.8%	5.3%	−0.41%
Max	3.004	143.3%	183.3%	35.2%
75th percentile	1.433	9.7%	8.3%	0.16%
Median	1.255	0.0%	0.0%	−0.03%
25th percentile	1.146	0.0%	−0.8%	−0.43%
Min	0.584	−136.0%	−89.0%	−422.5%
Std. Dev.	0.304	78.3%	95.9%	2.5%
N	204,031	115,720	115,720	82,052

Panel B: Average Target Price to Price Ratio (TP/P)

	To Recommendation			
From Recommendation	Strong Buy	Buy	Hold	Sell/Strong Sell
Strong Buy	1.40	1.30	1.18	1.04
Buy	1.41	1.31	1.12	1.21
Hold	1.37	1.31	1.16	1.01
Sell/Strong Sell	1.42	1.36	1.11	1.03
Initiated/Resumed as	1.43	1.31	1.15	1.07
Overall	1.41	1.31	1.16	1.04

Table II (*continued*)

Panel C: Average Change in Target Price ($\Delta TP/TP_{-1}$) and Corresponding Price Appreciation

From Recommendation	To Recommendation							
	Strong Buy		Buy		Hold		Sell/Strong Sell	
Strong Buy	6.0%,	5.7%	6.4%,	2.5%	−9.9%,	−0.2%	−14.5%,	−3.5%
Buy	12.7%,	5.1%	5.4%,	4.3%	−4.5%,	2.4%	−6.1%,	5.9%
Hold	22.8%,	4.6%	16.4%,	4.4%	0.6%,	0.01%	−7.2%,	−2.9%
Sell/Strong Sell	20.6%,	1.6%	15.6%,	2.1%	11.0%,	0.7%	0.5%,	−3.5%
Initiated/Resumed as	NA		NA		NA		NA	
Overall	6.6%,	5.6%	5.7%,	4.2%	−0.4%,	0.3%	−1.7%,	−2.9

recommendation, stock prices appreciated on average by 2.4 percent.[9] Finally, we note that in the case of recommendation reiterations, the magnitude of target price revisions is lower than in recommendation upgrades or downgrades.

We have also calculated statistics, as in Panels B and C, for the variation in earnings revisions by stock recommendation revisions (unreported). We find that, similar to the results in these panels, earnings revisions are monotonically related to the favorableness of the recommendation change. The fact that revisions in target prices, recommendations, and earnings forecasts occur generally in the same direction suggests that, to some extent, these signals share much of the same information content. In Section II we explore whether the information in each of these signals subsumes the information in any other.

II. Market Reaction to Target Price Announcements

A. Unconditional Informativeness of Target Prices

In this section, we examine whether the information content of target price announcements is associated with abnormal returns around those announcements. Specifically, we compute the abnormal return around each announcement and present average abnormal returns for portfolios ranked on the basis of the magnitude of the relevant information content measure. Abnormal return is computed as the difference between a firm's buy-and-hold return and the buy-and-hold return on the NYSE/AMEX/Nasdaq value-weighted market index over the period beginning two days prior and ending two days subsequent to the firm's target price announcement.[10] These results are reported in Figure 1.

[9] The average contemporaneous market return for all recommendation categories is approximately three percent.

[10] Results for the period of -1 to $+1$ days around the announcement are qualitatively similar. Also, to avoid possible cross-correlation problems caused by identical return observations, we delete all but one of identical return observations within each portfolio.

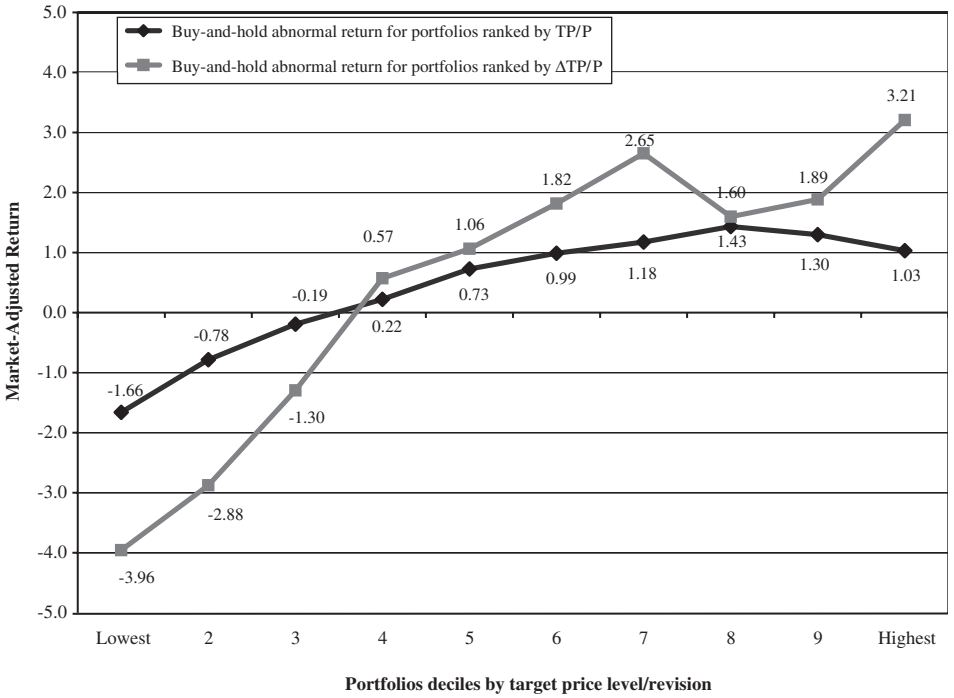

Figure 1. Average buy-and-hold abnormal return around announcements of target prices. This figure depicts average buy-and-hold abnormal returns for the period from two days prior to through two days subsequent to the announcement of target price for decile portfolios ranked on the basis of two target price information measures. Abnormal returns are computed as the difference between the firm buy and hold return and the buy and hold return on the NYSE/AMEX/Nasdaq value weight index. The information content measures are (a) the ratio of target price to preannouncement stock price (stock price outstanding two days prior to the announcement of the target price), denoted (TP/P), and (b) the change in the individual brokerage house target price scaled by preannouncement stock price, denoted ($\Delta TP/P$). To avoid a possible cross-correlation problem caused by identical return observations, we delete all but one of identical return observations within each portfolio.

The visual evidence in Figure 1 indicates that average abnormal returns around target price revisions are increasing in the favorableness of the target price and its revision. For example, the average abnormal return for portfolios ranked on the basis of the ratio of announced target price to the stock price outstanding two days prior to the announcement, TP/P, ranges from an average of -1.66 percent for the least favorable target price revision to 1.03 percent for the most favorable one. A larger spread in abnormal returns is associated with portfolios ranked on the basis of the revision in the individual brokerage house target price, with average abnormal returns ranging from -3.96 percent to 3.21 percent for the least and most favorable revisions, respectively.

While unreported, differences in average abnormal returns are highly statistically significant.[11]

Combining these findings with those in the extant literature of a significant positive (negative) price reaction to favorable (unfavorable) stock recommendations (e.g., Stickel (1995), Womack (1996)) and earnings forecast revisions (Givoly and Lakonishok (1979), Elton, Gruber, and Gultekin (1981), Lys and Sohn (1990), Francis and Soffer (1997)) provides preliminary evidence that investors perceive analyst price targets as informative signals regarding a firm's value. Furthermore, it raises an interesting question regarding the incremental information content of target prices in the presence of recommendation and earnings forecast revisions. We therefore extend our analysis, in Section II.B, below, to determine whether target price revisions are incrementally informative.

