Strategic distortions in analyst forecasts in the presence of short-term institutional investors

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We document that analysts cater to short-term investors by issuing optimistic target prices. Catering dominates among analysts at brokers without an investment banking arm as they face lower reputational cost. The market does not see through the analyst catering activity and their forecasts lead to temporary stock overpricing that short-term institutional investors exploit to offload their holdings to retail traders. We also report evidence consistent with catering brokers being rewarded with more future trades channelled through them. Our study identifies a new source of conflicts of interest in analyst research originating from the ownership composition of a stock.

Keywords: target prices; earnings forecasts; strategic distortions; short-term investors

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1. Introduction

Extensive literature documents that analysts behave strategically and issue optimistic forecasts to generate corporate business and commission fees for their brokers or please the firm's management (e.g., Dugar and Nathan, 1995; McNichols and O'Brien, 1997; Lin and McNichols, 1998; Hong and Kubik, 2003; Jackson, 2005). An important result in this literature is that institutional investors curb optimism in analyst forecasts as they reward brokers producing *less* biased research with their trades (Frankel et al., 2006; Ljungqvist et al., 2007). The underlying idea is that institutional investors prefer informative and unbiased research because they use sell-side analysts' research as an input into their valuation models and investment strategies (Ljungqvist et al., 2007; Cheng et al., 2006; Brown et al., 2014). However, previous research ignores likely heterogeneity in preferences for unbiased research among institutional investors stemming from differences in holding periods. Specifically, short-term institutional investors, such as hedge funds, may favour optimistically biased research that facilitates profitable trades. Analysts may be willing to issue biased forecasts to cater to short-term investors because this group generates the bulk of trade commissions (Goldstein et al., 2009; Hintz and Tang, 2003). The market may fail to see through biased forecasts in which case optimistic forecasts will lead to temporary increases in stock valuations that benefit short-term investors when they sell their holdings. This study sets out to test this catering hypothesis.

We expect that, to please short-term investors, analysts will issue optimistic target prices or increase bias in their target prices (TPs). We focus on target prices for stocks held by short-term investors because (1) TPs provide a direct investment recommendation compared to analyst earnings forecasts, which are inputs into valuation models, (2) stock recommendations derive from TPs (Bradshaw, 2002), hence any bias in stock recommendations should largely reflect optimism in analyst target prices, (3) TPs are more granular than stock recommendations making them more suitable to channel analyst optimism[1],

[1] Analysts cannot increase optimism in their stock recommendations if the outstanding recommendations are already at the top of the rating scale. Stock recommendation changes are constrained after 2002 because most brokers moved to a three-tier recommendation system and they had to disclose the distribution of their outstanding recommendations in each analyst report, which increases the cost of issuing optimistic recommendations (Kadan et al. 2009).

and (4) the reputational cost for biasing TPs is lower than for issuing optimistic EPS forecasts or stock recommendations because target prices do not factor into analyst and broker rankings such as those compiled by the Institutional Investor, The Wall Street Journal and StarMine (Brown et al., 2015).

To examine the proposition that analysts cater to short-term investors, we divide the analysis into two parts. In the first part, we establish that ownership by short-term institutional investors affects TP optimism. In the second part of the study, we examine short-term price reactions to analyst TP announcements. The latter tests suggest that the market does not see through the analyst catering activity and their forecasts lead to temporary stock overpricing that short-term institutional investors exploit to offload their holdings to retail traders. We use two measures of ownership by short-term investors: the average holding period for a representative investor in a stock from Gaspar et al. (2005, 2013), and the percentage ownership by hedge funds, which are on average short-term investors (Cella et al., 2013). Empirical tests confirm an economically significant relation between TP optimism and the institutional investor holding period—a one standard deviation reduction in the average institutional investor holding period associates with an increase in TP optimism by 65.7% compared to the average level. Importantly, we show that TP optimism increases only *after* analysts observe a significant *increase* in short-term ownership in a stock, consistent with analysts reacting to changes in the stock's ownership composition rather than investors reacting to optimistic TPs. We also conduct other tests to mitigate the impact of reverse causality inferences. Using hedge fund holdings as an alternative way of capturing ownership by short-term investors produces virtually identical conclusions. Together, the results confirm that analysts distort their TPs in the presence of short-term institutional investors.

Further tests reveal that it is analysts at brokers without an investment banking arm that advises on capital market transactions (IB) who are more likely to issue optimistic TPs. This evidence reflects that trade commissions are more important for non-IB brokers as IB brokers can diversify their revenue sources away from trade commissions (Rhee, 2010; Cowen et al. 2006). It is also consistent with the marginal cost of reputational loss from issuing biased forecasts being higher for IB brokers as accurate

and informative research helps win investment banking transactions (Ljungqvist et al., 2006).[2] Together, the evidence suggests that a specific analyst group—analysts with lower reputational costs—is more likely to cater to short-term investors.

A challenge to establishing the causality of the effect we document is addressing endogeneity concerns. We address endogeneity in three ways. We believe these three tests help alleviate the concern that our results reflect cases where short-term investors select firms with more biased TPs in the hope of exploiting potential stock misvaluation. First, we use instrumental variable regressions to mitigate the distortion arising from the endogenous choice of stocks investors hold. Second, we use regression specifications with firm- and analyst-fixed effects to control for the impact fixed omitted correlated variables have on the results. Third, we use a quasi-natural experiment related to the Lehman Brothers bankruptcy and explore in our tests the resulting exogenous variation in the use of reputable brokers.[3] Collectively, these results partially mitigate the concern about the impact of omitted variables or confounding effects. Further, we show that our results are robust to sensitivity tests, which include (1) using alternative measures of TP bias, (2) looking at *changes* in TP bias relative to *changes* in ownership composition, (3) addressing alternative explanations, and (4) employing different model specifications. We also document that catering happens on the short-side as analysts issue more *pessimistic* TPs for stocks with high short interest.

In the second part of the study, we first examine short-term price reactions to analyst TP announcements. Consistent with our prediction, we find that investors fail to see through analyst incentives to bias TPs for stocks with high short-term ownership. The short-term price reaction results

[2] To further support the conjecture that IB analysts face higher reputational costs for issuing biased forecasts, which discourages catering to short-term investors, we also examine analyst Institutional Investor All-America Research Team rankings. All-America (Star) analysts are more likely to be employed by investment banks because their presence has a bearing on the choice of the investment advisor in security offerings (Hong and Kubik, 2003; Hong et al., 2000; Ljungqvist et al., 2006; Loughran and Ritter, 2004; Dunbar, 2000). We find that Star analysts are less likely to bias TPs; any catering to short-term investors comes primarily from non-Star analysts.

[3] The collapse of Lehman Brothers not only reduced the pool of brokers through which investors can channel trades, but also put into question survival of many other brokerage houses. Because of the uncertainty about whether some brokers would survive to execute future trades, many investors switched to the safety of large reputable brokers. Thus, the uncertainty created by Lehman Brothers' collapse generated exogenous variation in the choice of brokers with investors normally choosing less reputable brokers opting for other investment banks (Mackintosh, 2008).

confirm that biased TPs lead to temporary increases in stock valuations, which could be interpreted as analysts creating "windows of opportunities" for short-term investors to sell their holdings. Correspondingly, we document that short-term institutional investors take advantage of these "windows of opportunities" and sell their holdings to retail investors. Specifically, we show that higher TP bias reduces (1) future percentage *short-term* institutional holdings and (2) the number of future *short-term* institutional investors in a stock. Long-term investors do not trade on optimistic TPs, which leads to an overall reduction in institutional ownership and a corresponding increase in retail investor ownership. Together, our evidence confirms that biased TPs facilitate more profitable trades by short-term investors at the expense of retail investors.[4] Our results are consistent with Brown et al. (2015, 38), who document that retail investors are the least important client group to brokerages and conclude that "most analysts focus on addressing the needs of large, institutional investors, rather than the needs of small, individual investors". Our story assumes that the catering broker will receive some commission, either from sales of holdings by short-term investors or the subsequent reinvestment of the sale proceeds. Our final test shows that short-term investors increase their holdings in other stocks covered by the broker that engages in catering and we can expect that at least some of their trades will be channelled through the catering broker. This result, jointly with the evidence that analysts cater to short-term investors, is consistent with the prediction that short-term investors reward catering brokers with their trades.[5]

This study is of interest to academics, regulators and market participants. First, it adds new evidence to the literature on conflicts of interest in analyst research (Dugar and Nathan, 1995; McNichols and O'Brien, 1997; Lin and McNichols, 1998; Hong and Kubik, 2003; Firth et al., 2013; Gu et al., 2013). We identify a new source of conflicts of interest arising from the ownership composition of the stock. Our

[4] Our results do not depend on analysts privately communicating their actions to short-term investors, i.e., "tipping", which most brokers proscribe (Irvine et al., 2007). Rather, public disclosure of the target price is necessary to create "windows of opportunities" for short-term investors to off-load their holdings. We assume short-term investors have the sophistication to recognize that analyst TPs are overly optimistic, for example, through comparison with their own valuations. This assumption is consistent with past studies which document that institutional investors, and short-term investors such as hedge funds in particular, are sophisticated investors (e.g, Malmendier and Shanthikumar 2007, 2014; Cella et al., 2013). Further, short-term institutional investors can easily access analyst target prices through analyst reports and morning notes as well as Bloomberg or Thomson Reuters terminals.

[5] Because data on how investors allocate trades across brokers is not available, our test provides indirect evidence of short-term investors rewarding catering brokers.

results qualify the conclusion in previous literature (e.g., Frankel et al., 2006 and Ljungqvist et al., 2007) that institutional investors curb analyst propensity to issue biased research. Rather, our findings suggest that non IB-affiliated analysts cater to the needs of short-term institutional investors, such as hedge funds, and issue biased forecasts that facilitate profitable trades by these investors at the expense of retail investors. Our results are in-line with the warning issued by Laura Unger, former acting chairman of the SEC, in a testimony before a congressional subcommittee that analysts face pressure from their institutional clients to produce biased research (Unger, 2001). We confirmed our results with informal analyst interviews, who accept the practice is quite common. We recommend that future research that examines properties of analyst forecasts, such as accuracy, bias and price impact, controls for the stock's ownership composition to ensure validity of tests.

Second, our study adds to the literature on the interactions between analysts and short-term investors such as hedge funds. Klein et al. (2014) and Swen (2014) show that hedge funds trade prior to analyst recommendation changes, which suggests that analysts disclose their private information to hedge funds so that hedge funds can buy the stock at a lower price. Our paper complements these studies as we focus on how analysts, through their optimistic forecasts, facilitate hedge fund *exits* from stocks they own.

Third, our results are important for regulators as they add to the concerns of the Securities and Exchange Commission (SEC) that certain market mechanisms create incentives for abusive market practices. Section 28(e) of the Securities and Exchange Act permits bundling of trade execution and research service costs. However, our results suggest that such bundling creates incentives for analysts unaffiliated with investment banks to issue research benefiting a small group of institutional investors at a disadvantage to retail investors. Our findings are topical given the recent argument by Juergens and Lindsey (2009) that, following regulation Fair Disclosure and the Global Research Analyst Settlement, brokers might have stronger incentives to extract revenue from trade commissions.

2. Research design

2.1 *Measures of short-term institutional investment*

In this study, we use two measures to capture holdings by short-term investors. First, following the extant literature (Gaspar et al., 2005, 2013), we calculate the institutional investor investment horizons using the Churn Ratio measure

$$CR_{i,q} = \frac{\sum_{k=1}^{Q_q} | N_{k,i,q}P_{k,q} - N_{k,i,q-1}P_{k,q-1} - N_{k,i,q-1}\Delta P_{k,q} |}{\sum_{k=1}^{Q_q} \frac{N_{k,i,q}P_{k,q} + N_{k,i,q-1}P_{k,q-1}}{2}} \quad (1)$$

where $CR_{i,q}$ is the churn ratio of investor i in quarter q, $N_{k,i,q}$ is the number of shares in firm k, held by investor i in quarter q; $P_{k,q}$ is the stock price of firm k in quarter q; Δ denotes the quarterly change operator; Q_q is the number of firms in investor's i portfolio in quarter q. The idea behind the *CR* measure is that we can classify an investor as short term if she churns her overall portfolio frequently. Inversely, we can classify an investor as long term if she holds her stock positions unchanged for a considerable period.

Using the *CR* measure, we then estimate Investor Turnover at the firm level as

$$Inv\_TR_{k,q} = \sum_{i \in S_{k,q}} w_{k,i,q} \left(\frac{1}{4}\sum_{r=1}^{4} CR_{i,q-r}\right) \quad (2)$$

which is defined as the weighted average of the time-averaged portfolio of churn rates of all the investors who have shares in firm k in quarter q. In other words, *Inv_TR* captures the average holding period of a representative investor. Equation (2) allows us to use the churn ratios for each institutional investor with positive shareholdings in a firm in order to characterize firms based on their *average institutional shareholder profile* as firms where the representative investor has long (low *Inv_TR*) or short (high *Inv_TR*) holding period.

The second measure of holdings by short-term investors is the percentage ownership by hedge funds, *%HF ownership*. The hedge fund industry has grown rapidly over the past decade, from less than

$500 billion in assets under management in 2000 to over $2,500 billion in 2014, becoming the most prominent group of short-term investors (Financial Conduct Authority, 2014; Ben-David et al., 2012). Using Equation (1), Cella et al. (2013) show that hedge funds have among the highest churn ratios compared to other investor groups (twice that of pension funds), consistent with their short holding periods.

