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Rewriting History [*] [†]

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Rewriting History

Abstract

Comparing two snapshots of the historical I/B/E/S database of research analyst stock recommendations, taken in 2002 and 2004 but each covering the same time period 1993-2002, we identify 54,729 ex post changes (out of 280,463 observations), including alterations of recommendation levels, additions and deletions of records, and removal of analyst names. The changes appear non-random across brokerage firms, analysts, and tickers, and have a significant impact on the overall distribution of recommendations across stocks and within individual stocks and brokerage firms. They also affect trading signal classifications, back-testing inferences, track records of individual analysts, and models of analysts' career outcomes in the three years following the changes.

Key words: Security analysts; Stock recommendations; Global Settlement; Career concerns; Forensic finance.

JEL classification: G21, G24, G28, J24, J44.

Comparing two snapshots of the entire historical I/B/E/S database of research analyst stock recommendations, taken in 2002 and 2004 but each covering the *same* time period 1993-2002, we identify tens of thousands of changes which collectively call into question the principle of replicability of empirical research. The changes are of four types: 1) The non-random removal of 19,904 analyst names from historic recommendations ("anonymizations"); 2) the addition of 19,204 new records that were not previously part of the database; 3) the removal of 4,923 records that had been in the data; and 4) alterations to 10,698 historical recommendation levels. In total, we document 54,729 ex post changes to a database originally containing 280,463 observations.

Our main contribution is to document the characteristics and effects of these pervasive changes. The academic literature on analyst stock recommendations, using I/B/E/S data, is truly vast: As of December 12, 2006, Google Scholar identifies 565 articles and working papers using the keywords "I/B/E/S", "analysts", and "recommendations". Given this keen academic interest, as well as the intense scrutiny that research analysts face in the marketplace and the growing popularity of trading strategies based on analyst output, changes to the historical I/B/E/S database are of obvious interest to academics and practitioners alike. We demonstrate that the changes have a significant effect on the distribution of recommendations, both overall and for individual stocks and individual brokerage firms. Equally important, they affect trading signal classifications, back-testing inferences, the track records of individual analysts, and models of analysts' career outcomes in the years since the changes occurred. Regrettably, none of the changes can easily be "undone" by researchers, which makes replicating extant studies difficult. Our findings thus have potentially important ramifications for existing and future empirical studies of equity analysts.

Why do the historical data now look different than they once did? The contents of the database changed at some point between September 2002 and May 2004, a period that not only coincided with close scrutiny of Wall Street research by regulators, Congress, and the courts, but also saw a

substantial downsizing of research departments at most major brokerage firms in the U.S. According to communication received from Thomson Financial (the owner of I/B/E/S) in November and December 2006, the anonymizations were caused by a series of software glitches, introduced in 2002-2003.[1] Surprisingly, despite the seemingly random nature of this type of shock to the data, the resulting patterns have apparently systematic components, rather than appearing random. For instance, bolder recommendations are more likely to be anonymized, as are recommendations from more senior analysts and *Institutional Investor* "all-stars." The characteristics of the additions and deletions are similarly unusual. Additions disproportionately consist of holds and sells; indeed, in the case of one prominent brokerage firm, 91.5% of its 234 additions are sells, and these increase the number of sells the firm has on the 2002 tape by a factor of 20. Deletions, on the other hand, disproportionately consist of strong buys, while alterations disproportionately consist of buys and strong buys (which are typically revised down). Perhaps most strikingly, all four types of changes correlate strongly with survival by both the brokerage firm and by the analyst.