B. Informativeness of Target Prices Conditional on Stock Recommendation and Earnings Forecast Revisions

Table III provides regression results relating event-day abnormal returns to recommendation changes, earnings forecast revisions, and the target price revision measure $\Delta TP/P$. We begin by regressing event-day abnormal returns (AR) on three recommendation revision categories, earnings forecast revision, $\Delta F/P$, and target price revision $\Delta TP/P$.[12] Our goal is to determine whether target price revisions are informative, controlling for recommendation and earnings forecast revisions. The regression takes the form

$$AR = \alpha_1 UPGRADES + \alpha_2 DOWNGRADES + \alpha_3 REITERATIONS + \beta\left(\frac{\Delta F}{P}\right) + \gamma\left(\frac{\Delta TP}{P}\right) + \varepsilon \quad (1)$$

where the indicator variables—*UPGRADES*, *DOWNGRADES*, *REITERATIONS*—take the value 1 if the stated recommendation revision is met and 0 otherwise.

The regression results reported in column 1 of Panel A indicate that target price revisions are positively and significantly related to event-day abnormal returns ($\gamma = 3.705$ with t-statistic $= 38.7$), controlling for the information in the associated stock recommendation and earnings forecast revisions. Economically, a

[11] In unreported results we perform two robustness tests. In the first, we examine whether earnings announcements drive the documented average returns around target price announcements. Toward this end, we exclude from the abnormal return calculation observations that fall within a five-day window of an earnings announcement. The results are qualitatively the same. (This result is also consistent with Womack (1996), who finds that the majority of recommendation changes are *not* in response to earnings releases.) In the second test, to account for the possibility that the documented abnormal return is caused by other firm-specific events immediately prior to the target price announcement, we calculate abnormal returns starting at day 0 through day $+2$. The results remain unchanged.

[12] We exclude from the analysis sell or strong sell recommendations because of the small number of such observations.

Table III

Relative Informativeness of Analyst Target Price, Stock Recommendation, and Earnings Forecast Revisions

The sample consists of all target price announcements between January 1997 and December 1999. The table reports regression results in which the dependent variable is the market-adjusted buy-and-hold abnormal return around target price announcements and the independent variables are indicator variables for analyst recommendations, target prices, and earnings forecast revisions. The recommendation indicator variables assume the value of 1 for the relevant recommendation revisions and 0 otherwise. The recommendation categories are upgrades, downgrades, and reiterations. We also report *p*-values of tests of equality of the regression coefficients. Abnormal return is computed as the difference between the firm buy-and-hold return and the buy-and-hold return on the NYSE/AMEX/Nasdaq value-weight index over the period beginning two days prior to and ending two days subsequent to the target price announcement. Earnings forecast revision is computed as the percentage change in the brokerage house current and prior annual earnings forecast scaled by the preannouncement stock price. Target price revision is measured as the change in the brokerage house target price, scaled by the preannouncement stock price. We winsorize the earnings forecast and target price revision variables at the 1st and 99th percentiles to mitigate the possible effect of extreme observations and verify that regression results are not sensitive to influential observations.

		Direction of Recommendation Revision			Sign of Target Price Revision		
Variable	All Observations (1)	Upgrades (2)	Downgrades (3)	Reiterations (4)	Positive (5)	Negative (6)	Zero (7)
α_1 (Recommendation upgrade indicator)	2.966	2.702			4.311	0.919	1.210
	21.3	18.6			25.7	2.7	3.7
α_2 (Recommendation downgrade indicator)	− 3.001		− 2.493		0.048	− 6.357	− 1.799
	− 20.5		− 15.9		0.2	− 26.8	− 5.9
α_3 (Recommendation reiteration indicator)	0.375			0.376	1.571	− 1.510	0.132
	12.1			12.1	29.0	− 16.2	2.7
β (Earnings forecast revision)	1.103	1.078	0.967	1.093	1.018	0.932	1.033
	30.8	4.8	7.9	28.7	12.7	17.4	15.8
γ (Price target revision)	3.705	6.278	8.094	3.330	1.787	0.678	—
	38.7	14.8	18.1	33.1	12.9	3.1	—
Adjusted R^2	5.5%	6.6%	13.2%	3.2%	9.5%	11.5%	1.1%
N	70,852	3,176	2,896	64,780	27,561	17,239	26,052

(*continued*)

Table III *Continued*

p-values of Tests of Equality of Regression Coefficients			
	All Observations (Column 1)	Recommendation Revision (Columns 2–4)	Target Price Revision (Columns 5–7)
$\alpha_1 = \alpha_2 = \alpha_3$	0.000		
β(Upgrade) = β(Downgrade) = β(Reiteration)		0.619	
β(Upgrade) = β(Reiteration)		0.948	
β(Downgrade) = β(Reiteration)		0.327	
γ(Upgrade) = γ(Downgrade) = γ(Reiteration)		0.000	
γ(Upgrade) = γ(Reiteration)		0.000	
γ(Downgrade) = γ(Reiteration)		0.000	
α_1(Positive) = α_1(Negative) = α_1(Zero)			0.000
α_2 (Positive) = α_2 (Negative) = α_2(Zero)			0.000
α_3(Positive) = α_3(Negative) = α_3(Zero)			0.000
β(Positive) = β(Negative) = β(Zero)			0.382
γ(Positive) = γ(Negative)			0.001

one standard deviation increase in $\Delta TP/P$ increases the event-day abnormal return by $0.783 * 3.705 = 2.9$ percent, on average. Moreover, it can be seen that revisions in both earnings forecasts and stock recommendations are informative as well. The positive and significant coefficient on $\Delta F/P$ indicates that the information in the earnings forecast revisions is not completely subsumed by either the target price revisions or the stock recommendations. The coefficients α_1, α_2, and α_3 and their expected ordering ($\alpha_2 < \alpha_3 < \alpha_1$) provide evidence that these recommendation revisions are incrementally informative. We easily reject the joint hypothesis that these parameters are equal with an F test (p-value < 0.0001).

The regression results provide interesting evidence regarding the role that target prices and earnings forecast revisions play in the case of recommendation reiterations. Earlier work (e.g., Barber et al. (2001)) has shown that recommendation reiterations are the least informative, as is evident in the economically small magnitude of the intercept associated with recommendation reiterations ($\alpha_3 = 0.375$, t-statistic $= 12.1$). In such reiterations, it appears that investors rely mostly on the information conveyed by the target prices and the earnings forecast revisions.[13]

Next, we investigate whether the regression results—and, in particular, the conclusions regarding the role of target price revisions—are sensitive to the type of recommendation and target price revisions. For example, when controlling for the information in earnings forecast revisions, is the market response to target price revisions similar when recommendations are upgraded, reiterated, or downgraded? Or, is the market response similar after positive and negative target price revisions? Toward this end, we conduct two more sets of regressions. In the first, we condition on the direction of the recommendation revision (columns 2–4), whereas in the second we condition on the sign of the target price revision (columns 5–7).

Consider first the regression results when we condition on the type of recommendation revision (upgrades, downgrades, and reiterations). It can be seen that target price revisions are associated with larger abnormal returns when analysts issue recommendation downgrades ($\gamma = 8.094$, t-statistic $= 18.1$) relative to either reiterations or upgrades. Indeed, the coefficient γ associated with recommendation downgrades is significantly larger than the one associated with recommendation upgrades or reiterations. The asymmetric reaction is consistent with the view that, given analysts' reluctance to issue unfavorable recommendation

[13] In additional analysis, we estimate separate regressions similar to the one in column 1 for each recommendation reiteration category. While the coefficient estimates on the price target and earnings forecast revision are significant and in the expected sign, the intercept estimate (i.e., the average abnormal return), while economically small, is significant and positive for both strong buy and buy reiterations and is significant and negative only for hold reiterations. This finding suggests that the positive coefficient on recommendation reiterations in column 1 of Panel A is driven primarily by events in which recommendation reiterations were either strong buy or buy. Further evidence on the role of recommendation revisions is given in the Appendix.

revisions, investors perceive downgrades as a more credible signal.[14] We also find that β—the slope on the earnings forecast revision—is not statistically different across the three recommendation revisions. Since an earnings forecast is a key input to the derivation of the target price along with an assumed financial ratio (Asquith et al. (2002)), this evidence suggests that when analysts issue a recommendation downgrade, investors view the chosen magnitude of the financial ratio (i.e., multiple) as more informative.