2.2 *Measures of target price bias*

In terms of our main dependent variable, we follow prior studies that examine bias in analyst earnings forecasts and target prices (Bradshaw et al., 2013, 2014; Bilinski et al., 2013; Bonini et al., 2010) and measure TP bias, $TP\ bias_{a,k,d}$, as the signed difference between the target price issued by analyst *a* for firm *k* on day *d* and the actual stock price at the end of the 12-month forecast horizon, $P_{k,12}$, scaled by the stock price two days before the TP issue date $P_{k,d-2}$,

$$TP\ bias_{a,k,d} = \frac{TP_{a,k,d} - P_{k,12}}{P_{k,d-2}}. \quad (3)$$

Positive values of *TP bias* indicate optimistic target prices. In calculating TP bias, we use the 12-month-ahead stock price to match the forecast horizon of the target price. This approach is similar to the standard way of measuring EPS accuracy where the forecast is benchmarked against the actual EPS revealed at earnings announcements. A significant advantage of the *TP bias* measure is that it captures instances where a select group or all analysts engage in catering. Both settings are important because catering can happen even if all analysts issue optimistic forecasts (e.g., because short-term investors would penalize brokers who do not engage in catering by withdrawing their trades). In sensitivity tests, we recalculate the TP bias measure (*TP bias 2*) based on a 6-month forecast horizon to adjust for revision in analyst target prices (Bradshaw et al., 2014).

We complement the *TP bias* and *TP bias 2* analyses with a measure of TP optimism based on the intuition that optimistic target prices will rarely be met by the actual share price over the forecast horizon.

Correspondingly, as in Bradshaw et al. (2014), we define an indicator variable for whether the maximum stock price over the next six months is smaller than TP, and zero otherwise,

$$TP\_not\_met_{a,k,d} = \begin{cases} 1 \ if \ P_{k,\max 6} < TP_{a,k,d} \\ 0 \ if \ P_{k,\max 6} \geq TP_{a,k,d} \end{cases}. \quad (4)$$

Following Bradshaw et al. (2014), in measuring *TP_not_met*, we choose a six-month horizon to control for revisions in analyst TPs, but our conclusions are similar when using a 12-month horizon.

The TP bias measures described so far capture ex-post accuracy similar to EPS forecasts accuracy measures used in past studies (e.g. Stickel, 1992; Sinha et al., 1997). For robustness, we also consider three ex-ante measures of TP optimism. First, following Bradshaw et al. (2013, 2014) we calculate the ratio of the target price to the share price around the forecast issue, i.e., the analyst's forecasted capital gain on the stock, *TP/P adj*. As in Bradshaw et al. (2014), we then adjust the forecasted ex-dividend return for the return on the S&P500 index because higher TP/P values could simply reflect higher expected return on the market

$$TP/P\ adj_{a,k,d} = \frac{TP_{a,k,d}}{P_{k,d-2}} - \frac{SP500_{12}}{SP500_{d-2}}. \quad (5)$$

Higher values of TP/P in Equation (5) indicate more optimistic forecasts. This measure is not influenced by investor trades following the forecast announcement and is easily observable by investors at TP forecast issue. A limitation of *TP/P adj* as a target price optimism measure is that high forecasted return can capture better firm prospects rather than analyst optimism.

The second ex-ante TP optimism measure is calculated as the consensus adjusted target price:

$$TP\,relative_{a,k,d} = \left(TP_{a,k,d} - TP_{consensus,k,d(-32,-2)}\right) \Big/ P_{k,d-2} \quad (6)$$

where $TP_{consensus,k,d(-32,-2)}$ is the median TP for stock *k* measured over 30 days prior to the TP issue date. *TP relative* captures relative TP optimism compared to the outstanding TP consensus. A limitation of the relative TP optimism measure is that it has low power to identify catering in instances where a large

number of analysts engage in this activity.

The final ex-ante TP optimism measure is the percentage revision in analyst *a* consecutive TPs for firm *k*:

$$\Delta TP_{a,k,d} = \frac{TP_{a,k,d} - TP_{a,k,d-i}}{TP_{a,k,d-i}} \tag{7}$$

where $TP\ bias_{a,k,d-i}$, is the preceding target price issued *i* days before the current TP. We require that TPs used to calculate revisions are no more than 300 days apart. More optimistic target prices should associate with stronger positive revisions. However, similar to *TP/P adj*, positive revisions can also capture better firm prospects. We acknowledge there is no single "ideal" TP optimism measure, which is why we use multiple measures to build confidence in our conclusions.

2.3 *The regression model*

We use a regression model to examine the association between bias in analyst TPs and shareholdings by short-term investors. Our main model specification is the following:

$$\begin{aligned} TP\ bias_{a,k,d} = {} & \beta_0 + \beta_1 Short\_term\_holdings_{k,q} + \beta_2 IO_{k,q} + \beta_3 Inv\_bank_{a,d} \\ & + \sum_{j=0}^{2} \beta_{4+j} A_{a,d} + \sum_{j=0}^{6} \beta_{7+j} F_{k,y-1} + \sum_{j=0}^{9} \beta_{14+j} Industry\ dummies \\ & + \sum_{j=0}^{11} \beta_{24+j} Year\ dummies + e_{a,k,d}. \end{aligned} \tag{8}$$

To avoid simultaneity, TP bias is for the next quarter compared to the quarter where we measure short-term holdings. In additional tests, we also use the other measures of TP optimism described in the previous section as dependent variables in Equation (8). The variable of interest is *Short_term_holdings*, which is either the measure of investor turnover or hedge fund ownership calculated in the quarter preceding the TP issue quarter. The coefficients on *Inv_TR* and *%HF ownership* should be positive if analysts bias their TPs to cater to the needs of short-term investors. We control for the level of institutional ownership in a firm, *IO*. We expect a negative relation between percentage institutional ownership, *IO*,

and TP bias consistent with the evidence in Frankel et al. (2006) and Ljungqvist et al. (2007) that institutional ownership moderates bias in analyst forecasts.[6]

We expect that optimistic TPs create a "window of opportunity" temporarily inflating valuations of stocks held by short-term investors. The "window of opportunity" exists even if most analysts issue optimistic TPs, however, we expect variation in catering activities across analysts due to heterogeneity in catering costs. Ljungqvist et al. (2006) document that firms are more likely to reward investment banks with advisory mandates if their analysts produce unbiased research. As a consequence, catering is more costly for analysts at brokers with an investment banking arm that competes for advisory mandates. *Inv_bank* captures whether the analyst is working at a broker with an investment banking arm (IB). We expect analysts at non IB brokers to be more likely to engage in distortion in their TPs in the presence of short-term investors as they face lower catering costs.

We use a number of analyst (A) and firm (F) characteristics to capture other predictors of TP bias. Analyst characteristics include analyst firm-specific forecasting experience (*Ana_experience*), which measures forecasting skill and knowledge an analyst has gained over time (Clement, 1999). We calculate the number of firms (*Ana_firm_followed*) an analyst follows as Clement (1999) suggests that it is more onerous and complex to actively follow and produce research reports for a large number of companies. We expect more experienced analysts and analysts who follow fewer firms to issue less optimistic TPs.

Firm characteristics include firm market capitalization (*MV*) and the number of analysts following a firm (*Firm_following*), which proxy, respectively, for the visibility of the stock in the market and the competition among analysts. We expect analysts to produce less biased forecasts for more prominent stocks and when the competition among analysts is high. *B/M* is the book-to-market ratio and *MOM* is the price momentum. Analysts are likely to be more optimistic about firms with higher growth options and firms that experienced recent price run-ups. We use stock price volatility scaled by the mean price level to measure firm total risk (*Cov*). We expect higher TP bias for more risky stocks. To control for time and

[6] *Inv_TR* and *IO* capture distinct concepts: *IO* captures the level of institutional holdings whereas *Inv_TR* the average holding period of a representative investor in a stock, thus the former variable does not subsume the latter as both capture different economic constructs. The correlation between *IO* and *Inv_TR* is only 0.037.

industry effects, we include industry dummies (*Industry dummies*) based on the Fama and French industry definitions and a set of annual dummies (*Year dummies*) for the TP issue year. Investor turnover and the level of institutional ownership in a firm are measured one quarter before the TP issue quarter. Analyst characteristics are measured at the TP issue date. Firm characteristics, other than analyst following, are measured at the end of the previous fiscal year *y*. *Firm_following* is measured at the TP issue date. We use heteroskedasticity-robust standard errors clustered at the firm and analyst level (Petersen, 2009). Table 1 provides detailed variable definitions. All continuous dependent and explanatory variables are winsorized at the 1% level.

Insert Table 1 around here

3. Data

We collect target prices from I/B/E/S Detail files from January 1999 to March 2011.[7] To calculate the TP bias measure, we select only target prices with a 12-month forecast horizon and for firms where the actual stock price is non-missing 12 months after the forecast issue date. Analyst and broker characteristics are constructed using both I/B/E/S TP and EPS Detail files starting from January 1995, which avoids eliminating observations in the early sample period when constructing our explanatory variables and produces more reliable measures (Clement, 1999). Daily stock price data and the number of shares outstanding, used to calculate firm market capitalization, are from CRSP. Accounting information is from the CRSP/Compustat merged database.

Information on quarterly institutional holdings is from Thomson-Reuters Institutional Holdings (13F) database. Thomson-Reuters collects information contained in Form 13F proxy statement filed with the Securities and Exchange Commission (SEC). All institutional investors with $100m or more in assets under management are required to file the 13F form with the SEC.

Hedge fund information comes from the CISDM database, which includes information on 6,000

[7] The other commonly used source of target price data, First Call, was acquired by Thomson Reuters in June 2001 and was subsequently merged with I/B/E/S. First Call target price data was discontinued in 2004.

active and 13,000 inactive hedge funds, providing one of the most comprehensive datasets on US hedge funds that is survivorship bias free. CISDM is commonly used in the hedge fund literature (e.g., Bollen and Pool, 2009; Cumming and Dai, 2010; Ding et al., 2009). To identify hedge fund holdings, we manually match CISDM data with the ownership data from 13F filings available on Thomson Reuters. Manual matching is necessary as the two databases use different conventions to report firm names and often abbreviate common words such as "management" or "company", which makes mechanical matching error prone. Having identified hedge funds on Thomson Reuters, we extract their quarterly positions. The number of unique hedge fund firms we identify increases from 233 in 2000 to 348 in 2011, peaking at 412 before the financial crisis.[8] Our final sample includes 374,615 target prices for 4,326 firms issued by 6,734 analysts employed by 433 brokers.

4. Evidence on bias in analyst target prices

4.1 *Descriptive statistics and univariate results*

Panel A of Table 2 presents summary statistics. The average TP bias is 8.4% of the share price and increases to 11.6% when we benchmark TPs against share prices measured 6-month from the TP issue date. The average forecasted ex-dividend return is 12.7%, and for 42.2% of stocks the maximum share price over the next six months is smaller than the target price. The mean percentage TP revision is 0.6% and TP relative is 2.7%. The average investor turnover is 0.213, which means that 10.7% (0.213/2 = 0.107) of the average investor's portfolio is turned over in a quarter, which approximately translates to 42.8% of the position being turned over in a given year.[9] Institutional investors hold 64.2% of outstanding equity and the average hedge fund holdings are around 7.2%. The majority of the analysts (52.8%) are affiliated with an investment bank, and the average analyst in our sample has almost 7 years of experience

[8] For comparison, Brunnermeier and Nagel (2004) use a sample of 53 unique hedge funds over period 1998–2000 when they match 13F data with hedge fund information, Brav et al. (2008) use 236 hedge funds, and Cheng et al. (2012) use 435 hedge funds over the period 1994–2008. The sample in Brown and Schwarz (2013) comprises 102 managers in 1999, increasing to 226 managers in 2008.

[9] The average investor turnover of 0.213 means that institutional investors hold an average stock in their portfolio for around 28 months (12/0.428 = 28.04).

and follows 16 firms. The average firm has $3.7 billion in market value, its book-to-market stands at 0.584, and it is followed by close to 12 analysts. The coefficient of variation for the share price is 0.098, and the three-month momentum is 6.5%.

Insert Table 2 around here

Panel B of Table 2 presents statistics based on portfolios that double sort our firms using *Inv_TR* and *IO*. *TP bias* reduces as we move from low *IO* to high *IO* portfolios. This result is consistent with prior studies that highlight the mitigating effect of institutional ownership on analyst optimism (Frankel et al., 2006; Ljungqvist et al., 2007). However, *TP bias* increases as we move from low to high *Inv_TR* portfolios. This happens whether we concentrate on high or low *IO* firms. Thus, we conclude that the effect of investor holding period is above and beyond the previously documented institutional ownership effect. The differences in *TP bias* between extreme turnover portfolios are both statistically and economically significant, consistent with our proposition that higher ownership by short-term investors increases optimism in analyst TPs.

Panel C reports dual sorts based on *IO* and hedge fund ownership. Here, we split hedge funds into terciles because for a number of firms the average hedge fund holdings are zero. As before, we observe that TP optimism increases as we move from a portfolio of stocks with the lowest to the highest hedge fund ownership irrespective of the *IO* level. In untabulated results, we find that the decile with the highest hedge fund ownership has 39% higher *Inv_Tr* compared to the decile with the highest ownership by bank trust and pensions funds, which confirms both variables capture the same underlying construct.

Panel D reports Pearson correlations between variables. All correlations between explanatory variables are comfortably below 0.8, which is the rule-of-thumb threshold for potential multicollinearity problems (Judge et al. 1982; Hill et al. 2012).

To conclude the univariate analysis, Figure 1a reports mean quarterly TP bias for three portfolios split by *Inv_TR*. Average TP bias is calculated for three quarters centred on the quarter where we allocate stocks into the three *Inv_TR* portfolios (*Inv_TR* is *calculated* in the quarter preceding portfolio formation). Average TP bias is similar across the three portfolios in quarter −1, but increases markedly for stocks with

high short-term ownership in quarters 0 and 1, which is consistent with our prediction. To sharpen the analysis, Figure 1b reports changes in TP bias as a function of changes in *Inv_TR* measured one quarter earlier. We plot the graph for the top and bottom *Inv_TR* portfolios from Figure 1a. TP optimism increases as holdings by short-term investors in a stock increase. For long-term investors, there is little evidence of an increase in TP bias as they increase stock ownership. Together, the evidence in Figures 1a and 1b is inconsistent with short-term investors purchasing stocks for which analysts are on average optimistic. Rather, TP bias increases in response to higher holdings by short-term investors. Overall, univariate results are consistent with our conjecture that analysts bias their target prices to cater to the needs of frequently trading investors.