We divide our analysis into two broad areas of interest: Individual recommendations and analyst-level research. At the recommendation level, the collective effect of the changes is to make the overall distribution of historic recommendations issued for U.S. companies between October 1993 and July 2002 appear more conservative in 2004 than it did in 2002, with considerably fewer strong buys and buys and more holds, sells, and strong sells.[2] The magnitude of this shift, while

[1] As of February 2007, Thomson Financial's position is that "changes to Recommendation History have occurred as part of necessary processes and maintenance." Previously, Thomson had indicated that the anonymizations were the result of three software glitches. The first produced incorrect start and end dates for some analysts' employment histories. The second caused selective ticker histories for certain analysts to be anonymized, in connection with attempts to consolidate duplicate analyst identifiers. The third, which can still occur, results in recommendations being attributed to an analyst who has departed; subsequent corrections involve anonymizing such recommendations. In unreported tests we find that these explanations appear to account for at most 70% of the anonymizations, but it is possible that other, as yet unidentified, software glitches may account for the remainder.

[2] This finding is distinct from Barber et al. (2006), who document a shift in the overall distribution of recommendations over time; we focus on a constant time period, 1993 through 2002.

statistically significant, is economically small overall, because in any given year no more than a sixth to a third of stocks are affected. For the subset of affected stocks, however, the changes result in a decidedly more conservative distribution of recommendations, especially in the late 1990s – a period that continues to be of central interest to researchers. Broker-level distributions, which can be used to predict the profitability of stock recommendations (Barber et al. (2006)), change even more dramatically. One reason why these findings are important is that the apparently optimistic bias in the historical distribution of recommendations was a frequently cited impetus to the regulatory proceedings that culminated in the Global Research Analyst Settlement of 2003 between New York attorney general Eliot Spitzer, the SEC, NASD, NYSE, North American Securities Administrators Association, state regulators, and twelve brokerage firms.

The changes to the I/B/E/S database also affect the classification of trading signals such as "upgrades" and "downgrades," the key inputs for a large literature on the profitability of analyst recommendations (e.g., Womack (1996), Barber et al. (2001), or Jegadeesh et al. (2004); see Ramnath, Rock, and Shane (2005) for a survey). Overall, using the 2004 tape instead of the 2002 tape results in 6.2% of upgrades and 5.3% of downgrades being "re-classified." In addition, there is a curious time trend, in that the alterations, deletions, and additions appear to affect more recent recommendations, and especially those issued in 2002, 11% of which would be re-classified.

Similarly, the changes impact the implementation of popular trading strategies based on analyst consensus recommendations. For example, employing a standard portfolio classification technique that forms quintiles based on the quarterly change in consensus analyst recommendations (a robust predictor of returns, as shown in Jegadeesh et al. (2004)) requires one to re-classify more than 17% of the ticker-quarter observations when using the 2004 tape compared to the 2002 tape. A simple trading strategy that buys stocks in the top consensus change quintile and shorts stocks in the lowest quintile each month performs 15.9% to 42.4% better on the 2004 tape than on the 2002 tape,

suggesting that the changes to the I/B/E/S database have resulted in the appearance of more profitable analyst research.

Track records of individual analysts are also affected. Analysts' track records are the key variable of interest in a large and growing literature on career concerns and agency problems in the analyst industry. (In December 2006, Google Scholar lists 129 articles and working papers containing the key words "analysts", "conflicts of interest", and "I/B/E/S".) Among the group of analysts with anonymized recommendations, we find that abnormal returns following subsequently anonymized upgrades-to-buy are significantly lower than are abnormal returns following upgrades *by the same analysts* that remained untouched. The return differential is large, ranging from 3.6% to 4.0% p.a. over the 1993-2002 period. It is even larger in the most recent, post-bubble period (as high as 7.4% p.a.), and for the sub-sample of bolder recommendations (5.2% and 9.1% p.a. in the full-sample and post-bubble periods, respectively).

Analysts whose track records are affected are associated with more favorable career outcomes over the 2003-2005 period than their track records and abilities would otherwise warrant. Following the career path modeling in Hong, Kubik, and Solomon (2000) closely, we find that analysts associated with anonymizations experience a more than 60% increase in the likelihood of subsequently moving from a low-status to a high-status brokerage firm. This effect is much larger than any other in our career outcome models. The magnitude of the effect of additions on career outcomes is also large, boosting the likelihood by more than 40%. Similarly, analysts are more likely to be rated the top stock picker in their sectors by the *Wall Street Journal*, which relies on Thomson Financial data, if some of their recommendations have been dropped or added.