In our second set of regressions, we repeat the same analysis as above but now condition on the sign of target price revision (columns 5–7). Our goal is to gain further insight into the relation between abnormal returns and target price revisions in these specific settings. We find that the slope coefficient of positive target price revisions (column 5) is significantly larger (p-value = 0.001) than that of negative revisions (column 6).[15] We also find that the estimated slope coefficients on the earnings forecast revisions are similar across the three groups, consistent with the results in columns 2–4.

Third, consider the intercept coefficients that capture the average abnormal return resulting from the recommendation revisions. These estimates provide information on the degree of consistency in investor reaction when revisions in recommendations and price targets are reinforcing or countervailing. As expected, abnormal returns associated with recommendation upgrades (downgrades) are economically and statistically the largest when such revisions coincide with positive (negative) target price revisions. For example, when target prices are revised upward (column 5), α_1, the intercept that captures the abnormal return due to recommendation upgrades, equals 4.311 and is significantly larger than the abnormal return due to recommendation downgrades and reiterations (0.048 and 1.571, respectively). Similarly, among the three recommendation revision indicators associated with negative target price revisions (column 6), the one associated with recommendation downgrades is statistically and economically the largest. Another intriguing finding is that, when partitioned by the sign of the target price change, recommendation reiterations are associated with a

[14] McNichols and O'Brien (1997), for example, report that coefficient estimates on recommendation upgrades are smaller in absolute value than those for recommendation downgrades. The evidence from columns 2 and 3, however, suggests that these estimates are not economically different. The reason for this discrepancy is our conditioning on the issuance of a target price. In unreported results, we find that when we do not condition on the presence of a target price, investor reaction to recommendation downgrades is larger in absolute value than to upgrades.

[15] The magnitude of the slopes on the target price revision in columns 5 and 6 are both lower than the slope reported in column 1. Whereas in column 1 we specify a linear relation between target price revisions and abnormal returns, the regressions in columns 5 and 6 allow the coefficient estimates on the stock recommendation to vary depending on the sign of the target price revision, thus exploiting the information in target price revisions as well. Indeed, when we estimate a regression similar to the one in column 1, but with the inclusion of a slope indicator variable that assumes the value of 1 for positive target price revisions and 0 for negative ones, the coefficient estimates on positive target price revisions is 3.095 compared to 4.375 on negative target price revisions (the difference is statistically significant, with a p-value = 0.001).

large and significant abnormal return. For instance, when issued along with a positive target price revision, reiterated recommendations are informative as the associated intercepts are economically and statistically significant ($\alpha_3 = 1.571$, t-statistic $= 29$). Similar evidence is obtained for reiterations accompanied by negative target price changes.

In additional unreported tests we have also examined the informativeness of target price revisions using event-day abnormal volume. Following Holthausen and Verrecchia (1990), who argued that abnormal volume and abnormal returns are equally relevant means of assessing information content, we have calculated for every firm and event in our sample an abnormal volume measure and then repeated the analysis reported in Table III. Specifically, we regress the absolute value of abnormal volume on target price revisions controlling for recommendation and earnings forecast revisions. Consistent with our earlier results we find that changes in target prices are positively related to abnormal volume. Indeed, target price revisions lead to the highest abnormal volume when issued with recommendation downgrades. Moreover, abnormal volume is highest when the direction of the target price and recommendation revisions coincide.

Taken together, the evidence presented in Table III supports the hypothesis that target prices are informative, both unconditionally and conditional on stock recommendation and earning forecast revisions. We find that target price revisions are deemed more informative when they are negative and when associated with recommendation downgrades. We also find that investor reaction is the strongest when the direction of the target price and recommendation revisions coincide rather than when they differ.[16]

C. Postevent Abnormal Returns

The preceding analysis is based on the assumption that investors respond quickly and rationally to the information conveyed in the analyst reports. Since some studies (e.g., Stickel (1995), Womack (1996), Barber et al. (2002)) have shown that market reaction to announcements of recommendation changes is incom-

[16] We have performed three additional tests. First, we estimate regressions in which we condition on the sign of the earnings forecast revision. We find that when earnings forecasts are revised downward, the abnormal return associated with target price revisions is larger than when earnings forecasts are either unchanged or revised upward. This is consistent with the analysis in which we conditioned on the type of recommendation changes in columns 2–4. Second, we examine whether the inclusion of prior stock returns affects the results reported above, since high (low) prior returns might proxy for unusual events in the recent past that might prompt analysts to revise their beliefs regarding firm value. We find strong evidence that target price revisions *are* correlated with prior returns. We also find, however, that in a regression such as that reported in column 1 of Panel A in Table III, the inclusion of prior one-, two-, three-, or six-month market-adjusted abnormal returns does not alter any of our conclusions. Third, we examine the effects of the coincidence of target price issuance with earnings announcements. We repeat the abnormal return regressions (conducted in Section II) separately for those events in which earnings announcements occurred within the previous five days and those events in which no such recent announcement occurred. We found that the slope coefficient on the target price revision is significant and is similar in magnitude across the two scenarios.

plete, we conclude this section with an exploration of postevent abnormal returns in which we ask whether investor reaction to target price revisions is unbiased. Accordingly, we extend the postevent window from event-day $+3$ through six months after the event and examine the abnormal returns in this period.

We begin by calculating equal-weight size and book-to-market adjusted cumulative abnormal returns (CAR) for each event in our sample. Specifically, we first obtain the market capitalization and book-to-market ratio for each firm prior to an event. Then, using the Fama and French 25 size and book-to-market sorted portfolios, we find the portfolio with the matching characteristics. Finally, we calculate the six-month CAR as the cumulative return on the event firm beginning in the first month *after* the event, minus the cumulative matching portfolio return over the same time period. To avoid possible cross-correlation problems arising from identical return observations, all but one of the identical return observations within each portfolio are deleted.

Consider first the average abnormal returns for subsamples of events classified by recommendation upgrades, reiterations, and downgrades. Within upgrade and downgrade recommendation groups we present abnormal return estimates for the highest and lowest tercile portfolios, sorted by the magnitude of the analyst's target price revision at the time of the event. For the reiterated recommendation category we report abnormal return estimates for the highest and lowest decile portfolios, since the number of observations in this case is more than an order of magnitude larger than in the other two categories. In this manner it is possible to observe whether target price revisions contain information for future abnormal returns above and beyond that provided in the associated recommendation. We calculate standard errors for our CAR estimates using the sample standard deviation of the abnormal returns. For example, inferences regarding the six-month CAR are based on the cross-sectional standard deviation of the event firms' six-month cumulative abnormal returns.

Table IV presents our results. Consider first the sample of target price revisions that were issued along with recommendation upgrades. From the row labeled "All target price revisions" we learn that, on average, target prices are revised upwards by 10 percent relative to the pre-event stock price. The average abnormal return is 1.03 percent for the first month after the event (t-statistic $= 4.1$), and increases to 3.08 percent (t-statistic $= 4.7$) six months after the event. The next two rows correspond to the abnormal return estimates for the two subsamples that are sorted based on the magnitude of the price-scaled target price revision. For events in the highest target price revision group (in which revisions averaged 37 percent), the average abnormal return through event month $+1$ is 1.97 percent (t-statistic $= 4.2$), and it increases to 5.21 percent (t-statistic $= 4.2$) through event month $+6$. When we examine events whose target price revision is in the lowest tercile (in which revisions average -20 percent), we find that abnormal returns are in general negative and insignificant and that by event month $+6$, equal -0.38 percent (t-statistic $= -0.4$).