Insert Figure 1 around here

4.2 *Multivariate results on the effect investor holding period has on target price optimism*

Panel A of Table 3 presents regression results for Equation (8) that models the effect investor holding period has on TP bias. Model 1 reports the effect *Inv_TR* has on *TP bias* after controlling for several analyst and firm characteristics. The *Inv_TR* coefficient is positive and highly significant (1.174; p<0.000). The impact of investor turnover on target price bias is economically significant and economically larger than the negative effect of institutional investor ownership. Specifically, a one standard deviation reduction in the holding period is associated with an increase in TP bias by 65.7% compared to the average level (results untabulated). This effect is opposite to and stronger (by approximately 18.2%) than the negative relation between TP bias and the percentage share ownership by institutional investors documented by Frankel et al. (2006) and Ljungqvist et al. (2007).[10]

Model 2 repeats Equation (8) but uses hedge fund ownership to capture holdings by short-term investors. We find a highly statistically (0.557; p<0.000) and economically significant coefficient of hedge

[10] We formally test that the magnitude of the investor turnover effect is higher than the magnitude of the institutional ownership effect by estimating Equation (8) where we first standardize all variables to have a mean of 0 and a standard deviation of 1. We reject the null that the coefficient on *Inv_TR* equals the absolute value of the *IO* coefficient, i.e., the absolute magnitudes of the two effects are different.

fund holdings. Specifically, a one standard deviation increase in hedge fund ownership is associated with an increase in TP bias by around 64% compared to the average level. This evidence corroborates the conclusion that analysts increase optimism in their TPs in the presence of short-term investors.

Models 3 and 4 report Equation (8) when we use the ex-ante TP optimism measure, *TP/P adj*. The conclusions from these regressions are the same as from the TP bias measure, which suggests our inferences are not sensitive to the choice of an ex-post TP bias measure.

Models 5 and 6 repeat Equation (8) but with *changes* in TP bias and short-term ownership (*ΔTP* bias and *ΔInv_TR or Δ%HF ownership*). The conclusions from the regressions in changes are the same as for our main regressions and consistent with the evidence in Figure 1b. Thus, a regression in changes confirms that analysts react to changes in investor holdings. This result is important because regressions in changes are less likely to suffer from omitted correlated variable problems (Skinner 1996).

The negative coefficient on *Inv_bank* in Models 1 to 4 shows that it is analysts at brokers without an investment banking arm that produce more biased TP forecasts. This result is consistent with IB analysts building a reputation for accurate research that promotes future investment banking transactions (Jackson, 2005; Cowen et al., 2006; Jacob et al., 2008).[11] The negative coefficient is also present on the interaction term between *Inv_bank* and *Inv_TR* (result untabulated). These results reflect that analysts working for non IB brokers (1) depend more on trade commissions than brokers with investment banking arms, who diversify income sources, and (2) face lower reputational cost of issuing biased forecasts compared to IB analysts as optimistic forecasts reduce the likelihood of future investment banking transactions, which are more important to the latter group (Ljungqvist et al., 2006; Jackson, 2005).

Insert Table 3 around here

The signs and significance of control variables are in line with prior studies. The coefficients on analyst following and on the book-to-market ratio are negative, suggesting that higher competition among analysts reduces bias in analyst TPs and that analysts tend to be less optimistic about the prospects of

[11] A regression in changes factors out the influence of constant variables, which explains why *Inv_bank*, is not significant in Models 5 and 6.

firms with lower growth options. Higher stock return volatility and firm size have a positive effect on *TP bias*, which is consistent with the evidence for stock recommendations in Agrawal and Chen (2008) and for target prices in Bradshaw et al. (2013, 2014). The former result indicates that bias in analyst TPs may be more difficult to detect when uncertainty is high, and the latter result suggests analysts may be more willing to issue biased forecasts to please managers from larger firms (Lim, 2001).

Panel B of Table 3 report results when we estimate Equation (8) using the other proxies for TP optimism, namely, *TP bias* 2, *TP relative*, *TP_not_met*, and *ΔTP* as dependent variables. The conclusions from these tests are similar compared to using the *TP bias* measure (for brevity, we report results for *Inv_TR*, however, the conclusions are the same for percentage hedge fund ownership). Further, Model 5 in Panel B examines analyst catering behaviour on the short-side. We test this proposition by including the percentage short-interest in Equation (8). We collect monthly short-interest data from Compustat Supplemental Short Interest File and scale it by the number of shares outstanding. We then use monthly values to calculate quarterly averages for the quarter preceding the quarter where we measure TP bias. The coefficient on short-interest is negative and significant, consistent with higher shorting activity incentivizing analysts to produce *less* optimistic target prices. This result suggests that catering happens both on the long and the short side.

Table 3 results may reflect analyst genuine over-optimism about stocks with high holdings by short-term investors rather than strategic distortions. To distinguish between the two explanations, we compare bias in analyst TPs to that in EPS forecasts for EPS forecasts issued jointly with the target price. If our findings in Table 3 are manifestations of inherent biases in analyst forecasts, that is, genuine optimism about prospects of firms with high short-term investors, then both TP and EPS bias should increase for stocks with high ownership by short-term investors. If our findings reflect analyst catering, we should observe a positive bias in analyst target prices, but not in earnings estimates. We follow previous literature (Das et al., 1998; Richardson et al., 2004) and measure EPS bias as the signed difference between the forecasted, one-year-ahead EPS and the actual EPS, scaled by the stock price measured two days before the TP issue date. This ensures consistent scaler for TP and EPS forecast bias. We do not find

a significant association between *Inv_TR* and EPS bias, which suggests our results are more likely to capture analyst catering. Together, Table 3 results present consistent evidence on higher optimism in analyst target prices in the presence of short-term investors such as hedge funds.[12]

5. Endogeneity and sensitivity tests

In this section, we first address the concern that our results may reflect endogeneity in the choice of stocks short-term investors invest in or unobserved heterogeneity in analyst behaviour. Then, we discuss several specifications of Equation (8), which confirm that our results are not driven by alternative explanations.

5.1 *Endogeneity concerns*

We acknowledge that our results can reflect different investment strategies of short-term compared to long-term investors. In particular, short-term investors may select firms where analysts tend to issue more biased TPs in the hope of exploiting potential stock misvaluation, e.g., short-term investors may favour growth stocks with higher cash flow uncertainty where analysts issue more optimistic forecasts. To address this concern, we run three tests: (1) we use instrumental variable regressions, (2) regressions with firm- and analyst-fixed effects to capture unobserved heterogeneity in firm and analyst characteristics, and (3) a natural experiment related to the 2008 Lehman Brothers collapse. We acknowledge that despite our best efforts endogeneity concerns can never be fully addressed, which is a common caveat in this line of research.

[12] Our results from Table 3 do not generalize the findings in Firth et al. (2013) and Gu et al. (2013), who report that Chinese brokers issue optimistic stock recommendations for their mutual fund clients. Their results are unsurprising because institutional investors in China do not moderate optimism in analyst forecasts. Contrary to the US evidence in Ljungqvist et al. (2007), Cheng et al. (2006), and Brown et al. (2014), Gu et al. (2013) report that high mutual fund ownership in China *increases* optimism in analyst stock recommendations, and the bias is incremental when brokers receive trading commissions from mutual funds. The difference in results in Firth et al. (2013) and Gu et al. (2013) compared to US studies reflect differences in the institutional setup: there are fewer funds and brokers in China compared to the US (e.g., Gu et al. report an average of 51 funds and 69 brokers) and brokers specialize in catering to few select funds (e.g., Gu et al. classify over 70% of brokers' mutual fund clients as affiliated). The concentrated market structure reduces competition between brokers for new clients and analyst incentives to issue accurate forecasts to attract new clients. Consistent with this prediction, Gu et al. (2013) report that over 85% of stock recommendations in their sample are classified as either strong buy/buy.

Table 4 reports 2SLS regression results, which we run to control for endogeneity in the choice of stocks by short-term investors. We use two instrumental variables, one firm-related and one investor-related. The firm-related instrument is a dividend dummy that takes the value of one if a firm pays a dividend, and zero otherwise. We expect a firm's payout policy to be a significant determinant of investor stock choices. Some long-term investors such as public and corporate pension funds, colleges and universities, labour unions, foundations, and other corporations are either fully or largely exempt from dividend taxes, which increases their incentive to hold dividend-paying stocks (Allen et al., 2000). Thus, the dividend dummy meets the relevance condition. However, it is unlikely that dividend policy will have a first order impact on temporary *TP bias*. Consistent with this prediction, Asquith et al. (2005) find that justifications supporting an analyst's opinion include references to share repurchases, but not dividend payments. Thus, we feel that the dividend dummy meets the exclusion restriction and is a valid instrument in our setting.

Following Edmans et al. (2012) and Michaely and Vincent (2013), our investor-related instrument is *MFFlow*. *MFFlow* captures the implied mutual fund trades, which are induced by flows by their own investors. Specifically, *MFFlow* for firm *k* in quarter *q* is:

$$MFFlow_{k,q} = \sum_{f=1}^{m} \frac{F_{f,q} \times Shares_{k,f,q-1} \times P_{k,q-1}}{TA_{f,q-1} \times VOL_{k,q}} \tag{9}$$

where $F_{f,q}$ is the total outflow from fund *f* in quarter *q*, $TA_{f,q-1}$ is the fund *f*'s total assets at the end of the previous quarter, $Shares_{k,f,q-1} \times P_{k,q-1}$ is the dollar value of fund *f*'s holdings of stock *k*, and $VOL_{k,q}$, is the total dollar trading volume of stock *k* in quarter *q*. The sum of flows is over funds for which quarterly investor outflows equal or exceed 5% of fund *f*'s total assets.[13] The idea behind this instrument is that significant investor outflows will force mutual funds to liquidate a portion of their holdings to repay their investors. This will affect a firm's *Inv_TR* but for reasons unrelated to the firm. Further, because mutual and hedge fund flows are correlated (Sialm et al., 2012), *MFFlow* can also capture hedge flow outflows,

[13] The definition of *MFFlow* follows Edmans et al. (2012), Appendix A. We have downloaded this variable from Alex Edman's website: http://faculty.london.edu/aedmans/ (accessed March 2014).

which lead to exogenous variation in hedge fund ownership. Hence, *MFFlow* is an ideal instrument in our setting meeting the relevance condition. However, investor outflows should not affect analyst forecasts as these are based on company fundamentals. Thus, the instrument meets the exclusion restriction as well.[14]

The 2SLS results in Table 4 confirm our previous findings. In particular, the *Inv_TR* and *%HF ownership* coefficients are positive in both models. Thus, our conclusions from Section 4 are robust to endogeneity in the choice of firms by short-term investors.

Insert Table 4 around here

Next, we examine if unobserved heterogeneity in analyst behaviour affects our conclusions. To illustrate, our results in Table 3 may reflect that analysts with past experience working for short-term investors, such as hedge funds, may be prone to issue more optimistic target prices for stocks with high ownership by short-term investors. Thus, it could be (unobserved) past analyst experience that explains higher bias, and not short-term holdings. To address the concern that unobserved analyst characteristics affect our conclusions, we repeat Equation (8) but now include analyst fixed effects. Column "Analyst FE" in Table 4 reports the results. We continue to find a significant relation between investor turnover and TP bias after controlling for analyst fixed effects, which corroborates our conclusions from Table 3. The conclusions are similar when we repeat the analysis using hedge fund holdings (results untabulated).

Column "Firm FE" reports results for Equation (8) where we include firm fixed effects to control for unobserved firm characteristics that can affect analyst propensity to issue more optimistic target prices. After controlling for firm fixed effects, we continue to find a strong relation between short-term investor holdings and optimism in analyst target prices and the coefficient on *Inv_TR* is even slightly larger than in Table 3. Repeating the analysis using hedge fund holdings leaves our conclusions unchanged (results untabulated).

Our third test takes advantage of the quasi-natural experiment related to the collapse of Lehman

[14] The two instruments are valid in our tests. For both models presented in Table 4, the Sargan-Hansen test of overidentifying restrictions does not reject the null that the instruments are valid. Also, the F-statistic of 411.5 comfortably rejects the hypothesis that the instruments are weak (Stock et al. (2002) advocate that the F-statistic should exceed 10 for inference based on the 2SLS estimator to be reliable when there is one endogenous regressor).

Brothers in September 2008. The collapse of the bank exposed significant fragility of the financial system and risk that some prime brokers would not survive to execute future trades. The uncertainty about whether some brokers would survive to execute future trades led many investors to switch to the safety of large reputable brokers, thus limiting the choice of brokers to channel trades through. Mackintosh (2008) indicates that around 100 hedge funds used Lehman Brothers as their prime broker and relied largely on the firm for financing. Upon the bank's collapse, their assets were frozen forcing hedge funds to fire-sale their assets. Mackintosh (2008) highlights that the Lehman Brothers collapse prompted hedge funds to reassess the riskiness of their prime brokers with many switching to large banks to ensure availability of financing and continuation in stock execution. We explore this exogenous shock to the broker choice in our tests. We expect that the sensitivity of TP bias to short-term investor holdings reduced after Lehman Brothers' bankruptcy as investors that would normally choose catering brokers sought the safety of large investment banks. For this test, we create an indicator variable *Lehman*, which takes a value of one in the two-year period after the Lehman Brothers collapse, and zero in the two-year period before September 2008. We then interact this variable with the investor turnover measure. The last column of Table 4 reports the relevant regression results. Consistent with our prediction, we document weaker association between optimism in analyst target prices and investor turnover after the Lehman Brothers bankruptcy. The indicator *Lehman* is negative, which suggests that on average TP optimism reduced after Lehman's collapse. Together, tests in this section suggest that our conclusion on the positive effect short-term investors have on analyst propensity to bias their target prices is not due to the endogeneity in the choice of firms these investors hold or other confounding explanations driven by omitted variables.