Collectively, our findings raise serious doubts about the replicability of past, current, and future studies using the I/B/E/S historical recommendations database.[3]

I. Data

I.A Sample Construction and Overview of Changes

The I/B/E/S historical detail recommendations database contains investment ratings for U.S. listed companies issued by most of the brokerage firms active in the U.S. Our analysis compares two snapshots of the *same* historical time period – October 29, 1993 to July 18, 2002 – taken at two different points in time: September 2002 and May 2004. We will refer to these snapshots as the 2002 and 2004 tapes, respectively. (We ignore recommendations on the 2004 tape dated after July 18, 2002.) To meet the minimum scholarly standard that research findings be replicable, each new tape must contain identical historical data (except for cleanups). This is not the case.

A typical I/B/E/S record includes the analyst's name and her six-digit *amaskcd* identifier as assigned by I/B/E/S; the name of the analyst's employer at the time of the recommendation; the I/B/E/S ticker and historical CUSIP of the company concerned; the date the recommendation was issued; and the recommendation itself. Different brokerage firms use different wordings for their recommendations, which I/B/E/S translates into a numerical score on the following scale: Strong buy=1, buy=2, hold=3, sell=4, strong sell=5.

We merge the 2002 and 2004 tapes by I/B/E/S ticker,[4] standardized brokerage firm name,[5] and date. This reveals four types of changes to the I/B/E/S historical recommendations database:

1) Alterations: Records whose recommendation levels are different on the 2002 and 2004 tapes;

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[3] For related work on the impact of problems in other archival databases (e.g., CRSP, Compustat), see Rosenberg and Houglet (1974), Bennin (1980), Shumway (1997), Canina et al. (1998), Shumway and Warther (1999), and Elton, Gruber, and Blake (2001). See http://www.kellogg.northwestern.edu/rc/crsp-cstat-references.htm for a summary.

[4] We have verified that the changes we document are not due to changing I/B/E/S tickers.

[5] In some cases, I/B/E/S uses multiple codes to identify the same brokerage firm (e.g., NOMURA and NOMURAUS both decode to Nomura Securities). We standardize such name variations.

2) Deletions: Records that appear on the 2002 tape but not on the 2004 tape;

3) Additions: Records that appear on the 2004 tape but not on the 2002 tape;[6]

4) Anonymizations: Records attributed to specific analysts on the 2002 tape whose names are missing on the 2004 tape (and whose *amaskcd* identifiers have been set to zero).

There are 280,463 investment recommendations on the 2002 tape. By 2004, there are 10,698 alterations (3.8%), 4,923 deletions (1.8%), 19,204 additions (6.8%), and 19,904 anonymizations (7.1%). We find very little overlap between the changes, suggesting they are almost always independent of each other. For instance, it is rarely the case that an anonymized recommendation is also altered, or that deletions are linked to additions. This makes it unlikely that I/B/E/S simply dropped and replaced records containing errors.[7] Overall, there are around 55,000 changes in total. They are thus pervasive. Since 2004, there have been few additional alterations, additions, or anonymizations, though deletions continue to occur; see Appendix A.[8]

Panel A of Table I presents a breakdown of each type of change, by year. Each is observed throughout the 1993-2002 sample period, with no apparent time trends. The annual number of affected records varies from 3,349 in 1993 to 6,929 in 1999.