Next, we examine events associated with recommendation reiterations. While there is little trace of an economically meaningful drift for all reiteration events,

Table IV

Postevent Cumulative Abnormal Returns

Size and book-to-market adjusted cumulative abnormal returns (CARs) are calculated for each event in our sample as follows. First, we obtain the market capitalization and book-to-market ratio for each firm prior to the event. Then, each firm is matched with a benchmark portfolio return from the Fama and French 25 size and book-to-market sorted portfolios. Third, a t-month CAR ($t = 1, \ldots, 6$) is calculated by cumulating the event firm return beginning in the first month after the event through event-month $+$ t minus the cumulative matching portfolio return over the same time period. We present CARs for subsamples of events classified by recommendation upgrades, downgrades, and reiterations. Within each recommendation upgrade and downgrade groups, we present CARs for tercile portfolios sorted based on the magnitude of the analyst's target price revision at the time of the event. For recommendation reiterations, we present CARs for decile portfolios sorted based on the magnitude of the analyst's target price revision at the time of the event. We winsorize monthly return observations at the 2nd and 98th percentiles to mitigate the possible effect of extreme observations. To avoid a possible cross-correlation problem caused by identical return observations, we delete all but one of identical return observations within each portfolio. Standard errors for the CAR estimates are obtained using the sample standard deviation of the abnormal returns. For example, inferences regarding the six-month CAR are based on the cross-sectional standard deviation of the events-firms' six-month CARs. The resulting t-statistics are presented below the CAR estimates. Within each possible recommendation/target price classification we also report the average of the target price revisions (scaled by preannouncement stock price). For example, for all events in which recommendations were upgraded, the average target price revision was 10 percent.

		Postevent Month					
	Average Target Price Revision	+1	+2	+3	+4	+5	+6
Recommendation upgrades							
All target price revisions	10%	1.03	1.45	1.73	2.66	2.82	3.08
		4.1	4.0	3.9	5.1	4.8	4.7
Most favorable target price revisions	37%	1.97	2.83	3.21	4.23	4.98	5.21
		4.2	4.1	3.7	4.2	4.4	4.2
Least favorable target price revisions	−20%	0.08	0.08	−0.23	−0.20	−0.13	−0.38
		0.2	0.1	−0.3	−0.2	−0.1	−0.4
Recommendation reiterations							
All target price revisions	−1%	0.31	0.73	0.96	1.09	0.90	1.08
		3.7	6.1	6.3	6.1	4.5	5.0
Most favorable target price revisions	32%	1.19	3.49	4.22	4.77	5.24	6.22
		5.8	10.9	10.4	10.1	10.0	11.0
Least favorable target price revisions	−58%	−0.68	−1.07	−1.10	−1.16	−1.74	−1.88
		−4.3	−4.5	−3.9	−3.5	−4.7	−4.6
Recommendation downgrades							
All target price revisions	−31%	−0.80	−0.50	−0.41	−0.17	−0.53	−0.36
		−3.0	−1.3	−0.8	−0.3	−0.9	−0.5
Most favorable target price revisions	13%	−1.14	−0.90	−0.66	−0.86	−0.11	0.13
		−2.7	−1.5	−0.9	−1.0	−0.1	0.1
Least favorable target price revisions	−91%	−0.63	−0.40	−0.08	−0.23	−1.43	−1.19
		−1.2	−0.5	−0.1	−0.2	−1.2	−0.9

we find large and significant postevent drifts when the information content in the target price is used. Indeed, the CAR of recommendation reiterations associated with target price revisions in the highest (lowest) tercile is 6.22 (-1.88) percent by event month $+6$. Finally, when we examine events associated with recommendation downgrades, we find little evidence of drift.

The evidence reported in Table IV that prices drift in the direction of the target price revision for both recommendation upgrades and reiterations suggests that target prices contain information regarding future abnormal returns. Since these findings are subject to some methodological concerns (see Fama (1998) and Barber and Lyon (1997)), we now turn to a calendar-time portfolio regression approach, which has been advocated by Fama (1998) and applied by Jaffe (1974), Mandelker (1974), and Brav and Gompers (1997). This approach is conducted by forming a portfolio that includes all events that are announced within the previous τ periods (in this paper we set τ equal to six months). In our setting, we form the month t portfolio return by either equal weighting or value weighting firm returns for events that occur within the *previous six months*. Once a firm has been added to the portfolio, if analysts issue additional reports on the firm, we refrain from adding it again to the portfolio. The equal-weight portfolio returns in excess of the risk-free rate are then benchmarked relative to the maintained asset pricing model, and evidence for abnormal performance is based on the magnitude and significance of the regression intercept. It is well known that the portfolio approach eliminates the problem of cross-sectional dependence among the sample events and is not susceptible to misleading rejections owing to compounding of single-period returns (Mitchell and Stafford (2000)).[17]

We address the choice of a benchmark model by relying on Carhart's (1997) four-factor model, which is an extension of the three-factor model of Fama and French (1993).[18] Thus, the regression framework is given by

$$r_{p,t} - r_{f,t} = \alpha + \beta_1 \cdot RMRF_t + \beta_2 \cdot SMB_t + \beta_3 \cdot HML_t + \beta_4 \cdot PR12_t + \varepsilon_t \qquad (2)$$

and we focus our inferences on the magnitude and statistical significance of the intercept, α.

Table V presents the regression results for portfolios in which monthly returns are weighted equally. Consider first the regression results in which portfolios are formed alternatively based on the three recommendation revision categories without conditioning on target price revisions (denoted "All"). In contrast to the

[17] Mitchell and Stafford (2000) point out that the portfolio approach has several potential problems that arise from the changing composition of the portfolio through time, which can potentially lead to heteroskedasticity. We have verified that heteroskedasticity alters none of the conclusions drawn below.

[18] The first factor, RMRF, is the excess return on the value-weighted market portfolio. The second factor, SMB, is the return on a zero-investment portfolio formed by subtracting the return on a large firm portfolio from the return on a small firm portfolio. The third factor is the return of another mimicking portfolio, HML, defined as the return on a portfolio of high book-to-market stocks less the return on a portfolio of low book-to-market stocks. The fourth factor, PR12, is formed by taking the return on high return stocks minus the return on low return stocks over the preceding year.

Table V
Calendar Time Regressions

The sample is all target price announcements between January 1997 and December 1999. Portfolios are formed by including all events that were announced within the previous six months. The portfolios' equally weighted monthly returns, in excess of the risk-free rate, are regressed on the following four factors: *RMRF*, the excess return on the value-weighted market portfolio; *SMB*, the return on a zero investment portfolio formed by subtracting the return on a large firm portfolio from the return on a small firm portfolio; *HML*, the return on a portfolio of high book-to-market stocks less the return on a portfolio of low book-to-market stocks; and *PR*12, formed by taking the return on high momentum stocks minus the return on low momentum stocks. We report regression results for portfolios classified by recommendation upgrades, reiterations, and downgrades. We form tercile (decile) portfolios for recommendation upgrades/downgrades (reiterations) based on the magnitude of the analyst target price revision, which we then regress on the four factors. For example, conditional on a recommendation upgrade, we construct a portfolio that includes firms whose target price revision occurred within the pervious six months and was in the top or bottom tercile at the time it was announced. We winsorize monthly return observations at the 2nd and 98th percentiles to mitigate the possible effect of extreme observations. Adjusted R^2 and t-statistics are presented for each regression.

	Intercept	*RMRF*	*SMB*	*HML*	*PR*12	Adjusted R^2
Recommendation upgrades						
All target price revisions	0.373	1.150	0.537	0.171	0.005	95.5%
	1.69	23.37	8.86	2.56	0.09	
Most favorable target price revisions	0.799	1.170	0.748	− 0.169	− 0.022	95.1%
	2.59	17.01	8.83	− 1.81	− 0.32	
Least favorable target price revisions	− 0.112	1.231	0.429	0.344	− 0.061	88.0%
	− 0.31	15.54	4.42	3.22	− 0.76	
Recommendation reiterations						
All target price revisions	0.094	1.129	0.686	0.221	− 0.110	98.7%
	0.70	38.62	18.86	5.34	− 3.30	
Most favorable target price revisions	0.478	1.161	0.780	− 0.152	− 0.009	99.0%
	3.07	33.07	17.33	− 3.08	− 0.28	
Least favorable target price revisions	− 0.080	1.232	0.690	0.216	− 0.311	95.4%
	− 0.31	22.26	9.48	2.74	− 4.87	
Recommendation downgrades						
All target price revisions	− 0.325	1.179	0.471	0.275	− 0.132	93.7%
	− 1.32	21.44	6.95	3.69	− 2.35	
Most favorable target price revisions	− 0.297	1.141	0.442	0.244	0.103	91.1%
	− 0.99	17.16	5.36	2.71	1.48	
Least favorable target price revisions	− 0.354	1.332	0.614	0.219	− 0.538	90.7%
	− 0.94	15.86	5.94	1.93	− 6.29	

results reported in Table IV, we find no evidence of abnormal postevent return for all three recommendation revision categories.