5.2 *Alternative explanations and additional tests*

Our main regressions are at firm-broker level, which averages churn ratios across all investors holding the stock. To sharpen the analysis, we also repeat the analysis at investor-firm-broker level. Like our main prediction, we expect analysts to cater more to investors classified as short-term, which we capture by investor-specific quarterly stock turnover measured across all investor's holdings, *Investor TR*. We also

measure the importance of a stock in an investor's portfolio. *Portfolio importance* is the ratio of an investor's ownership in a stock scaled by the sum of all holdings. *Ownership concentration* is the ratio of an investor's holding in a stock scaled by the total institutional ownership in that stock. To capture the blockholding effect specific to short-term investors, we interact *Portfolio importance* and *Ownership concentration* with *Investor TR*. We expect analysts to issue more optimistic target prices for more important and concentrated ownership by short-term investors measured at the investor and stock level. Analysts should be more likely to cater in cases an investor incurred a loss on a stock. Specifically, *Loss on stock* is an indicator variable equal to 1 if the market-adjusted return on a stock over the quarter is negative and 0 otherwise. Finally, we control for whether the holding period of an investor is shorter than that of a representative investor in a stock. Specifically, we create an indicator variable *Investor TR > Inv_TR* equal to 1 if the individual investor turnover is higher than that of a representative investor and 0 otherwise.

Table 5 reports results for investor-firm-broker level regressions. Model 1 confirms that analysts cater to short-term investors by issuing optimistic target prices and the effect is incremental to the aggregate investor turnover measure. Model 2 documents that analysts cater more if an investor experienced a loss on a stock; from an investor perspective, analyst catering is particularly valuable in such cases. Model 3 documents more optimistic target prices when a higher proportion of an investor's wealth is allocated to a stock and Model 4 reports more optimistic target prices for investors with higher blockholding in a stock. Both results are consistent with analysts catering more strongly when an investment in a stock is more important to an investor. Jointly, Table 5 results are consistent with our main analysis.

Insert Table 5 around here

In additional tests, we perform a battery of tests to confirm our main results, dismiss alternative explanations and showcase the robustness of our conclusions. We summarize these results here without tabulating.

- We document a negative association between TP optimism (changes in TP optimism) and a dummy

variable for low short-term investor holdings (an indicator variable for a reduction in short-term institutional holdings), which suggests that analysts may also obscure their TPs by issuing low-ball estimates when short-term holdings are low (reducing).

- To ensure our results are not a manifestation of a correlation between stock liquidity and TP bias, we include stock turnover in Equation (8) and find consistent evidence.
- We find that our results are unchanged when we control for bias in analyst earnings forecasts calculated in a similar way to *TP bias*. Thus, the effect we identify does not reflect common sources of bias in analyst earnings forecasts, such as the earnings walk down (Richardson et al., 2004).
- We find that our results are unchanged when we control for management guidance, which may induce TP optimism (Cotter et al., 2006). This result suggests that our results do not capture instances where analysts issue optimistic forecasts to please a firm's management (e.g., Lim, 2001; Koch et al., 2013).
- Our results could capture persistence in TP optimism that correlates with short-term investor stock picks. To test this prediction, we re-run Equation (8) controlling for past TP bias and find no change to our conclusion. Thus, our results do not capture instances where short-term investors invest into stocks for which analysts have been optimistic in the past.
- We repeat our main analysis after excluding a 5-day window centred on earnings announcements and find consistent evidence. This result suggests that our conclusions are not due to the confounding effect of new information revealed at earnings announcements.
- We find that our results persist after 2002. In 2002, the Securities and Exchange Commission introduced sweeping changes to the rules related to the production, utilization and compensation for analyst research (NASD Rule 2711 and NYSE Rule 472). These rules aimed to reduce conflicts of interest arising from investment banking transactions in analyst research that led to unduly optimistic recommendations during the internet bubble period (Boni and Womack, 2003; Barber et al., 2006).
- We confirm that our focus on TPs, as opposed to stock recommendations, is appropriate in our

setting. We document that controlling for TP optimism, *Inv_TR* does not affect the probability of having an optimistic stock recommendation. This result confirms that analysts channel their bias through TPs, not stock recommendations, when they cater to short-term investors.

- Consistent with the prediction that analysts that face higher reputational costs for catering are less likely to issue optimistic TPs, we find that Institutional Investor All-America Research Team star analysts are less likely to produce optimistic TPs. All-America (Star) analysts are more likely to be employed by investment banks because their presence has a bearing on the choice of the investment advisor in security offerings (Hong and Kubik, 2003; Hong et al., 2000; Ljungqvist et al., 2006; Loughran and Ritter, 2004; Dunbar, 2000).

6. Do investors see through distortions in analyst TPs?

Our evidence suggests that analysts bias their TPs for stocks with high short-term institutional ownership. Next, we examine if investors see through analyst incentives and discount TPs issued for these firms. If the catering strategy is successful and investors do not see through the bias, we expect non-negative market reactions for TP revisions in firms with higher levels of investor turnover. To examine this proposition, we consider price reactions to percentage target price (Δ*TP*) revisions by analyst *a* for firm *k* on day *d*, and how these vary with investor turnover. Following Malmendier and Shanthikumar (2007, 2014), our model has the form:

$$CAR_{a,k,d} = \alpha_0 + \alpha_1 \Delta TP_{a,k,d} + \alpha_2 \Delta TP_{a,k,d} * Inv\_TR_{k,q} + \alpha_3 \Delta EPS_{a,k,d} + \alpha_4 Downgrade_{a,k,d} + \alpha_5 Upgrade_{a,k,d} + \alpha_6 Inv\_TR_{k,q} + u_{a,k,d}. \quad (10)$$

We use a three-day cumulative abnormal return (*CAR*) centred on each TP announcement date to measure the price response to target price revisions. We expect the coefficient on Δ*TP* to be positive if target prices have incremental information content (Brav and Lehavy 2003, Asquith et al. 2005). Further, if analysts' strategy of biasing target prices for stocks with high ownership by short-term investors is successful, the interaction term Δ*TP*Inv_TR* should be non-negative. For robustness, we also estimate Equation (10) when we interact revisions in analyst target prices with hedge fund ownership, Δ*TP*%HF*

ownership. We focus on a short window around TP announcement because previous studies suggest investors react quickly to information revealed in the target price (Brav and Lehavy 2003, Asquith et al. 2005, Da and Schaumburg 2011). Therefore, optimistic TPs should lead to temporary overvaluation in a relatively short window after the forecast issue, which creates a "window of opportunity" for short-term investors to sell their holdings. We use the CRSP value-weighted index as the benchmark to measure abnormal returns.

Prior studies have shown that investors react to revisions in analyst earnings forecast (ΔEPS) and that changes in stock recommendations also lead to significant market reactions (Asquith et al., 2005), thus we control for ΔEPS as well as negative (*Downgrade*) and positive (*Upgrade*) changes in stock recommendations. We require that the forecasts used to calculate revisions are no more than 300 days apart and that the revisions in EPS are for the same fiscal year. The former criterion eliminates infrequently revised forecasts and the latter ensures forecast revisions reflect only analyst new information for a fiscal year. These additional selection criteria reduce the sample size to 283,763 observations. Price reactions and forecast revisions are measured in the next quarter compared to the quarter where we measure investor holdings, which avoids simultaneity. Our conclusions are unchanged when we measure investor holdings in the concurrent quarter. Similarly to past studies (e.g., Keung, 2010), we assume that the EPS forecast revision is zero for stand-alone TPs.

Panel A of Table 6 provides descriptive statistics on positive (Panel A1) and negative (Panel A2) TP revisions during our sample period. The average positive target price revision is 15.27% and associates with a market reaction of 2.31%. In contrast, the average negative target price revision is approximately −16.35% and associates with a market reaction of −3.11%.

Insert Table 6 around here

Model 1 in Panel B of Table 6 documents significant price reaction to TP announcements controlling for revisions in analyst earnings forecasts and stock recommendation. This result is consistent with past evidence that TP announcements convey valuable new information (e.g., Brav and Lehavy 2003, Asquith et al. 2005). Importantly, Model 2 illustrates that the coefficient on the interaction term

Δ*TP*Inv_TR* is non-negative. This result suggests that price-setters do not see though analyst catering and do not discount target prices issued for stocks with high short-term ownership where TP are optimistic. Model 3 reports similar evidence for hedge fund holdings.[15] Table 6 results confirm that biased TPs lead to temporary price increases in stocks held predominantly by short-term investors. This creates "windows of opportunities" for short-term investors to sell their temporarily overpriced holdings.[16]

6.1 *Long-run abnormal returns following TP issuance*

If analysts "pump" stocks held by short-term investors, we should observe more disappointing returns subsequent to the forecast issue compared to stocks where analysts do not engage in catering. In other words, analysts trade off the investment value of their forecasts for higher bias that caters to short-term investor needs. To test this prediction, we examine Jensen's alphas from regressing 12 months of daily returns on the Carhart (1997) model. Specifically, each quarter, we allocate stocks to three portfolios formed on investor turnover and three portfolios formed on the ratio of market-adjusted TP/P. We use *TP/P adj* as the measure is not affected by changes in stock price after portfolio formation, however, our conclusions are unchanged when we use our main TP bias measure or market unadjusted TP/P. We then regress 250 daily returns, the average number of trading days in a year, for each stock in a portfolio on the four-factor model and calculate average alpha, which captures mean daily abnormal returns.

Panel C of Table 6 reports average intercepts from the four-factor regressions. For the portfolio of

[15] The non-negative coefficient on *ΔTP*Inv_TR* is consistent with the evidence in Malmendier and Shanthikumar (2007, 2014), who document that investors, particularly small traders, react more strongly to affiliated analysts' stock recommendation upgrades (Malmendier and Shanthikumar 2007) and revisions (Malmendier and Shanthikumar 2014), which tend to be biased. They predict that "small investors might not seek information about analyst distortions even if the costs of obtaining such information are low. They take recommendations at face value and trust analysts too much" Malmendier and Shanthikumar (2007, 458).

[16] One could argue that short-term investors may benefit more from privileged private disclosure of analyst TPs rather than from the analyst attempting to "pump" the market. Three facts counter this argument. First, using daily volume data, Juergens and Lindsey (2009) do not find evidence that analysts working for a market-maker pre-release reports on their stock upgrades to benefit privileged clients. Second, market regulation, e.g., Nasdaq Rule 2110-4 that governs trades in anticipation of analyst reports, may limit private disclosure if this activity can attract the regulator's attention. Third, private disclosure only does not guarantee profitable trades if the market price does not change. Thus, it is unclear how short-term investors benefit from private disclosure of overly biased TPs. Rather, it is public disclosure of optimistic TPs that temporarily increase stock valuations that maximizes the likelihood of beneficial trade for short-term investors.

stocks held predominantly by long-term investors, low *Inv_TR*, we observe that alphas increase as we move from the portfolio of low to high forecasted returns, *TP/P adj*. As target prices in the low *Inv_TR* portfolio are unaffected by short-term investor pressure to issue optimistic forecasts, the trend in abnormal returns is consistent with valuable investment advice conveyed by analyst target prices (Brav and Lehavy, 2003; Huang et al., 2009). However, for portfolios with high short-term ownership, abnormal returns for the high *TP/P adj* stocks are significantly lower compared to the low *TP/P adj* stocks.[17] These results are consistent with TPs for stocks with high short-term ownership being tainted by pressure from short-term investors to bias these forecasts, which reduces their investment value. A corroborating result is also evident when we look at high *TP/P adj* stocks and observe significantly lower abnormal returns when moving from the portfolio of stocks with low to high short-term ownership, consistent with the latter TPs being less credible. Panel D repeats the analysis for sorts on hedge fund ownership and produces similar evidence to Panel C.

Analysts may hesitate to issue unfavourable target prices for fear of hurting short-term investors and losing their business. Thus, their less favourable opinions about stocks held by short-term investors should be more credible. Consistent with this prediction, the difference in returns on high compared to low *Inv_TR* portfolio for the low *TP/P adj* stocks is positive and significant. This result is consistent with investors anticipating analyst behaviour and considering less favourable opinions about stocks with high short-term ownership to be comparatively more credible, further supporting our catering story.

6.2 *Do short-term investors sell their temporarily overpriced holdings?*

Next, we examine if short-term investors act on biased TPs and exit from stocks where analyst optimistic TPs lead to temporary price increases. The new regression model, which we estimate at firm level, has the form

[17] The magnitudes of abnormal returns are comparable with other studies that examine returns to trading strategies based on analyst forecasts. To illustrate, Malmendier and Shanthikumar (2007) report daily abnormal returns of −0.04% to −0.07% for a zero-investment portfolio of recommendations issued by affiliated compared to unaffiliated analysts.

$$IO_{k,q+1} = \varphi_0 + \varphi_1 \text{Avg } TP\,bias\_f_{k,q} + \varphi_2 \text{Avg } TP\,bias\_f_{k,q} * Inv\_TR_{k,q} + \varphi_3 Inv\_TR_{k,q} + \varphi_4 IO_{k,q} + \varphi_5 \text{Avg } Inv\_bank_{k,q} + \sum_{j=0}^{2} \varphi_{6+j} \text{Avg } A_{k,q} + \sum_{j=0}^{6} \varphi_{10+j} F_{k,y-1} + \sum_{j=0}^{9} \varphi_{17+j} Industry\,dummies + \sum_{j=0}^{11} \varphi_{27+j} Year\,dummies + v_{k,q+1} \quad (11)$$

where the dependent variable is the one-quarter ahead *IO*, and the prefix "Avg" indicates a firm-quarter average. We regress future institutional ownership on the mean TP bias of all TPs issued for a firm in a quarter, Avg *TP bias_f*, and an interaction term between Avg *TP bias_f* and *Inv_TR*. We expect to find a negative coefficient on Avg *TP bias_f *Inv_TR* if the reduction in future institutional holdings is higher among stocks owned by short-term investors when analysts issue optimistic TPs. We examine investor holdings one quarter ahead rather than shortly around TP announcement because institutional holdings are available on a quarterly basis. This setup biases against finding significant results as we would expect short-term investor trading to happen shortly around the TP announcement. For robustness, we also estimate Equation (11) where the dependent variable is (1) the future institutional ownership by short-term investors, (2) the future institutional ownership by long-term investors, (3) the number of future institutional investors, and (4) the number of future hedge funds in a stock. We use the median quarterly median investor turnover, *Inv_TR*, to identify stocks owned predominantly by short-term vs. long-term investors.