Panel B of Table I presents a breakdown of each type of change, by I/B/E/S rating level. Of the 280,463 original recommendations on the 2002 tape, 28.6% are strong buys, 36.7% are buys, 31.4% are holds, 1.7% are sells, and 1.6% are strong sells. The average recommendation level is 2.11. By

[6] We exclude from our analysis 22,240 additions by brokerage firms that did not contribute data to I/B/E/S in 2002 but appeared on the 2004 tape, as they have since disappeared. On closer inspection, these brokers are quantitative research shops that produce algorithmic recommendations constrained to be symmetrically distributed. Any academic research that inadvertently included their data will severely understate the well-known optimistic bias in recommendations.

[7] Specifically, when we form all pairwise matches of additions and deletions on {broker, recommendation year, I/B/E/S ticker}, we find only 301 pairwise matches. Likewise, there are few (922) pairwise matches of additions and alterations, and even fewer (25) of alterations and deletions.

[8] Using earlier and later tapes, we can document the time series of changes. For instance, between January and September 2002, there were nine anonymizations, i.e. one per month on average. Between September 2002 and May 2004, the sample period which we focus on, there were 995 anonymizations per month on average. Between May 2004 and February 2006, there were 591 anonymizations, or 28.1 per month on average.

comparison, the 10,698 records subject to alteration have an average recommendation of 1.98 on the 2002 tape and include disproportionately few holds. On the 2004 tape, their average is more pessimistic, largely because of the near trebling in the number of negative recommendations. Deletions are disproportionately strong buys, with an average recommendation level of 1.7. Additions are the opposite, containing disproportionately holds and sells, with an average recommendation level of 2.44. The distribution of the 19,904 anonymized recommendations largely mirrors that of the 2002 tape. As we show in Section II.A, the net effect of alterations, deletions, and additions is to make the distribution of recommendations over the 1993-2002 time period appear more conservative.

Panel C of Table I reveals an interesting time trend among the alterations. In the early sample years, alterations result in about as many downward as upward revisions of the original ratings. Since the end of the 1990s boom market, on the other hand, and especially in 2002, negative revisions significantly outnumber positive ones. Thus, alterations contribute to the appearance of more conservative sell-side research in the early 2000s.

I.B Characteristics of Ex Post Changes

Affected records have certain characteristics in common that appear non-random. In Table II, we split brokerage firms into two groups depending on whether any of their recommendations have been altered, deleted, added to, or anonymized.[9] Around one in six brokerage firms is associated with alterations, one in three with deletions and with additions, and nearly two in three with anonymizations.[10]

[9] Many brokerage firms have merged over the sample period. After allocating the historic recommendations of the predecessors to the surviving brokerage firm as of June 30, 2002 using the bank merger data described in Asker and Ljungqvist (2005), there are 385 distinct brokerage firms. Sixteen firms never revealed analyst names on the 2002 tape, leaving 369 brokerage firms whose recommendations could be subject to anonymization.

[10] We obtain qualitatively similar results if we require a substantial fraction of a brokerage firm's recommendations (such as 5%) to have been anonymized, rather than "at least one."

Brokerage firms associated with these changes are substantially larger, both in terms of the size of their investment banking operations and the size of their research departments. Most remarkably, they employ between eight and 16 times more analysts on average in 2002 than do unaffected brokerage firms. The main cause of this difference is the fact that the group of unaffected firms includes a disproportionate number with zero headcounts in 2002, suggesting they have ceased publishing sell-side research or at least stopped contributing data to I/B/E/S.[11] In fact, continuing to publish research appears to be a pre-condition for a brokerage firm's recommendations to have changed: Not a single recommendation associated with one of the 89 brokerage firms that have ceased publishing investment research by 2002 has been anonymized, whereas an astonishing 85.4% of the 280 firms that continue publishing research had some recommendations anonymized. Similar, though slightly less extreme patterns hold for alterations, deletions, and additions.

Beyond size and continued production of sell-side research, affected brokerage firms have two further characteristics in common: They include the twelve firms sanctioned in the Global Settlement (except for alterations) and they tend to be integrated securities firms, offering both investment banking and research services. For example, of the 65 brokerage firms that lead-managed at least one underwritten equity transaction in 2002 (our proxy for the presence of an investment banking operation), 61 (93.8%) saw some anonymizations, whereas of the 304 brokerage firms without investment banking operations in 2002, only 178 (58.6%) did.