Next, within each recommendation category, we present regression results for portfolios in which we condition on the magnitude of the target price revision at the time of the portfolio formation. Consider first recommendation upgrades. It can be seen that firms with the highest target price revision tend to comove with

the returns of small growth firms, and that the portfolio intercept, 0.799 percent, is large both economically and statistically. When we consider firms in the lowest tercile of target price revisions, we find that the portfolio covaries with the returns of small, value firms but find no evidence of abnormal performance. This evidence is consistent with the view that over our sample period small growth firms exhibited strong price appreciation whereas value stocks in general performed poorly.

In the case of recommendation reiterations, we still find strong evidence of abnormal performance for the high target price revision. The other portfolios in this case yield insignificant estimates of abnormal returns. Much like with recommendation upgrades, it can be seen that the high target price revision portfolio tends to comove with the returns of small, low book-to-market firms, while the lowest target price revision portfolio returns covary with the returns of small value firms. Finally, the evidence within recommendation downgrades is consistent with the event-time analysis, with insignificant intercepts for both highest and lowest target price revisions. Interestingly, the estimated factor loadings for firms with a recommendation downgrade indicate that the key difference between firms with the lowest and highest target price is their exposure to the momentum factor. While both sets of firms comove with the returns of small growth firms, those that receive an upward (downwards) revision to their target price behave like other "winner" ("loser") firms.[19]

The abnormal return evidence presented in this section is consistent both with an irrational "underreaction" interpretation (e.g., Jegadeesh and Titman (1993)) and with rational learning (Brav and Heaton (2002)). We caution, however, that our three-year sample period coincides with the highs of the bull market in the United States, which might be viewed historically as an unusual period. Therefore, an alternative viable view is that the evidence of postevent returns is unique to this period and unlikely to persist as more data becomes available. We leave for future research a detailed study of these explanations.

III. Modeling the Long-term Relation between Market and Target Prices

We extend the analysis in Section II with an investigation of the long-term dynamics of the stock and target prices. Our objectives are to further investigate the extent to which analyst price targets are systematically related to firms' fundamental values and to quantify the low-frequency dynamics of these price series.

Because both sets of prices are nonstationary, we employ a cointegration framework and estimate the linear combination of the price series that is stationary. This linear combination is termed as the price system's "long-term relation"

[19] In additional unreported tests, we repeat the regression analysis but with value-weighted portfolio returns. Specifically, we construct our portfolios as explained above but weigh the component monthly returns with the lagged market capitalization of the constituent firms. We find that across the three recommendation classifications, the pattern of positive (negative) performance subsequent to a high (low) revision in the target price is qualitatively the same as in Table V.

and is parameterized as the *ratio* of target and market prices.[20] Since target prices are predominantly one-year-ahead prices, this ratio can be interpreted as the analysts' estimate of the firm's ex ante return.

Cointegration also implies that any price deviations from the long-term ratio are stationary as well. That is, if on a given date the ratio of the two prices is equal to the long-term relation, then a shock to any of the variables will lead to a price path that will settle back to the long-term relation. We analyze the price system's reaction to deviations from this long-term ratio by examining which price series corrects to the long-term relation, once the system has been perturbed away. That is, are analysts the ones reacting to a deviation from the long-term relation by adjusting their target prices, or, do stock prices contribute towards most of the adjustment?

Our empirical analysis is conducted on a time series of individual firms' weekly stock prices and consensus target prices. Consensus target price is calculated as the average target price across all brokerage houses. Target prices outstanding for more than 90 days are excluded from the consensus. We choose a weekly interval to avoid microstructure problems associated with daily data. Given the long-term nature of the cointegration analysis, we require each firm to have a minimum of 500 trading days (approximately 104 consecutive weeks) with continuous stock and target price data.[21] The final sample consists of 900 firms.

To set the stage for our methodological approach and to build intuition for the full-sample analysis, we begin by examining the joint price behavior of a single firm, IBM.

A. Basic Setup and Application to IBM's Stock and Target Price Behavior

Figure 2 depicts the time series of weekly market prices for IBM over our sample period, January 1997 through December 1999. We also plot the weekly consensus target price and the ratio of target to market price, denoted TP/P. Inspection of this figure provides a key insight. While both price series are nonstationary (we are unable to reject the null of nonstationarity with an augmented Dickey–Fuller test), it is evident that market and target prices share a long-run common

[20] Our use of the term "long-term relation" differs from that used in the traditional cointegration literature (Engle and Granger (1987)) in which the term "long-term equilibrium" has been employed. The motivation for the use of the latter term is the idea that when two cointegrated economic variables drift apart from this equilibrium, economic forces eventually drive them back to it (e.g., Lee, Myers, and Swaminathan (1999), Hasbrouck (2002)). Finally, as Campbell and Shiller (1988) argue, such an "equilibrium" can occur simply because one variable is a rational expectation of the future value of another variable that follows an integrated process. Since target prices are, by definition, analysts' forecasts of future prices, we have therefore chosen to avoid using the term "long-term equilibrium" in our analysis in favor of "long-term relation."

[21] While the choice of a two-year minimum period reduces the number of firms that we can study, it is a necessary requirement, as we are interested in studying the long-term dynamics of target and market prices. We have replicated the cointegration analysis using a minimum of 250 trading days and obtained similar results. In addition, the analysis was conducted on size-sorted portfolios containing all firms in our database. Our conclusions regarding the dynamics of market and target prices remain unchanged.

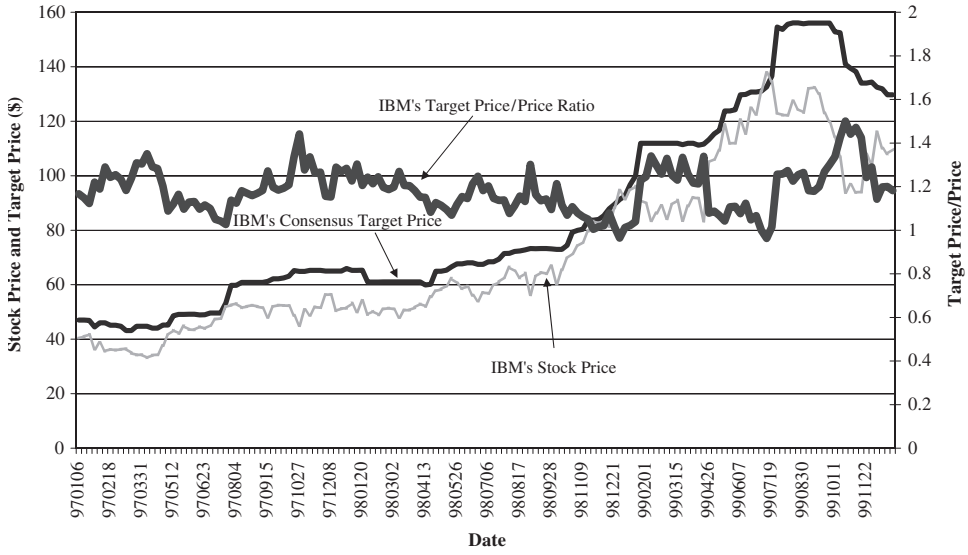

Figure 2. IBM's weekly stock price, target price, and target price-to-price ratio. This figure depicts weekly market price and consensus target price for IBM. The market prices are from CRSP and the weekly consensus target price is the average of all outstanding target prices issued over the preceding 90 days. All target prices are from the First Call database. We also plot the ratio of the target price to market price at each point in time, denoted by TP/P. The vertical axis on the left-hand side corresponds to the price series while the axis on the right-hand side corresponds to the TP/P ratio.

relation. This association is captured by our third variable, TP/P. It can be seen that target prices, which are forward looking, are consistently higher than current market prices, but that the ratio of the two price series fluctuates about a common value at approximately 1.2 (see the right-hand-side vertical axis). When either price series deviates from this ratio, the system tends to revert back to this value over time.