Model 1 in Table 7 reports results for Equation (11) without the interaction term Avg *TP bias_f*Inv_TR*. The coefficient on Avg *TP bias_f* is negative and significant indicating that, on average, high TP bias today translates into lower institutional holdings next quarter. This evidence is consistent with the conclusion in Ljungqvist et al. (2007) that institutional investors reduce holdings in stocks where analysts issue misleading reports.

Insert Table 7 around here

Model 2 includes the interaction term Avg *TP bias_f*Inv_TR* and its negative coefficient suggests that it is short-term investors who reduce their holdings for stocks with optimistic TPs.

Ownership by long-term investors does not change when analysts issue optimistic target prices as evidenced by the zero coefficient on Avg *TP bias_f*. Thus, it is short-term investors who sell their holdings to retail investors.

To sharpen the analysis, Models 3 and 4 report regression results for Equation (11) where we split future ownership into ownership by short-term and long-term investors, respectively, using quarterly median investor turnover. In other words, the column *Future holdings by short-term investors* captures institutional holdings where the quarterly *Inv_Tr* is below median. For Model 3, the significant negative coefficient on the interaction term Avg *TP bias_f*Inv_TR* confirms that when analysts produce optimistic target prices for stocks currently owned by short-term investors, future short-term ownership of these stocks reduces. The interaction term is not distinguishable from zero in Model 4, which suggests that future long-term ownership in stocks with predominantly short-term ownership does not change in response to optimistic target prices. These results corroborate the conclusion that short-term investors sell their holdings to retail investors.

The conclusion that short-term investors reduce their holdings in stocks where analysts produce optimistic target prices is unchanged when we use (1) the number of future institutional investors (Model 5) and (2) the number of future hedge funds (Models 6 and 7) as the dependent variables. We run these robustness tests because future percentage holdings can change even if the number of investors holding the stock remains constant. The economic effects that we document in Table 7 are significant. To illustrate, using Model 6, a one standard deviation increase in TP bias for stocks with large hedge fund ownership is associated with a reduction in the future number of hedge funds holding the stock by 45.2%. In unreported result, we find that our conclusions are qualitatively the same when we use the ex-ante measure of TP bias, *TP/P adj*, which suggests our conclusion is not affected by the way we measure target price optimism. Together, Table 7 results confirm that short-term institutional investors take advantage of "windows of opportunities" created by biased TPs to offload their equity positions to retail investors. These results also preclude an alternative explanation for our results, namely that analysts identify underpriced stocks and short-term investors trade on this information—if analysts identify underpriced

stocks with high future returns, short-term investors should be increasing their holdings.

Our result that retail investors do not see through biased analyst forecasts and are net purchasers of stocks from short-term investors is consistent with past evidence. Mikhail et al. (2007) document that small investors are more easily misled by analysts than large investors and are net purchasers following recommendation revisions regardless of the type of recommendation. Malmendier and Shanthikumar (2007) document that retail investors follow analyst stock recommendations literally, trade in the direction of the recommendation, and their trades exert price pressures that lead to significant abnormal price reactions at stock recommendation announcements. However, large traders adjust for bias in analyst stock recommendations.

Three reasons can explain myopic retail investors' investment patterns and why retail investors do not learn over time. First, retail investors face high information acquisitions costs. For example, retail investors do not have the time to analyse vast quantities of public data and access to information though portals, such as Bloomberg, is costly for them. Further, target prices available through open financial portals such as finance.yahoo.com or finance.google.com may be available at a lag and at consensus rather than analyst level, which means retail investors have more stale and less precise information. Second, retail investors can attribute their poor trade choices to bad luck and timing. Consistent with this prediction, Barberis et al. (1998) and Cohen et al. (2002) report that retail investors are slow to incorporate new information into prices and Griffin et al. (2011) document that retail investors were net buyers and institutional investors net sellers at the peak of the internet bubble. Third, investors may not distinguish between bias and error in analyst TPs and attribute poor trade performance to high inaccuracy of analyst TPs. Consistent with this intuition, Bradshaw et al. (2016) report that analysts strategically produce more optimistic forecasts in instances where the forecasting difficulty is higher. They document that because earnings forecasting difficulty is higher compared to revenue forecasting, analysts can easier justify optimistic earnings than revenue forecasts.

6.3 Do short-term investors reward brokers for their catering behaviour?

Catering to short-term investors must benefit the analyst's broker in the form of higher future "soft dollars" in trade commissions.[18] Though we cannot directly observe how investors allocate their trades across brokers, we propose an indirect test based on whether short-term investors increase their holdings in *other* stocks covered by the catering broker. Brokers tend to cover stocks with high expected trade commissions (Jackson, 2005; Brown et al., 2015; Niehaus and Zhang, 2010; Green et al., 2014). Hence, if short-term investors increase holdings in other stocks covered by the catering broker, we can expect that at least *some* of their trades will be channelled through the broker. If short-term investors do not increase holdings in other stocks covered by the catering broker, or avoid these stocks, it is hard to argue that catering benefits the broker. As brokers employ multiple analysts who in turn cover several stocks, there is an opportunity for a repeated game as short-term investors anticipate future catering behaviour for the newly purchased stocks. Importantly, catering to existing clients can also attract new clients who anticipate similar analyst behaviour in the future for other stocks.

Equation (12) describes the regression model we use to investigate whether issuing optimistic target prices for stocks held predominantly by short-term investors increases these investors' holdings of other stocks covered by the broker. Specifically, the dependent variable is the average one-quarter ahead institutional ownership of all stocks (excluding firm *k*) covered by broker *b*, Avg $IO\ other_{b,-k,q+1}$, and the regression model is

$$\begin{aligned}\text{Avg } IO\,other_{b,-k,q+1} = {} & \gamma_0 + \gamma_1 \text{Avg } TP\,bias\_b_{b,k,q} + \gamma_2 \text{Avg } TP\,bias\_b_{b,k,q} * Inv\_TR_{k,q} \\ & + \gamma_3 Inv\_TR_{k,q} + \gamma_4 IO_{k,q} + \gamma_5 \text{Avg } IO\,other_{b,-k,q} \\ & + \sum_{j=0}^{9} \gamma_{6+j} Industry\ dummies + \sum_{j=0}^{11} \gamma_{16+j} Year\ dummies + v_{b,-k,q+1}.\end{aligned} \tag{12}$$

[18] "Soft dollar" payments is a standard practice where institutional investors commit to (1) allot their trading volume to brokers where sell-side analysts provide valuable service and (2) pay a fixed five to six cent-per-share commission fee that is higher than the typical marginal cost of trading (Goldstein et al., 2009; Juergens and Lindsey, 2009; Maber et al., 2014). The UK Financial Conduct Authority estimates that "UK investment managers pay an estimated £3bn of dealing commissions per year to brokers, with around £1.5bn of this spent on research.", (Financial Conduct Authority, 2014b, 5). Buy-side institutions that manage portfolios for their clients favour "soft dollars", rather than explicit payments for research reports, since the cost of the former is born by the client, whereas the latter would have to be paid from the buy-side institution's own capital (Maber et al., 2014).

The model regresses future average *IO* holdings of *other* stocks covered by a broker on average TP bias of all TPs issued by a broker for firm *k* in a quarter, Avg *TP bias_b*, and an interaction term between Avg *TP bias_b* and investor turnover for firm *k*, Avg *TP bias_b*Inv_TR*. If short-term investors reward catering brokers with more future trades, we expect a positive coefficient on this interaction term. This is because we anticipate that investors are more likely to channel at least some of their trades on stock covered by catering analysts through the brokers these analysts work for.

The model controls for *Inv_TR* and *IO* for stock *k*. We control for current mean institutional ownership of all stocks (excluding firm *k*) covered by the broker *b*, Avg *IO other*$_{b,-k,q}$, as we expect some persistence in institutional holdings of other stocks covered by a broker across quarters. Including Avg *IO other*$_{b,-k,q}$ also helps control for investors' choice of brokers. To illustrate, γ_5 captures instances when an investor chooses broker *b* because this is a prime broker for a large number of stocks.

Model 1 in Table 8 reports estimates for Equation (12). The negative coefficient on Avg *TP bias_b* indicates that, on average, institutional investors reduce holdings in other stocks covered by broker *b* if the broker produces optimistic target prices for stock *k*. This evidence is consistent with the conclusion in Frankel et al. (2006) and Ljungqvist et al. (2007) that institutional investors penalize brokers that produce biased research. The positive coefficient on the interaction term Avg *TP bias_b*Inv_TR* suggests that short-term investors increase their holdings in other stocks covered by the broker that caters to them in stock *k*. Though indirect, this evidence is consistent with short-term investors rewarding catering brokers with more future trades in other stocks covered by this broker.

To corroborate the conjecture that short-term investors reward catering brokers with more future trades in this broker's other covered stocks, we repeat Equation (12) when we split Avg *IO other* into future holdings by short-term investors (Model 2) and by long-term investors (Model 3). This split is similar to Table 7. We observe that the positive coefficient on the interaction term Avg *TP bias_b*Inv_TR* is present only for Model 2, which confirms that it is short-term investors who increase their holdings in other stocks covered by the catering broker.

Insert Table 8 around here

To strengthen our inferences, we also re-estimate Equation (12) using hedge fund holdings. Specifically, the dependent variable is the average one-quarter ahead hedge fund holdings of other stocks covered by broker *b* (i.e., stocks covered by broker *b* excluding firm *k*), Avg *HF other*$_{b,-k,q+1}$, and we regress it on *%HF ownership* in stock *k* and its interaction with Avg *TP bias_b* for stock *k*. The positive coefficient on the interaction term Avg *TP bias_b*%HF ownership* in Model 4 confirms that hedge funds increase their future holdings in other stocks covered by the catering broker.[19] Together, Table 8 results are consistent with the view that catering brokers could benefit from higher future trade commissions.[20] In unreported results, we performed two additional tests. First, we estimated Equation (12) for a sample of brokers with unchanged stock coverage between consecutive quarters and find consistent evidence. This result suggests Table 8 evidence is not due to changes in brokers' stock coverage. Second, we used changes in quarterly holdings as the dependent variable in Equation (12), which assumes complete persistence in holdings, i.e., γ_5=1. These regressions produce conclusions similar to Table 8. However, we acknowledge that despite our best efforts, we can only produce an indirect test that investors reward catering brokers with their trades and we caution against the causal interpretation of this result.

7. Conclusions

This study examines the effect the investment horizon of institutional investors has on bias in analyst target prices. We document that for stocks with high short-term institutional ownership, analysts bias their TPs and that the bias is largely concentrated among analysts not working for brokers with an investment banking arm, which reflects lower marginal cost of reputation loss from issuing biased TPs for these analysts. Investors fail on average to see through analyst incentives and do not discount biased TPs issued for stocks with high short-term ownership. Short-term investors take advantage of temporary stock price

[19] The small coefficient on *%HF ownership other* reflects that hedge funds trade frequently and have holdings across multiple brokers.

[20]We expect analyst and broker incentives to maximize fees to align as analysts are compensated from the fees brokers receive from share trading (see also Jackson, 2005; Cowen et al., 2006; Beyer and Guttman, 2011). Thus, analysts would not object issuing biased research. Further, analysts have an incentive to produce optimistic research as this can lead to more favourable career outcomes (Hong and Kubik 2003; Horton et al. 2017).

increases and sell their shares to retail investors. We also find evidence consistent with short-term investors rewarding brokers engaging in catering with more future trades channelled through the broker. The evidence that brokers cater to short-term investors, such as hedge funds, is consistent with the survey evidence in Brown et al. (2015) and anecdotal evidence. For example, Schack (2003, 3) quotes the director of equity research at ABN AMRO saying "[W]all Street caters to the hedge funds and the high-turnover funds. It doesn't even cater to long-term-oriented institutions like us. We typically own a stock anywhere from three to five years. But the Street has to play to the paying customer, and the paying customer now is hedge funds and the hot money. We're not trading enough to make anyone rich.". The catering behaviour we document is permissible within the current US regulatory regime. This contrasts the European setting where the Markets in Financial Instruments Directive II that came into force on 3rd January 2018 unbundles research payments from trade executions.

References

Agrawal, A. and Chen, M.A. 2008. Analyst conflicts and research quality, *Journal of Law and Economics*, Vol. 51, 503–537.

Allen, F., Bernardo, A., and Welch, I. 2000. A theory of dividends based on tax clienteles, *The Journal of Finance*, Vol. 55, 2499–2536.

Asquith, P., Mikhail, M., and Au, A. 2005. Information content of equity analyst reports, *Journal of Financial Economics*, Vol. 75, 245–282.

Barber, B., Lehavy, R., McNichols, M., and Trueman, B. 2006. Buys, holds, and sells: the distribution of investment banks stock ratings and the implications for the profitability of analysts recommendations, *Journal of Accounting and Economics*, Vol. 41, 87–117.

Barberis, N., Shleifer, A., and Vishny, R., 1998. A model of investor sentiment. *Journal of Financial Economics*, Vol. 49,307−345.Ben-David, I., Franzoni, F., and Moussawi, R. 2012. Hedge Fund stock trading during the financial crisis of 2007-2009, *Review of Financial Studies*, Vol. 25, 1–54.

Beyer, A., and Guttman, I. 2011. The effect of trading volume on analysts forecast bias, *The Accounting Review* 86, 451-481.

Bilinski, P., Lyssimachou, D., and Walker, M. 2013. Target price accuracy: International evidence, *The Accounting Review*, Vol. 88, 825–851.

Bollen, N. and Pool, V. 2009. Do hedge fund managers misreport returns? Evidence fom the pooled distribution, *The Journal of Finance*, Vol. 64, 2257-2288.

Boni, L. and Womack, K. 2003. Wall Street research: Will new rules change its usefulness? *Financial Analysts Journal*, Vol. 59, 25–29.

Bonini, S., Zanetti, L., Bianchini, R., and Salvi, A. 2010. Target price accuracy in equity research, *Journal of Business Finance & Accounting*, Vol. 37, 1177–1217.

Bradshaw, M. 2002. The use of target prices to justify sell-side analysts stock recommendations, *Accounting Horizons*, Vol. 16, 27–41.

Bradshaw, M., Brown, L., and Huang, K. 2013. Do sell-side analysts exhibit differential target price forecasting ability?, *Review of Accounting Studies*, Vol. 18, 930–955.