We find similarly strong and systematic patterns at the analyst level. Table III splits analysts into two groups depending on whether any of their recommendations have been altered, deleted, added to, or anonymized. Of the 7,817 analysts with named records on the 2002 tape, 12% are associated with alterations, 11.1% with deletions, 23.6% with additions, and 27.3% with anonymizations. The average number of affected records per analyst varies from 5.5 deletions to

[11] By construction, brokerage firms that have ceased publishing research are not those taken over by another broker.

10.9 alterations (though the medians are lower for each type of change). This corresponds to between 17.6% and 40.2% of the average affected analyst's historical records on the 2002 tape.

Panel B shows that analysts associated with alterations, deletions, or additions work for significantly smaller brokerage firms on average, and analysts at sanctioned brokers are less likely to have records altered or deleted on the 2004 tape.

According to Panel C, affected analysts appear to have the very best job prospects (Hong and Kubik (2003)). They are not only more likely to be *Institutional Investor* "all-stars" or "top stock pickers" according to the *Wall Street Journal* "Best on the Street" survey, they are also associated with more accurate earnings forecasts compared to their sector peers, as defined in Hong, Kubik, and Solomon (2000),[12] and tend to be more senior as judged by the average time they have been in the profession.[13] Finally, they issue significantly more recommendations than unaffected analysts.[14]

Arguably the most remarkable result of Table III is shown in Panel D. Much like all four types of change correlate with survival by the brokerage firm, we find that they also correlate with survival by the analyst: Affected analysts are vastly more likely to remain in the industry beyond 2002. For example, 70.8% of the anonymizers continue to contribute recommendations and earnings forecasts to I/B/E/S after 2002, compared to only 46.9% of the non-anonymizers.[15]

In Table IV, we ask whether conditional on brokerage firm and analyst characteristics,

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[12] The absolute forecast error of analyst *i* covering company *k* in year *t* is the difference between the analyst's most recent forecast of year-end EPS (issued between January 1 and July 1 of that year) and subsequent realized earnings. Absolute forecast errors are scaled so that the most accurate analyst scores one and the least accurate zero. The analyst's relative forecast accuracy in year *t* is her average score across the *k* stocks she covers over years *t*-2 to *t*.

[13] We measure analyst characteristics as of the earlier of 2002 or the date of the analyst's retirement.

[14] Analysts with these characteristics tend to publish more, and Table III shows that more prolific analysts are more likely to be associated with affected records. However, this correlation does not drive the summary statistics. For example, we find the same patterns if we focus on analysts who make an above-median number of recommendations.

[15] Because we define continued employment in the industry based on an analyst contributing data to I/B/E/S, these numbers are lower bounds. Analysts whose employers cease to contribute data to I/B/E/S (e.g., S&P), or those moving to employers that do not contribute data to I/B/E/S, will be classified as having left the industry, as will analysts who no longer have their name listed first on research reports (perhaps because a more senior analyst has been recruited to the team) or who have been promoted to the position of research director (and so stop publishing).

recommendations have changed randomly. The unit of analysis here is thus a recommendation, rather than a brokerage firm or an analyst. We use multivariate probit models to relate the probability that a given recommendation is altered, dropped, added, or anonymized to the characteristics of the analyst and her brokerage firm, three recommendation-level attributes, as well as random brokerage effects to control for otherwise omitted heterogeneity arising from differences across brokerage firms.