Using a cointegration approach (Engle and Granger (1987)), we provide direct evidence regarding both the long-term relation and the manner with which these prices correct toward this long-term relation. To do that, we assume that analysts' ex ante expected return, and therefore the mean of the TP/P ratio, is constant over our sample period. We denote the time t target price by tp_t and the market price by p_t. The (2×1) vector x_t has elements tp_t and p_t. Both variables are assumed integrated of order one, that is, stationary after first differencing. Cointegration of the two price series means that there is a (2×1) vector β such that the following linear relationship holds: $\beta' x_t = 0$.[22]

[22] We have conducted Johansen's cointegration rank test for each of the 900 price series that we later study in Section III.C and find that we are able to reject the null of no cointegration essentially for all firms.

We begin by writing the price system in an error correction form:

$$\Delta x_t = \sum_{i=1}^{p} \Pi_i \Delta x_{t-i} + \Pi x_{t-1} + \varepsilon_t, \ \forall t = 1, \ldots, T, \tag{3}$$

where Δx_{t-i} is a (2×1) vector of first differences lagged i periods and $\varepsilon_t \sim N(0,\Omega)$, assumed independent over time. The matrices Π_i and Ω are both (2×2), and the latter is assumed positive definite. Π is the (2×2) long-run impact matrix that contains the cointegrating vector. Inclusion of this term in this vector autoregressive regression (VAR) follows from the Granger Representation Theorem. Π's rank is equal to the number of cointegrating relations which in our simple case is just one.

Following earlier literature, we parameterize Π as follows:

$$\Pi = \alpha \beta', \tag{4}$$

where both α and β are (2×1) vectors. The vector β contains the cointegrating coefficients, and for identification we normalize its first element to -1, that is, $\beta \equiv (-1, b)$. For example, if, on average, analysts forecast that target prices are 20 percent higher than current market prices, then $\beta = [-1 \ \ 1.2]$. The vector α is the *vector of weights* in the VAR regression. This vector can be interpreted as a vector of "adjustment coefficients"; that is, the elements in α allow us to quantify how target prices and market prices react to past deviations from the long-term relation. By obtaining estimates of the elements in α, we can quantify the way in which the two time series contribute to the correction of the system back to the long-term relation.

B. Cointegration Results for IBM

We present the cointegration results in Panel A of Table VI. We focus our attention on b, the parameter capturing the long-run ratio of target prices relative to market prices, as well as on the (2×1) vector α, capturing the response coefficients of each price variable to deviations from the long-run relation. The long-term relation for IBM is 1.23, indicating that, *ex ante*, analysts expected that IBM's annual return would be 23 percent.

The estimates of the vector of response coefficients, α, provide interesting evidence on the manner with which target and market prices adjust to the long-term relation. The target price response, α_{tp}, is large and positive (0.17, with a t-statistic = 8.15), while the market price response, α_{market}, is statistically indistinguishable from zero. This finding can be interpreted as follows. Suppose market and target prices are currently 100 and 123 dollars, respectively, and that a 4-dollar revision in the consensus target price leads to a market price adjustment of 1.6 dollars. In this case, the new ratio (1.25) differs from its long-term value of 1.23. The regression analysis indicates that the consensus target price is adjusted by 17 percent of $(127 - 1.23 * 101.6)$, or 35 cents in the first week. Since α_{market} is insignificantly different from zero, it can be seen that in IBM's case, once the system of prices has been shocked away from its long-term relation, it is predominantly the analysts, rather than market participants, who tend to revise their target prices toward the long-run relation.

TableVI
Cointegration Regression Results

The table provides regression results of the cointegration analysis. Panel A presents results for IBM's 151 weekly observations of target and market prices spanning the period January 1997 through December 1999. The target price series is formed by equal-weighting all outstanding target prices that were issued within the previous 90 days. The regression setup is given in Section III and we estimate the parameter b, which captures the long-run ratio of target prices-to-market prices, and the vector α, which contains the response coefficients of each price variable to deviations from the long-run equilibrium. The first row contains the parameter estimates and the second contains the corresponding p-values. We do not report standard errors associated with b, as these are based on asymptotic theory whose finite sample properties are undetermined. Panel B provides results for the full sample of 900 firms that have at least one year of continuous record of weekly target and market prices. For each parameter we calculate the mean, median, 25th, 50th, and 75th percentile, as well as the standard deviation across the 900 firm regression estimate. Panel C provides regression results for subsamples of firms sorted by market capitalization (size). Size terciles are formed on the basis of NYSE capitalization cutoffs and are adjusted quarterly. For each size sort, we report the average of the regression estimates. For example, for the smallest 300 firms in this sample the average long-run ratio b is 1.37.

	Long-run Ratio b	Target Prices Response α_{tp} (%)	Market Prices Response α_{market} (%)
Panel A: IBM			
	1.23	0.17	0.04
	—	0.00	0.35
Panel B: Full Sample			
Mean	1.28	0.09	− 0.02
25th percentile	1.20	0.07	− 0.04
Median	1.26	0.09	− 0.01
75th percentile	1.33	0.11	0.01
Standard deviation	0.11	0.04	0.04

Panel C: Size-sorted Results				
Portfolio	Number of Firms	Long-run Ratio b	Target Prices Response α_{tp} (%)	Market Prices Response α_{market} (%)
Small	126	1.37	0.09	− 0.02
Medium	347	1.29	0.09	− 0.02
Large	427	1.23	0.10	− 0.01

C. Full-Sample Implementation of the Cointegration Analysis

In this subsection, we implement the cointegration analysis for the full sample of 900 firms and estimate, for each firm, the parameters that capture the long-run ratio of target prices relative to market prices, b, as well as the (2×1) vector of response coefficients, α, that captures how each price variable responds to deviations from the long-run relation. We report the results in Panel B of Table VI.

Since the regression analysis results in 900 sets of parameter estimates, we report summary statistics only.[23]

Consider first the full sample results of the long-run ratio of target-to-market prices, *b*, given in the first row. The first column indicates that the grand-average (median) of the 900 estimates equals 1.28 (1.26). That is, conditional on at least two years of continuous consensus coverage, the average firm in this sample is expected to earn 28 percent annually. Furthermore, with the 25th and 75th percentiles equal to 1.20 and 1.33, we learn that the distribution of these estimates is quite disperse, with a slight skew to the right.[24]

Next, consider the full-sample estimates of the response coefficients, α_{tp} and α_{market}. The second column provides the grand average (median) of α_{tp}, which equal 9.0 (9.0) percent. From this we learn that for the average firm, the analysts' weekly response to a one-dollar shock in either target price or stock price that causes a deviation from the long-term relation is to revise the target price by nine percent of the resulting deviation. As discussed earlier, a positive response coefficient is consistent with analysts revising their target prices toward the long-term relation once the system has been perturbed away from it. The market price response coefficient, α_{market}, is smaller by one order of magnitude, as can be seen from the third column. The grand-average (median) of the market's response coefficient is only -0.02 (-0.01) percent, suggesting a two percent weekly correction in response to a one-dollar deviation from the price system's long-term ratio. The above evidence is consistent with the interpretation that analysts revise their targets toward the long-term relation once the system has been shocked away from it. The same statistics for market prices, α_{market}, indicate a much smaller reaction to deviations from the long-term relation by market participants.