Bradshaw, M.,Huang, A., and Tan, H. 2014. Analyst target price optimism around the world, Working paper, Boston College.

Bradshaw, M.,Lee, L., and Peterson, K. 2016. The interactive role of difficulty and incentives in explaining the annual earnings forecast walkdown, *The Accounting Review*, Vol. 91, 995-1021.

Brav, A., Jiang, W., Partnoy, F., and Thomas, R. 2008. Hedge fund activism, corporate governance, and firm performance, *The Journal of Finance*, Vol. 63, 1729-1775.

Brav, A., and Lehavy, R. 2003. An empirical Analysis of Analysts Target Prices: Short-term

informativeness and long-term dynamics, *Journal of Finance*, Vol. 58, 1933–1967.

Brown, L., Call, A., Clement, M., and Sharp, N. 2015. Inside the "Black Box" of sell-side financial analysts, *Journal of Accounting Research*, Vol. 53, 1-47.

Brown, L., Call, A., Clement, M., and Sharp, N. 2014. Skin in the Game: The inputs and incentives that shape buy-side analysts stock recommendations, Working paper, Temple University.

Brown, S. and Schwarz, Ch. 2013. Does market participants care about portfolio disclosure? Evidence from hedge fund 13f filings, Working paper, NYU and UC Irvine.

Brunnermeier, M. and Nagel, S. 2004. Hedge funds and the technology bubble, *The Journal of Finance*, Vol. 59, 2013-2040.

Carter, R. and Manaster, S. 1990. Initial Public Offerings and underwriter reputation, *The Journal of Finance* Vol. 45, 1045–1067.

Cella, C., Ellul, A., and Giannetti, M. 2013. Investors horizons and the amplification of market shocks, *Review of Financial Studies* Vol. 26, 1607–1648.

Cheng, C., Huang, H., Li, Y., and Stanfield, J. 2012. The effect of hedge fund activism on corporate tax avoidance, *The Accounting Review* Vol. 87, 1493-1526.

Cheng, Y., Liu, M., and Qian, J. 2006. Buy-side analysts, sell-side analysts, and investment decisions of money managers, *Journal of Financial and Quantitative Analysis* Vol. 41, 51–83.

Clement, M. 1999. Analyst forecast accuracy: Do ability, resources, and portfolio complexity matter?, *Journal of Accounting and Economics* Vol. 27, 285–303.

Cotter, J., Tuna, I., and Wysocki, P. 2006. Expectations management and beatable targets: how do analysts react to explicit earnings guidance?, *Contemporary Accounting Research* Vol. 23, 593–624.

Cowen, A., Groysberg, B., and Healy, P. 2006. Which types of analyst firms are more optimistic?, *Journal of Accounting and Economics* Vol. 41, 119-146.

Cumming, D. and Dai, N. 2010. A law and finance analysis of hedge funds, *Financial Management* Vol. 39, 997-1026.

Das, S., Levine, C., and Sivaramakrishnan, K. 1998. Earnings predictability and bias in analysts earnings forecasts, *The Accounting Review* Vol. 73, 277–294.

Ding, B., Getmansky, M., Liang, B., and Wermers, R. 2009. Share restrictions and investor flows in the hedge fund industry, Working paper, UAM, UC Irvine and UM.

Dugar, A. and Nathan, S. 1995. The effect of investment banking relationships on financial analysts earnings forecasts and investment recommendations, *Contemporary Accounting Research* Vol. 12, 131-160.

Dunbar, C.G. 2000. Factors affecting investment bank initial public offering market share, *Journal of Financial Economics* Vol. 55, 3–41.

Edmans, A., Goldstein, I., and Jiang, W. 2012. The Real Effects of Financial Markets: The impact of prices on takeovers, *The Journal of Finance* Vol. 67, 933–971.

Financial Conduct Authority 2014a. Hedge fund survey, FCA.

Financial Conduct Authority 2014b. Discussion on the use of dealing commission regime: Feedback on our thematic supervisory review and policy debate on the market for research, FCA.

Firth, M., Lin, Ch., Liu, P., and Xuan, Y. 2013. The Client Is King: Do mutual fund relationships bias analyst recommendations?, *Journal of Accounting Research* Vol. 51, 165–200.

Frankel, R.M., Kothari, S.P., and Weber, J. 2006. Determinants of the informativeness of analyst research, *Journal of Accounting and Economics* Vol. 41, 29–54.

Gaspar, J., Massa, M., and Matos, P. 2005. Shareholder investment horizons and the market for corporate control, *Journal of Financial Economics* 76, 135–165.

Gaspar, J., Massa, M., and Matos, P., Patgiri, R., and Rehman, Z. 2013. Payout policy choices and shareholder investment horizons, *Review of Finance*, Vol. 17, 261–320.

Goldstein, M., Irvine, P., Kandel, E., and Wiener, Z. 2009. Brokerage commissions and institutional trading patterns, *Review of Financial Studies* Vol. 22, 5175–5212.

Green, C., Jame, R., Markov, S., and Subasi, M. 2014. Broker-hosted investor conferences, *Journal of Accounting and Economics* Vol. 58, 142-166.

Gu, Z., Li, Z, and Yang, Y. 2013. Monitors or Predators: The influence of institutional investors on sell-side analysts, *The Accounting Review* Vol. 88, 137-169.

Hill, R., Griffith, W. and Lim, G. 2012. Principles of econometrics, 1st ed. Hoboken: John Wiley & Sons.

Hintz, B. and Tang, K. 2003. U.S. Brokerage: Institutional equities at a crossroads, New York, NY: Sanford Bernstein.

Hong, H., Kubik, J.D. 2003. Analyzing the analysts: Career concerns and biased earnings forecasts, *The Journal of Finance* Vol. 58, 313–351.

Hong, H., Kubik, J.D., and Solomon, A. 2000. Security Analysts career concerns and the herding of earnings forecasts, *RAND Journal of Economics* Vol. 31, 121–144.

Horton, J., Serafeim, G., and Wu, S. 2017. Career concerns of banking analysts, *Journal of Accounting and Economics*, Vo. 63, 231–252.

Huang, J., Mian, M., and Sankaraguruswamy, S. 2009. The value of combining the information content of analyst recommendations and target prices, *Journal of Financial Markets* Vol. 12, 754–777.

Irvine, P., Lipson, M., and Puckett, A. 2007. Tipping, *The Review of Financial Studies* Vol. 20, 741-768.

Jackson, A. 2005. Trade generation, reputation, and sell-side analysts, *The Journal of Finance* Vol. 60, 673–717.

Jacob, J., Rock, S., and Weber, D.P. 2008. Do non-investment bank analysts make better earnings

forecasts?, *Journal of Accounting, Auditing & Finance* Vol. 23, 23-61.

Judge, G., Hill, R., Griffiths, W., Lutkepohl, H., and Lee, T. 1982. Introduction to the theory and practice of econometrics, New York: Wiley.

Juergens, J. and Lindsey, L. 2009. Getting out Early: An analysis of market making activity at the recommending analysts firm, *The Journal of Finance* Vol. 64, 2327–2359.

Kadan, O., Madureira, L., Wang, R., and Zach, T. 2009. Conflicts of interest and stock recommendations: The effects of the global settlement and related regulations, *Review of Financial Studies* Vol. 22, 4189–4217.

Keung, E. 2010. Do supplementary sales forecasts increase the credibility of financial analysts earnings forecasts?, *The Accounting Review* Vol. 85, 2047–2074.

Klein, A., Saunders, A., and Wong, Y.T.F. 2014. Do hedge funds trade on private information?, evidence from upcoming changes in analysts stock Recommendations, Working paper, NYU.

Koch, A., Lefanowicz, C., and Robinson, J.R. 2013. Regulation FD: A review and synthesis of the academic literature, *Accounting Horizons* Vol. 27, 619–646.

Lim, T. 2001. Rationality and analysts forecast bias, *The Journal of Finance*, 56, 369–385.

Lin, H. and McNichols, M. 1998. Underwriting relationships, analysts earnings forecasts and investment recommendations, *Journal of Accounting and Economics* Vol. 25, 101–127.

Ljungqvist, A., Marston, F., Wilhelm, W.J., 2006. Competing for securities underwriting mandates: banking relationships and analyst recommendations, *The Journal of Finance*, Vol. 61, 301–340.

Ljungqvist, A., Marston, F., Starks, L., Wei, K., and Yan, H. 2007. Conflicts of interest in sell-side research and the moderating role of institutional investors, *Journal of Financial Economics* Vol. 85, 420–456.

Loughran, T. and Ritter, J. 2004. Why has IPO underpricing changed over time?, *Financial Management* Vol. 33, 5–37.

Maber, D., Groysberg, B., and Healy, P. 2014. The use of broker votes to reward brokerage firms and their analysts research activities, Working paper, Harvard Business School.

Mackintosh, J. 2008, Hedge funds reassess prime broker risk, The Financial Times. September 15.

Malmendier, U. and Shanthikumar, D. 2007. Are small investors naive about incentives?, *Journal of Financial Economics* Vol. 85, 457–489.

Malmendier, U. and Shanthikumar, D. 2014. Do security analysts speak in two tongues?, *Review of Financial Studies* Vol. 27, 1287–1322.

McNichols, M. and OBrien, P.C. 1997. Self-selection and analyst coverage, *Journal of Accounting Research* Vol. 35, 167–199.

Michaely, R. and Vincent, C. 2013. Do institutional investors influence capital structure decisions?,

Working paper, Johnson School of Management.

Mikhail, M., Walther, B., and Willis, R. 2007. When security analysts talk, who listens?, *The Accounting Review* Vol. 82, 1227–53.

Niehaus, G. and Zhang, D. 2010. The impact of sell-side analyst research coverage on an affiliated brokers market share of trading volume, *Journal of Banking & Finance* Vol. 34, 776-787.

Petersen, M. 2009. Estimating standard errors in finance panel data sets: Comparing approaches, *Review of Financial Studies* Vol. 22, 435–480.

Richardson, S., Teoh, S., and Wysocki, P. 2004. The walk-down to beatable analyst forecasts: the role of equity issuance and insider trading incentives, *Contemporary Accounting Research* Vol. 21, 885–924.

Rhee, R. 2010. The decline of investment banking: Preliminary thoughts on the evolution of the industry 1996-2008, *Journal of Business & Technology Law* Vol. 5, 75–99.

SEC 1998. Inspection report on the soft dollar practices of broker-dealers, investment advisers and mutual funds, Securities and Exchange Commission. September 22.

SEC 2006. Commission guidance regarding client commission practices under section 28e) of the Securities Exchange Act of 1934, Release No. 34-54165. File No. S7-13-06.

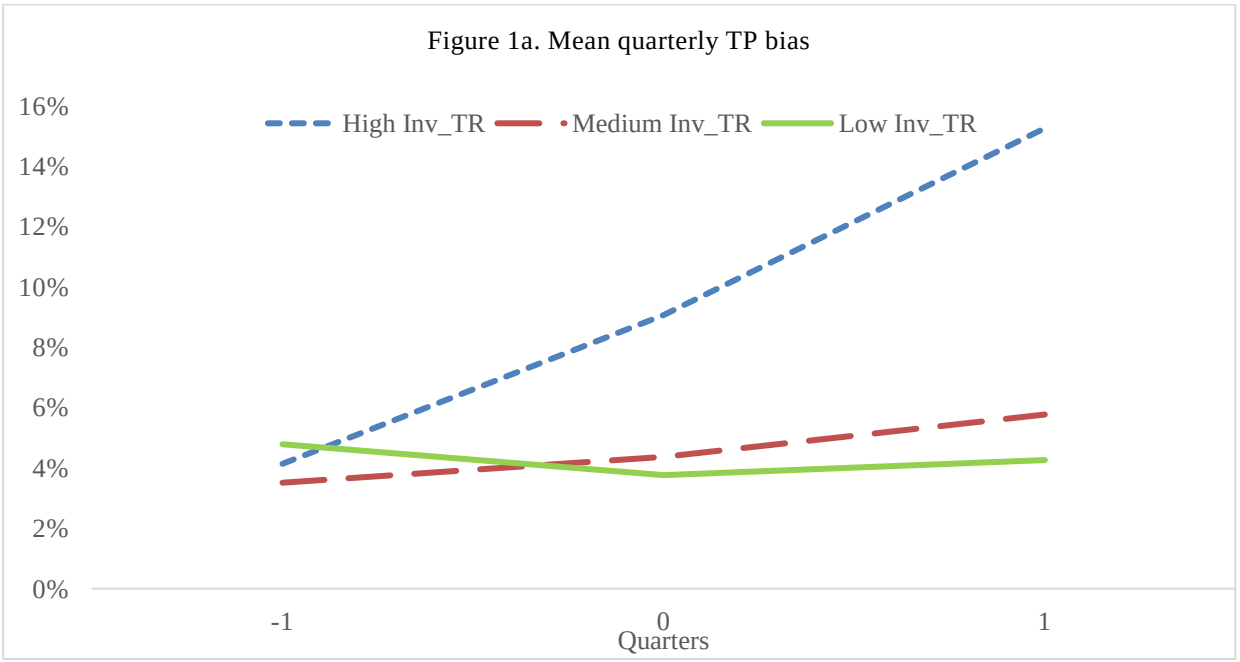
Schack, J. 2003. Unsettled on Wall St, institutional investor, October 14.

Sialm, C., Sun, Z., and Zheng, L. 2012. Home bias and local contagion: evidence from funds of hedge funds, NBER working paper.

Stock, J. H., Wright, J. H., and Yogo, M. 2002. A survey of weak instruments and weak identification in generalized method of moments, *Journal of Business and Economic Statistics* Vol. 20, 518–29.

Unger, L. 2001. Written testimony concerning conflicts of interest faced by brokerage firms and their research analysts. given before the subcommittee on capital markets, insurance, and government sponsored enterprises, committee on financial services, United States House of Representatives.

Figure 1. Mean quarterly level and change in TP bias for stocks split by investor turnover



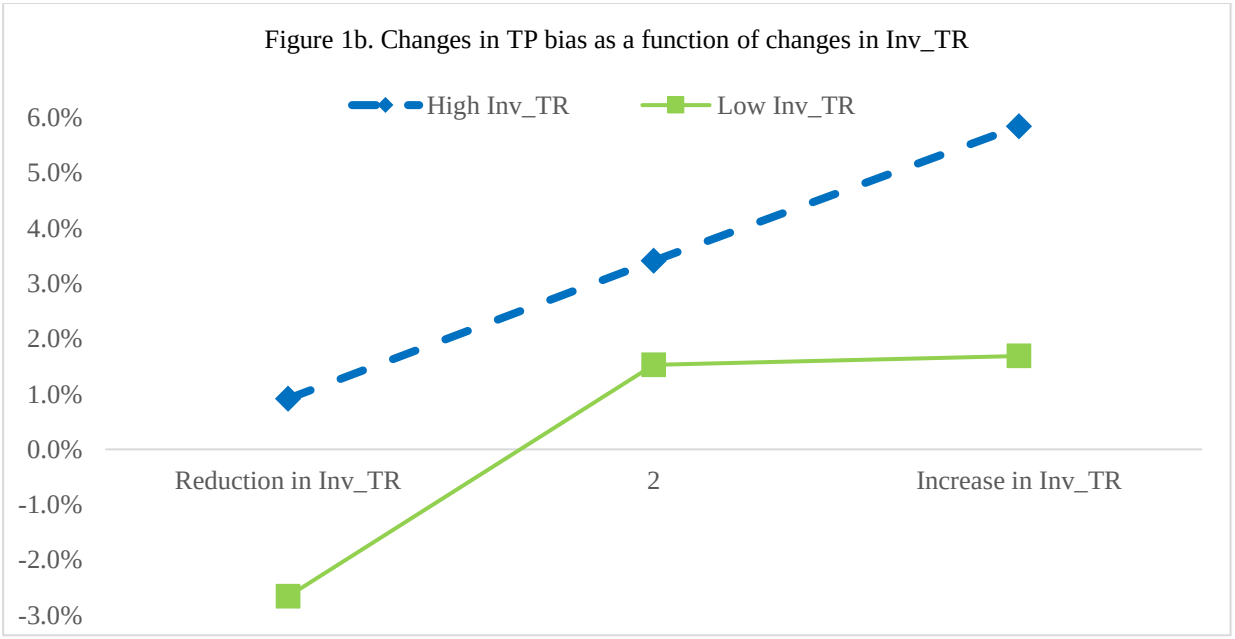


Figure 1a reports mean quarterly TP bias for stocks split into terciles by investor turnover. The averages are calculated for three quarters centered on the quarter where we allocate stocks into the three investor turnover groups. Figure 1b reports changes in TP bias as a function of changes in *Inv_TR* measured one quarter earlier. The plots are for the top and bottom *Inv_TR* portfolios.

Table 1. Variables definition

Variable	Definition
1. Analyst TP, EPS and stock recommendation bias measures	
TP bias	Bias in the analyst's target price (TP), which is the difference between the target price and the stock price at the end of the 12-month forecast horizon, scaled by the stock price two days before the TP issue date (see equation (3)).
TP bias 2	An alternative measure of *TP bias*, which is the difference between the target price and the stock price at the end of the 6-month forecast horizon, scaled by the stock price two days before the TP issue date.
TP_not_met	An indicator variable for whether the maximum stock price over the next six months is smaller than TP (see equation (4)).
TP/P adj	Market-adjusted analyst expected ex-dividend stock return, which is calculated as the ratio of the target price to the stock price measured two days before the TP issue date. The ratio is then adjusted for the return on the S&P500 index over the next 12-month period (see equation (5)).
TP_relative	The difference between the analyst's TP and the median TP for a firm measured over 30 days prior to the TP issue date. We scale the difference by the stock price two days before the TP issue date (see equation (6)).
ΔTP	The percentage revision in the analyst target price for a firm calculated as the difference between two consecutive TPs issued by an analyst for a stock (see equation (7)).
Optimistic stock recommendation	An indicator variable taking the value of one when the analyst issues a stock recommendation above the consensus, and zero otherwise. The consensus recommendation is estimated over the previous 12 months.
Avg *TP bias_f*	Average TP bias of all TPs issued for a firm in a quarter.
Avg *TP bias_b*	Average TP bias of all TPs issued by a broker for a firm in a quarter.
Past Avg *TP bias*	Average TP bias of all TPs issued for a firm in the previous quarter.
EPS bias	EPS forecast bias measured as the signed difference between the forecasted, one-year-ahead EPS and the actual EPS, scaled by the stock price measured two days before the TP issue date. We select only EPS forecasts issued jointly with the TP.
2. Institutional ownership and holding period measures	
Inv_TR	Following Gaspar et al. (2005, 2013), this is the weighted average churn ratio of institutional shareholders holding equity in a firm during the quarter. The investor turnover ratio is measured in the one quarter preceding the TP issue quarter.
IO	The level of institutional holdings in a stock measured in the one quarter preceding the TP issue quarter.
#IO	The number of institutional investors in a stock measured in the one quarter preceding the TP issue quarter.
%HF ownership	The level of hedge fund holdings in a stock measured in the one quarter preceding the TP issue quarter.
#HF ownership	The number of hedge funds holding a stock measured in the one quarter preceding the TP issue quarter.
MFFlow	The hypothetical annual change in mutual fund holdings implied by previously disclosed holdings and quarterly mutual fund outflows≥5% of total fund assets from Edmans et al. (2012).
Avg *IO other*	The average institutional ownership of all stocks (excluding firm *k*) covered by a broker calculated for the current quarter.
Avg *%HF ownership other*	The average hedge fund ownership of all stocks (excluding firm *k*) covered by a broker calculated for the current quarter.

Continued on next page

Table 1 continued

3. Analyst and broker characteristics	
Ana_experience	The number of years an analyst has issued at least one TP or EPS forecast.
Ana_firm_followed	The number of companies for which an analyst issued at least one TP or EPS forecast over the previous 12 months.
Inv_bank	An indicator variable taking the value of one for analysts affiliated with an investment bank, and zero otherwise. To identify investment banks we use the Carter and Manaster (1990) list as updated by Loughran and Ritter (2004).
Star	An indicator variable for analysts selected to the All-America Research Team by the Institutional Investor magazine in the previous year. We use the Institutional Investor magazine ranking from the October issue of year *t* to identify forecasts issued by star analysts over the subsequent 12-months.
4. Firm characteristics	
Short-interest	Short-interest for a stock measured in the quarter prior to the TP issue date.
B/M	The book-to-market ratio, which is the book value of common equity scaled by the market capitalization measured at the previous fiscal year-end.
Cov	Stock price standard deviation measured over 90-days before the previous fiscal year-end, scaled by the mean price level over this period.
Div_dummy	A dummy variable taking the value of one if the firm pays a dividend, and zero otherwise.
Lehman	An indicator variable equal to one in the two-year period after the Lehman Brothers collapse, and zero in the two-year period before September 2008.
Firm_following	The number of analysts issuing at least one TP or EPS forecast for a firm over the previous 12 months.
Mom	Buy-and-hold stock returns for 90-days prior to the previous fiscal year-end.
MV	Firm market capitalization measured at the previous fiscal year-end.
Industry effect	Ten industry dummies based on Fama and French industry definitions.
Year effect	A set of annual dummies for the TP issue year.
5. Price reaction analysis variables	
CAR (−1,1)	The three-day cumulative abnormal return around the TP announcement.
Δ*EPS*	The percentage revision in the analyst EPS forecast for a firm calculated as the difference between two consecutive EPS forecasts issued by an analyst for a stock and the same fiscal year.
Upgrade	An indicator variable for an upward revision in the analyst stock recommendation for a firm.
Downgrade	An indicator variable for a downward revision in the analyst stock recommendation for a firm.

The table provides definitions of the dependent and independent variables used in the study.

Table 2. Descriptive statistics

Panel A: Descriptive statistics					
	Mean	*Median*	*STD*	*Q1*	*Q3*
TP bias	0.084	0.075	0.669	−0.259	0.403
TP bias 2	0.116	0.092	0.590	−0.181	0.358
TP/P adj	0.127	0.082	0.528	−0.137	0.324
TP relative	0.027	0.043	0.208	-0.091	0.130
ΔTP	0.006	0.000	0.284	-0.101	0.101
TP_not_met	0.422	0.000	0.494	0.000	1.000
Inv_TR	0.213	0.207	0.047	0.183	0.236
%HF ownership	0.072	0.060	0.055	0.032	0.099
IO	0.642	0.686	0.230	0.492	0.825
Inv_bank	0.528	1.000	0.499	0.000	1.000
Ana_experience	6.781	6.000	3.512	4.000	9.000
Ana_firm_followed	15.685	15.000	8.343	11.000	19.000
Firm_following	11.563	9.000	8.592	5.000	16.000
Cov	0.098	0.077	0.074	0.050	0.121
B/M	0.584	0.447	0.544	0.261	0.724
MV	3664.2	822.1	7362.6	280.7	2847.7
Mom	0.065	0.045	0.302	−0.099	0.193

Panel B: Mean TP bias for dual sorts on IO and Inv_TR				
	High *IO*	2	3	Low *IO*
High *Inv_TR*	0.102	0.146	0.181	0.264
2	0.021	0.068	0.080	0.177
3	−0.016	0.024	0.047	0.129
Low *Inv_TR*	0.012	−0.004	0.046	0.096

Panel C: Mean TP bias for dual sorts on IO and %HF ownership				
	High *IO*	2	3	Low *IO*
High *%HF ownership*	0.057	0.091	0.134	0.244
2	0.013	0.056	0.080	0.190
Low *%HF ownership*	0.001	−0.006	0.046	0.135

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Table 2. continued

Panel D: Pearson correlations

	TP bias	*Inv_TR*	*IO*	*Inv bank*	*Ana_ experience*	*Ana_firm_ followed*	*COV*	*Firm_ following*	*B/M*	*MV*
Inv_TR	0.126									
IO	−0.089	0.037								
Inv bank	−0.016	−0.048	0.025							
Ana_experience	−0.039	0.013	0.124	−0.014						
Ana_firm_followed	−0.014	−0.009	0.038	0.055	0.360					
COV	0.061	0.182	−0.132	−0.054	−0.099	−0.048				
Firm_following	−0.027	−0.084	0.139	0.095	0.007	−0.020	−0.086			
B/M	−0.058	−0.060	−0.070	−0.004	0.075	0.056	0.145	−0.142		
MV	0.035	−0.238	−0.043	0.121	0.056	−0.014	−0.230	0.590	−0.187	
Mom	0.047	0.131	−0.045	0.011	−0.108	−0.036	−0.013	−0.016	−0.229	−0.007

Panel A presents descriptive statistics of the main variables used in this study. All variables are defined in Table 1. The sample includes 374,615 analyst forecasts for 72,629 firm-quarters. STD denotes the standard deviation. *Q1* and *Q3* denote the 25th and 75th percentiles. Panel B presents the average *TP bias* for portfolios double sorted by *Inv_TR* and *IO*. Panel C presents the average *TP bias* for portfolios double sorted by *Inv_TR* and *%HF ownership*. Panel D reports the Pearson correlations.

Table 3. Main regression results: the relation between TP bias and investor turnover and hedge fund ownership

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	TP bias		*TP bias*		*TP/P adj*		*TP/P adj*		*ΔTP bias*		*ΔTP bias*	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Panel A. Main TP optimism measures												
Intercept	−0.069	0.320	0.274	0.000	0.302	0.000	0.418	0.000	−0.002	0.908	0.027	0.079
Inv_TR	1.174	0.000			0.420	0.001						
%HF ownership			0.557	0.000			0.267	0.003				
ΔInv_TR									0.085	0.000		
Δ%HF ownership											0.004	0.010
IO	−0.203	0.000	−0.247	0.000	−0.252	0.000	−0.275	0.000	0.006	0.568	0.012	0.239
Inv_bank	−0.018	0.010	−0.018	0.010	−0.013	0.017	−0.013	0.016	−0.001	0.788	−0.001	0.722
ln *Ana_experience*	−0.013	0.118	−0.014	0.090	0.003	0.690	0.002	0.725	0.000	0.884	0.000	0.989
ln *Ana_firm_followed*	0.010	0.222	0.009	0.244	0.003	0.682	0.003	0.692	−0.003	0.259	−0.002	0.379
Cov	0.666	0.000	0.740	0.000	0.862	0.000	0.887	0.000	0.072	0.094	0.066	0.126
ln *Firm_following*	−0.063	0.000	−0.052	0.001	−0.034	0.009	−0.030	0.024	0.001	0.883	0.000	0.959
ln *B/M*	−0.018	0.077	−0.025	0.011	0.014	0.109	0.011	0.187	−0.002	0.513	−0.001	0.574
ln *MV*	0.015	0.052	0.007	0.334	−0.013	0.042	−0.016	0.018	−0.003	0.077	−0.003	0.121
Mom	−0.016	0.459	−0.001	0.971	−0.068	0.000	−0.063	0.000	0.100	0.000	0.101	0.000
Industry effect	Yes		Yes		Yes		Yes		Yes		Yes	
Year effect	Yes		Yes		Yes		Yes		Yes		Yes	
N	374615		374615		374615		374615		200514		200514	
F-test/Wald-Chi2	559.73		554.39		925.41		925.16		296.03		286.88	
p-value	0.000		0.000		0.000		0.000		0.000		0.000	
R^2	11.82%		11.60%		17.67%		17.65%		7.85%		7.62%	

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Table 3. continued

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	TP bias 2		*TP relative*		*TP_not_met*		*ΔTP*		*TP bias & Short-*		*EPS bias*	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Panel B. Additional TP optimism measures												
Intercept	0.198	0.001	-0.040	0.005	−0.307	0.077	0.029	0.011	0.026	0.706	0.036	0.000
Inv_TR	0.646	0.000	0.048	0.039	0.851	0.024	0.230	0.000	1.184	0.000	−0.003	0.872
Short interest									−0.790	0.000		
IO	−0.211	0.000	0.006	0.219	−0.413	0.000	0.007	0.138	−0.128	0.002	−0.005	0.462
Inv_bank	−0.016	0.009	-0.014	0.000	−0.074	0.001	0.002	0.071	−0.017	0.011	0.001	0.387
ln *Ana_experience*	0.003	0.686	0.014	0.000	0.066	0.008	0.006	0.000	−0.012	0.127	0.001	0.526
ln *Ana_firm_followed*	0.003	0.692	-0.004	0.218	−0.021	0.364	-0.004	0.000	0.008	0.294	−0.002	0.294
Cov	0.715	0.000	0.011	0.485	0.446	0.033	0.030	0.096	0.359	0.000	0.023	0.103
ln *Firm_following*	−0.054	0.000	0.003	0.155	−0.242	0.000	-0.004	0.038	−0.027	0.085	0.002	0.465
ln *B/M*	−0.005	0.581	0.000	0.763	0.005	0.831	0.006	0.000	−0.022	0.029	0.005	0.006
ln *MV*	0.004	0.611	0.000	0.853	0.098	0.000	-0.001	0.420	−0.007	0.364	−0.003	0.013
Mom	−0.034	0.064	0.008	0.022	−0.118	0.005	0.078	0.000	0.045	0.049	−0.008	0.009
Industry effect	Yes		Yes		Yes		Yes		Yes		Yes	
Year effect	Yes		Yes		Yes		Yes		Yes		Yes	
N	374615		283407		374615		297112		374615		132367	
F-test/Wald-Chi2	594.03		8.31		8931		708.17		461.43		13.64	
p-value	0.000		0.000		0.000		0.000		0.000		0.000	
R^2	11.61%		0.22%		3.70%		8.76%		12.31%		1.59%	

The table presents regression results examining the relation between TP bias and investor turnover and hedge fund ownership. All variables are defined in Table 1. We report the coefficient estimate (*Coeff.*) and the *p*-value (*p-value*) for each covariate. The reported p-values are based on heteroskedasticity-robust standard errors clustered at the firm and analyst level. ln indicates a natural logarithm.