The evidence regarding the estimates of the response coefficients may seem inconsistent with the results reported in Section II.C, in which we detect abnormal return drifts subsequent to the target price revision. We argue, however, that the two empirical findings are, in fact, not inconsistent with each other. While the event-study approach allows us to isolate investor reactions to extreme target price revisions by conditioning both on the magnitude of the target price revision and the type of recommendation change, the cointegration approach provides lower frequency evidence in which unconditional estimates of target and market price are calculated. Hence, abrupt target price revisions are averaged with less

[23] Because we estimate the regressions on a firm-by-firm basis, the results do not account for possible cross-correlation in the regression errors. While it is beyond the scope of this paper to estimate a large variance-covariance matrix or price errors, we note that the individual firm parameter estimates are, however, consistent and, in our setup, estimated quite precisely.

[24] Our analysis leaves open the question of whether the estimates of ex ante returns are consistent with those elicited from an asset-pricing model such as the CAPM or the Fama and French three-factor model. We note here that, much like the high estimates that we report, the geometric average annual market return over our sample period is quite high at 19.9 percent. Furthermore, in unreported analysis we have contrasted the cointegration estimates of *b* with expected returns from the Fama and French model, allowing for the possibility of mispricing as in Pastor and Stambaugh (1999). We find that allowing for mispricing uncertainty regarding the Fama and French three-factor model can indeed account for the cross-sectional dispersion in the reported estimates of *b*.

extreme changes. It is therefore not surprising that our estimates of α_{market}, the market price response coefficient, are extremely small.

We conclude this section by presenting, in Table VI, Panel C, parameter estimates sorted by the firms' market capitalization (size). To the extent that size differences are associated with cross-sectional differences in information asymmetry or risk, our analysis sheds light on the dynamics of target prices as they relate to this characteristic of firms. We form size terciles based on NYSE capitalization cutoffs and adjust these quarterly. Event firms are then classified based on the market value of their equity at the end of the preceding quarter. Consider first the estimates of the long-run ratio of target-to-market prices, b. Beginning with firms in the smallest tercile, the average estimate of b is 1.37 and declines monotonically to 1.23 for the firms in the largest tercile. This pattern indicates that analysts expect a higher annual price appreciation for small stocks, which is consistent with asset pricing models, such as the Fama and French three-factor model, that include size as a risk factor. Finally, the information regarding the response coefficients α_{tp} and α_{market} indicates that there are no cross-sectional differences in either analyst or the market reactions to deviations from the long-term relationship across the size terciles. As with the IBM results, the overall evidence supports the interpretation that market prices react to the information conveyed in analyst reports but that any correction to the long-term relation between target and market prices is predominantly made by analysts.

IV. Linking the Evidence from the Short- and Long-term Analyses

The preceding section provides evidence as to the dynamics of target and market prices as well as to their common long-term relation. We now seek to build on these results and link them to the short-term event study conducted in Section II. Specifically, we construct an estimate of the *expected* one-week-ahead consensus target price and then examine whether investors understand the long-term dynamics of the price series. We do this by testing whether event-day abnormal returns are correlated with the *unexpected* part of the target price revision (for a similar approach, see Lowry and Schwert (2002)). Toward this end, we first estimate for each of the 900 firms a one-week-ahead forecast of the consensus target prices, using the sample information that would have been available to investors prior to the release of the analyst reports. We require a minimum of 10 weekly observations to fit the cointegration regression. Using the expected consensus target price, we construct two variables. One is the *expected* target price revision, which equals the scaled difference between preannouncement consensus target price and the forecasted one. The second is the *unexpected* target price revision, which equals the difference between the announced and the expected target price. We scale both the expected and unexpected variables by the event-firm's market price two days prior to the event.

Next, we estimate a regression similar to the one conducted in Section II but by employing the expected and unexpected target price proxies rather than the scaled change in the individual brokerage house target price, $\Delta TP/P$. If the coin-

tegration setup provides an adequate description of the evolution of market and target prices, we expect that only the unexpected component of the target price revision would be related to event-time abnormal returns. The regression takes the following form:

$$AR = \alpha_1 UPGRADES + \alpha_2 DOWNGRADES + \alpha_3 REITERATIONS + \beta\left(\frac{\Delta F}{P}\right) + \gamma\left(Expected\frac{\Delta TP}{P}\right) + \eta\left(Unexpected\frac{\Delta TP}{P}\right) + \varepsilon \quad (5)$$

The regression results are reported in Table VII. Consider the results for Model I first. Consistent with our prediction, we find that, controlling for the recommendation and earnings forecast revisions, average abnormal returns are significantly associated with the proxy for unexpected revision in target price (slope coefficient = 2.671 with t-statistic = 27.0). We also find no reliable relationship between abnormal returns and the expected revision in target price. This finding is consistent with the view that investors understand the long-term dynamics documented in Section III and thus are able to anticipate some of the analysts' revisions.

The association that we estimate between unexpected target price revisions and event-day abnormal returns implicitly imposes the restriction that market participants react symmetrically to unexpected revisions in target prices, irrespective of the current levels of target and market prices. We now relax this restriction by constructing four alternative measures of unexpected target price revisions that condition on the magnitude of the pre-event ratio of target-to-market price relative to the estimate of the firm's long-term relation. Specifically, suppose that at the time of the announcement, the pre-event target price to market price ratio is 1.25 and the current estimate of the long-term ratio is 1.20. If the target price revision was *away* from the long-term ratio of 1.20, we classify it as "Unexpected $\Delta TP/P$ above/away." A target price revision toward the long-term ratio is classified as "Unexpected $\Delta TP/P$ above/towards." The remaining two variables, unexpected target price revisions when the pre-event target price to market price ratio is lower than the estimate of long-term ratio, are defined similarly.

The column labeled "Model II" in Table VII provides the regression results. We find that in cases where the pre-event ratio of target-to-market prices is *below* the long-term relation, unexpected target price revisions away from the long-term relation are associated with larger negative abnormal returns than in any of the other cases ($\eta_3 = 6.864$ with t-statistic = 20.1). Indeed, the latter abnormal return is nearly twice as high as in the case in which the pre-event ratio of target-to-market prices is *above* the long-term relation and the unexpected target price revision is away from the long-term relation cases ($\eta_1 = 2.712$ with t-statistic = 17.7). The p-value for the hypothesis that the previous two reactions are equal indicates that we can reject this null. Finally, it can be seen that unlike market responses to unexpected target price revisions away from the long-term relation, target price revisions toward the long-term relation are economically and statistically smaller.

TableVII

Informativeness of Target Prices Based on the Cointegration Regression

The sample contains all target price announcements between January 1997 and December 1999. The table reports regression results in which the dependent variable is the market-adjusted buy-and-hold abnormal returns around target price announcements. The independent variables are indicator variables for analysts' recommendation revisions, earnings forecast revisions, and expected and unexpected target price revisions. The indicator variables assume the value 1 for the relevant recommendation revision and 0 otherwise. The recommendation categories are upgrades, downgrades, and reiterations. Abnormal returns are computed as the difference between the firm buy-and-hold return and the buy-and-hold return on the NYSE/AMEX/Nasdaq value-weighted index over the period beginning two days prior to and ending two days subsequent to the target price announcement. Earnings forecast revision, denoted $\Delta F/P$, is computed as the percentage change in the brokerage house current and prior annual earnings forecast scaled by preannouncement stock price. Expected target price revisions for each firm and event are constructed as follows. We first estimate a one-week-ahead forecast of the consensus target prices using the sample information that would have been available to investors prior to the release of the analyst report. We require a minimum of 10 weekly observations to fit the cointegration regression. The difference between the regression forecast and the preannouncement consensus target price, denoted (Expected $\Delta TP/P$), serves as a proxy for the expected consensus target price revision. Unexpected target price revision, denoted (Unexpected $\Delta TP/P$), is the difference between the announced and expected target price. Both the expected and unexpected target price variables are scaled by the event-firm's market price two days prior to the event. We winsorize all variables at the 1st and 99th percentiles to mitigate the possible effect of extreme observations. In addition, we verify that regression results are not sensitive to influential observations. The number of observations in each regression is 43,660.