Table 4. Regressions dealing with endogeneity concerns

	1st stage		2nd stage		2nd stage		Analyst FE		Firm FE		LB collapse	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Intercept	0.242	0.000	−0.439	0.005	−0.008	0.904	−0.211	0.000	−3.299	0.000	0.496	0.000
Inv_TR			2.866	0.000			1.161	0.000	1.194	0.000	1.395	0.000
%HF ownership					5.338	0.000						
IO	0.022	0.000	−0.188	0.000	−0.705	0.000	−0.155	0.000	−0.092	0.034	−0.170	0.001
Div_dummy	−0.011	0.000										
MFFlow	0.001	0.000										
*Inv_TR*Lehman*											−0.923	0.009
Lehman											−0.348	0.000
Controls	Yes		Yes		Yes		Yes		Yes		Yes	
Industry effect	Yes		Yes		Yes		Yes		No		Yes	
Year effect	Yes		Yes		Yes		Yes		Yes		Yes	
Firm FE	No		No		No		No		Yes		No	
Analyst FE	No		No		No		Yes		No		No	
N	218077		218077		218077		374615		374615		150670	
F-test/Wald Chi2	4733.46		4863.11		4696.61		270.81		264.97		683.76	
p-value	0.000		0.000		0.000		0.000		0.000		0.000	
R^2	40.18%		10.86%		3.11%		8.51%		22.07%		20.90%	

The table reports regression results from the first and second stage of a 2SLS model that examines the relation between TP bias and investor turnover and hedge fund ownership. All variables are defined in Table 1. The dependent variable in the first stage regression is *Inv_TR*. The instruments in the 2SLS model are *Div_dummy* and *MFFlow*. It also reports results using the original specification but including analyst and firm fixed effects. The last column presents results from a quasi-natural experiment based on Lehman Brothers collapse. *Lehman* is an indicator variable equal to one in the two-year period after the Lehman Brothers collapse, and zero in the two-year period before September 2008. The reported *p*-values for 2SLS regressions are based on heteroskedasticity-robust standard errors clustered at the analyst level. *p*-values for regressions with analyst and firm fixed effects are based on heteroskedasticity-robust standard errors clustered at the firm and analyst level. ln indicates a natural logarithm. *F-test* is the model specification F-test for the first stage regression and fixed-effects regressions. *Wald Chi2* is the model specification Chi2-test for the for second stage regression.

Table 5. Investor-level regressions

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Intercept	−0.347	0.000	−0.369	0.000	−0.369	0.000	−0.379	0.000
Investor TR	0.010	0.041	0.013	0.001	0.012	0.001	0.013	0.000
Investor TR > Inv_TR			−0.002	0.278	−0.002	0.277	−0.002	0.251
Loss on stock			0.063	0.000	0.063	0.000	0.063	0.000
Portfolio importance					−0.035	0.430		
*Portfolio importance*Investor TR*					0.198	0.063		
Ownership concentration in a stock							0.200	0.008
*Ownership concentration in a stock*Investor TR*							0.571	0.038
Inv_TR	1.353	0.000	1.330	0.000	1.330	0.000	1.329	0.000
IO	−0.198	0.000	−0.195	0.000	−0.195	0.000	−0.193	0.000
Controls	Yes		Yes		Yes		Yes	
Industry effect	Yes		Yes		Yes		Yes	
Year effect	Yes		Yes		Yes		Yes	
N	10024866		10024866		10024866		10024866	
F-test	4961.79		4673.14		4419.51		4427.28	
p-value	0.000		0.000		0.000		0.000	
R2	13.75%		13.88%		13.88%		13.89%	

The table presents investor-firm-broker level regression results examining the relation between TP bias and investor turnover. *Investor TR* is the quarterly investor-level measure of stock turnover. *Investor TR > Inv_TR* is an indicator variable equal to 1 if the investor-level stock turnover is higher than the average turnover measured across all investors holding a stock, and 0 otherwise. *Loss on stock* is an indicator variable equal to 1 if the market-adjusted return on a stock over the quarter is negative, and 0 otherwise. *Portfolio importance* measures the importance of a stock in an investor's portfolio and is calculated as the ratio of the investor's ownership in a stock scaled by the sum of all investor holdings. *Ownership concentration* measures the magnitude of an investor's blockholding in a stock and is measured as the ratio of the investor's holding in a stock scaled by the total institutional ownership in that stock. Other variables are defined in Table 1. We report the coefficient estimate (*Coeff.*) and the *p*-value (*p-value*) for each covariate. The reported p-values are based on heteroskedasticity-robust standard errors clustered at the quarter and investor level.

Table 6. Price reaction regressions

Panel A: Descriptive Statistics					
	Mean	*STD*	*p-value*	*Q1*	*Q3*
Panel A1: positive TP revisions					
CAR (−1,1)	2.31%	6.44%	0.000	−1.15%	5.06%
Δ*TP*	15.27%	14.50%	0.000	5.71%	20.00%
Δ*EPS*	3.30%	19.75%	0.000	0.00%	2.69%
Panel A2: negative TP revisions					
CAR (−1,1)	−3.11%	8.90%	0.000	−7.10%	1.63%
Δ*TP*	−16.35%	13.05%	0.000	−22.22%	−6.58%
Δ*EPS*	−8.35%	32.63%	0.000	−4.82%	0.00%

Panel B: Price reaction regressions

	Model 1		Model 2		Model 3	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Intercept	−0.001	0.016	0.000	0.899	0.000	0.861
Δ*TP*	0.112	0.000	0.093	0.000	0.095	0.000
Δ*TP*Inv_TR*			0.088	0.026		
Δ*TP*%HF ownership*					0.233	0.000
Δ*EPS*	0.033	0.000	0.033	0.000	0.033	0.000
Downgrade	−0.038	0.000	−0.038	0.000	−0.038	0.000
Upgrade	0.021	0.000	0.021	0.000	0.021	0.000
Inv_TR			−0.004	0.532		
%HF ownership					−0.013	0.021
N	283763		283763		283763	
F-test	4810.84		3249.25		3220.22	
p-value	0.000		0.000		0.000	
R^2	13.41%		13.42%		13.51%	

Panel C: Long-run abnormal returns relative to the Carhart (1997) model

	Low *TP/P adj*	High *TP/P adj*	Diff (High−Low) *TP/P adj*	*p*-value
Low *Inv_TR*	0.028%	0.058%	0.030%	0.000
High *Inv_TR*	0.090%	0.033%	−0.057%	0.000
Diff (High−Low) *Inv_TR*	0.062%	−0.025%		
p-value	0.000	0.002		

Panel D: Long-run abnormal returns relative to the Carhart (1997) model

	Low *TP/P adj*	High *TP/P adj*	Diff (High−Low) *TP/P adj*	*p*-value
Low *%HF ownership*	0.033%	0.041%	0.007%	0.147
High *%HF ownership*	0.046%	0.005%	−0.041%	0.004
Diff (High−Low) *Inv_TR*	0.013%	−0.036%		
p-value	0.101	0.002		

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Table 6. continued

Panel A presents descriptive statistics on the price reaction to analyst forecast revisions. Variables are defined in Table 1. *STD* denotes the standard deviation. *Q1* and *Q3* denote the 25th and 75th percentiles. Panel B presents regression results for the price reaction model. The reported *p*-values are based on heteroskedasticity-robust standard errors clustered at the firm and analyst level. Panel C (Panel D) reports one-year average daily abnormal returns relative to the Carhart (1997) model for stocks sorted by investor turnover (hedge fund ownership) and TP bias measured by the market-adjusted TP/P.

Table 7. The relation between future institutional holdings and bias in analyst target prices

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Future IO		*Future IO*		*Future holdings by short-term investors*		*Future holdings by long-term investors*		*Future #IO*		*Future #HF ownership*		*Future #HF ownership*	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Intercept	0.069	0.000	0.063	0.000	0.044	0.000	0.087	0.001	−0.438	0.000	−9.041	0.000	−4.984	0.000
Avg *TP bias_f*	−0.017	0.000	0.004	0.408	0.009	0.230	−0.022	0.051	−0.029	0.143	−0.225	0.075	−0.316	0.014
Avg *TP bias_f *Inv_TR*			−0.099	0.000	−0.120	0.000	0.047	0.438	−0.155	0.046				
Inv_TR	0.108	0.001	0.137	0.000	0.193	0.000	−0.103	0.345	0.268	0.021				
IO	0.823	0.000	0.822	0.000	0.827	0.000	0.823	0.000	−0.268	0.000			−2.362	0.000
#IO									0.008	0.000			0.018	0.000
Avg *TP bias_f * #HF ownership*											−0.035	0.005	−0.031	0.011
#HF ownership											0.710	0.000	0.617	0.000
Controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry effect	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year effect	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
N	67163		67163		33582		33581		67163		67163		67163	
F-test	1429.8		1394.4		1277.9		846.0		5743.4		2294.7		2580.0	
p-value	0.000		0.000		0.000		0.000		0.000		0.000		0.000	
R^2	75.91%		75.93%		76.19%		75.84%		92.81%		86.22%		86.54%	

This table presents firm-level regression results on the relation between TP bias and future institutional ownership. The dependent variable for Models 1 and 2 is the one-quarter ahead institutional ownership in a stock. For Model 3, it is the one-quarter ahead ownership by short-term investors, for Model 4, it is the one-quarter ahead ownership by long-term investors, for Model 5, it is the one-quarter ahead number of institutional investors in a stock, and for Models 6 and 7, it is the one-quarter ahead number of hedge funds in a stock. The 'Avg' prefix indicates a firm-quarter average. Other variables are defined in Table 1. The reported *p*-values are based on heteroskedasticity-robust standard errors clustered at the firm level.

Table 8. Impact of TP bias on future institutional holdings of other stocks covered by a catering broker

	Model 1		Model 2		Model 3		Model 4	
	Future IO of other stocks		*Future IO of other stocks by short-term investors*		*Future IO of other stocks by long-term investors*		*Future %HF Ownership*	
	Coeff.	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*	*Coeff.*	*p-value*
Intercept	0.159	0.000	0.211	0.000	0.176	0.000	0.056	0.000
Avg *TP bias_b*	−0.003	0.005	−0.007	0.002	−0.004	0.164	0.001	0.002
Avg *TP bias_b *Inv_TR*	0.011	0.032	0.019	0.030	0.020	0.171		
Inv_TR	−0.023	0.000	−0.052	0.000	0.067	0.001		
IO	0.000	0.428	−0.002	0.000	−0.002	0.000		
Avg *IO other*	0.742	0.000	0.664	0.000	0.665	0.000		
Avg *TP bias_b *%HF ownership*							0.019	0.000
%HF ownership							−0.003	0.000
Avg *%HF ownership other*							0.060	0.032
Industry effect	Yes		Yes		Yes		Yes	
Year effect	Yes		Yes		Yes		Yes	
N	269374		133737		133375		269374	
F-test	645.02		333.58		439.21		132.22	
p-value	0.000		0.000		0.000		0.000	
R^2	73.65%		61.41%		68.22%		30.89%	

The table reports broker-level regression results that examine whether issuing optimistic target prices for stocks held predominantly by short-term investors increases these investors' holdings of other stocks covered by the catering broker. The dependent variable in Model 1 is the average one-quarter ahead institutional ownership for all stocks (excluding firm *k*) covered by a broker. Models 2 and 3 show results for regressions where the dependent variable is the average future short-term (ST-IO) and long-term (LT-IO) institutional ownership, respectively. Model 4 reports results for Equation (12) where we use hedge fund holdings. Specifically, the dependent variable is the average one-quarter ahead hedge fund holdings of all stocks (excluding firm *k*) covered by broker *b*. Avg *TP bias_b* is the average bias of all TPs issued by a broker for firm *k* in a quarter. Avg *IO other* is the average institutional ownership for all stocks (excluding firm *k*) covered by the broker in a quarter. Investor turnover and institutional holdings are measured for stock *k*. *%HF ownership* is the hedge fund ownership for stock *k* in a quarter. *%HF ownership other* is the average hedge fund ownership for all stocks (excluding firm *k*) covered by the broker in a quarter. The reported p-values are based on heteroskedasticity-robust standard errors clustered at the broker level. All other variables are defined in Table 1.