Variable	Model I	Model II
α_1 (Recommendation upgrades)	2.120	2.171
	17.8	18.5
α_2 (Recommendation downgrades)	− 2.188	− 1.887
	− 14.0	− 12.9
α_3 (Recommendation reiterations)	− 0.070	0.162
	1.9	3.6
β (ΔF/P)	2.153	2.173
	29.4	30.7
γ (Expected $\Delta TP/P$)	2.326	
	1.8	
η (Unexpected $\Delta TP/P$)	2.671	
	27.0	
η_1 (Unexpected ΔTP/P above/away)		2.712
		17.7
η_2 (Unexpected $\Delta TP/P$ above/towards)		1.288
		1.7
η_3 (Unexpected $\Delta TP/P$ below/away)		6.864
		20.1
η_4 (Unexpected $\Delta TP/P$ below/towards)		1.494
		9.6
R^2	5.9%	6.7%
p-values of tests of equality of coefficients		
$\eta_1 = \eta_2$		0.072
$\eta_3 = \eta_4$		0.000
$\eta_1 = \eta_3$		0.000
$\eta_2 = \eta_4$		0.794

V. Summary and Conclusions

Using a large database of analyst price targets, stock recommendations, and earnings forecasts, we examine short-term market reactions to target price announcements and long-term comovement of target and market prices. Consistent with our predictions, we find that target prices are informative both unconditionally and conditional on contemporaneously issued recommendation and earnings forecast revisions. Moreover, revisions in target prices contain information about six-month postevent abnormal returns. Recommendation and earnings forecast revisions are also found to be informative in the presence of target prices. We document a role for the degree of the recommendation change for a given target price change, suggesting that the degree of the stock recommendation revision conveys analysts' uncertainty regarding the overall assessment of the firm's prospects. We provide additional evidence as to the dynamic properties of analyst price targets by examining their long-term comovement relative to stock prices. Using a cointegration framework, we find that, on average, one-year-ahead target prices are 28 percent higher than current market prices, an estimate that we refer to as the long-term relation of the price system. This framework allows us to document the dynamics that force the two sets of prices to converge on the long-term relation. We show that, while market prices react to the information conveyed in analyst reports, once the price system has been shocked away from this long-run relation, any subsequent correction is done primarily by analysts, while market prices alone contribute little to this correction phase. We provide evidence that the market understands the latter relationship.

Target prices and, more generally, financial analysts have recently received considerable attention. This paper is the first to explore and document evidence on the informativeness and time-series behavior of analysts' target prices, thus contributing to our understanding of price formation in equity markets. First, as Asquith et al. (2002) and others document, target prices are often computed as the product of forecasted earnings and an earnings multiple. Hence, controlling for the revision in the earnings forecast, the announcement of a target price provides researchers with a unique opportunity to observe how investors incorporate information on the reduced form "model" deemed correct by the analysts in forecasting future price appreciation. Our findings of a monotonic relation between abnormal returns and target price revisions, controlling for earnings forecast revisions, is consistent with the view that market participants view the magnitude of the multiple used by the analyst as informative. Second, the evidence that target price revisions contain information regarding future abnormal returns is important and consistent with either market underreaction due to investor behavioral biases or rational learning in the face of structural uncertainty (Brav and Heaton (2002)). The evidence of such a "drift," however interpreted, is also relevant to the current debate regarding the objectivity and unbiasedness of analyst reports.

Our findings should serve as a starting point for further research on various related questions. Since the ratio of target-to-market prices can be viewed as a measure of ex ante expected return, it would be interesting to examine whether

these ex ante returns are unbiased and are more accurate relative to forecasts generated from asset pricing models such as the CAPM or intrinsic value measures such as in Lee et al. (1999). These ex ante expectations can also be used in asset pricing tests, such as that in Fama and MacBeth (1973), in lieu of realized returns (see Brav, Lehavy, and Michaely (2002)).

Various other questions warrant further investigation: Are there any cross-sectional differences in market reaction based on firm and brokerage house characteristics? How do analysts determine their target prices? Are these prices based on valuation models whose inputs include their own earnings forecasts? What governs analyst decisions to issue or withhold target prices? What, if any, are the consequences on analysts' reputations of providing "incorrect" target prices or "chasing" the stock price? Are any differences to be found in target prices between "affiliated" and "unaffiliated" analysts (Michaely and Womack (1999))? Finally, given that the sample period we study is quite unusual in the history of U.S. capital markets, additional "out-of-sample" evidence is desired. We leave these intriguing questions for future research.

Appendix: Additional Evidence on the Role of Recommendation Revisions

We report additional tests designed to explore the role of the magnitude of recommendation revisions (e.g., hold-to-buy relative to hold-to-strong buy), controlling for the information in both target price and earnings forecast revisions. We expect the magnitude of a recommendation revision to be informative even in the presence of target prices. For a given target price revision, the magnitude of the associated recommendation revision can provide additional information on an analyst's level of confidence in that target price. For example, a positive revision in a target price could be perceived as more credible (or more precise) when accompanied by a revision from a hold to a strong buy rather than a revision from a hold to a buy recommendation. Hence, a target price might reflect the mean of the analyst's posterior beliefs regarding the firm's value, while a recommendation provides additional information regarding the dispersion of these beliefs.

We investigate this view as follows. First, we split the sample into two subsets, depending on the type of the recommendation revisions, namely upgrades and downgrades. Then, within each such classification, we consider the possible recommendation revisions and regress event-day abnormal returns on an intercept as well as on earnings forecasts and target price revisions.

The results are presented in Table A1. Consider first columns 1–3 in which we focus on recommendation upgrade categories. To ensure a meaningful interpretation of the incremental role of the relative recommendation revision, we focus on recommendations that were revised *from* and revised *to* the same recommendation. Thus, we compare among three possible such upgrades: (1) hold to strong buy, (2) buy to strong buy, and (3) hold to buy.

The regression results are consistent with the prediction that, controlling for earnings forecast and target price revisions, more-extreme revisions in stock

Table A1
The Role of Recommendation Revisions

	Recommendation Upgrades from			Recommendation Downgrades from		
Variable	Hold to Strong Buy (1)	Buy to Strong Buy (2)	Hold to Buy (3)	Strong Buy to Hold (4)	Strong Buy to Buy (5)	Buy to Hold (6)
α (Intercept)	3.459	2.479	2.670	− 3.239	− 1.960	− 2.655
	9.3	13.1	9.3	8.6	9.0	9.2
β (Earnings forecast revision)	0.497	1.051	1.260	0.260	2.443	0.813
	1.0	3.1	3.3	1.4	9.5	3.7
γ (Target price revision)	5.639	7.779	4.605	9.093	6.798	8.600
	5.9	12.3	6.4	10.1	10.8	9.4
Adj. R^2	5.7	7.9	5.8	14.6	14.3	12.3
N	517	1,879	780	554	1,465	887

recommendations are perceived as providing more-informative signals. For example, the coefficient estimate associated with upgrades to strong buy from hold (3.459) is significantly different (p-value = 0.018) from the one associated with upgrades to strong buy from buy (2.479). Similarly, upgrades from hold to strong buy are larger than upgrades from hold to buy, although these differences are marginally significant (p-value = 0.088).

When we consider recommendation downgrades in columns 4–6, we find results consistent with the hypothesis that the magnitude of a recommendation revision conveys independent information to market participants. Specifically, we examine downgrades from: (1) strong buy to hold, (2) strong buy to buy, and (3) buy to hold. We find that the coefficient estimate associated with downgrades from strong buy to hold (− 3.239) is significantly different (p-value = 0.005) from the one associated with downgrades from strong buy to buy (− 1.960). Similarly, revisions from strong buy to hold are associated with a larger negative abnormal return than revisions from buy to hold (− 3.239 vs. − 2.655). These results support an informative role for the magnitude of recommendation revisions, consistent with the interpretation that analysts employ the degree of the recommendation revision to convey their confidence in their target price estimate.

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