Judged by the pseudo-R^2, which range from 47.3% to 75.8%, each type of change appears highly predictable rather than random. All else equal, deletions, additions, and anonymizations are 25%, 20%, and 117% more likely if the analyst continues to be employed in the industry. By implication, the conditional likelihood of a recommendation made by an analyst who has retired by 2002 being anonymized is zero. The *t*-statistic for this variable is 32.1, making it easily the most significant determinant of anonymization.[16]

Recommendations from *Institutional Investor* all-stars are 21% less likely to be altered, 10% less likely to be dropped, 10% less likely to be added, and 61% *more* likely to be anonymized. Those from *Wall Street Journal* top stock pickers are a third more likely to have been added or anonymized. Indeed, with the exception of all-star status, additions and anonymizations share many of the same determinants; for instance, they are more likely among analysts with fewer recommendations to their name. Seniority has a positive effect on the likelihood of each type of change, but the economic magnitudes are more modest.

Unlike the size of the brokerage firm's investment banking operation, the size of the research department has a large effect: Recommendations are 13% more likely to be altered, 48% more likely to be deleted, 19% more likely to be added, and 41% more likely to be anonymized for a one

[16] Results are robust to excluding from the set of anonymizers analysts with very few or very many anonymizations, and those who appear to have left the industry before 2002.

standard deviation increase in the log number of analysts employed in 2002. Alterations and additions are significantly less likely to occur at sanctioned brokerage firms.

Whether the brokerage firm has stopped contributing data to I/B/E/S predicts anonymization perfectly and so cannot be controlled for in that model. We also see significantly fewer alterations and additions at inactive brokerage firms. Deletions, on the other hand, are 143% more likely if the brokerage firm no longer contributes data to I/B/E/S. (We find no support for the hypothesis that such brokerage firms requested all their historical data to be removed from I/B/E/S.)

Among the recommendation-level characteristics, bolder recommendations are more likely to be altered or anonymized, and less likely to be dropped. As we will see in Section III, bold anonymized recommendations tend to be poor performers. Finally, additions are less likely for investment banking clients or large issuers of securities.

In sum, the changes to the I/B/E/S historical recommendations database are widespread and appear non-random across brokerage firms, analysts, and tickers.

I.C Do the Changes Reflect Data Corrections?

It is possible that records changed simply because I/B/E/S discovered errors on the 2002 tape. To rule out this possibility, we hand-check the data integrity of the 2002 tape against the analyst report collection available through Thomson's Investext service and news sources accessed through the Reuters/Dow Jones Factiva service.

In order to investigate the anonymizations, we focus on six randomly selected brokerage firms, namely three bulge-bracket investment banks and three medium-sized brokerage firms. (The terms governing our use of the I/B/E/S data prevent us from naming the firms we selected.) We are able to verify the analyst's identity in 1,144 anonymization cases. In only 43 of these (3.8%) does the name of the analyst writing the report *not* match the name on the 2002 I/B/E/S tape, indicating that the names on the original 2002 tape are largely accurate.

We conduct a series of similar, random Investext searches for the three other types of changes.[17] For the deletions, we are able to identify 96 exact matches by broker/ticker/date, only two of which suggest that the analyst's name on the 2002 tape was incorrect. Widening the match window to two weeks on either side of the I/B/E/S recommendation date yields 147 additional matches, of which only three indicate an obvious error in the original 2002 record. Thus, at least for this small, random sample, the vast majority of the deleted records (97.9%) appear to be valid recommendations that should not have been deleted.

We are able find less than 20% of the 1,055 additions we hand-checked in Investext, even if we widen the window to two weeks either side. This could mean that some additions are not bona fide historical recommendations, or if they were, that they were not available through public channels such as I/B/E/S and Investext. Moreover, as the origin of the additions is unclear, it is possible that the 19,204 additions are not a random subset of the bona fide historical recommendations that were for some reason not on the 2002 tape. We can, however, rule out two possibilities: 1) That the additions are the result of merging I/B/E/S and First Call (another Thomson Financial database of stock recommendations),[18] and 2) that the additions represent a simple expansion of the I/B/E/S coverage (i.e., the ex post inclusion of new analysts, new brokers, or new tickers).[19]

Alterations include many cases where *every* historical buy (say) at a given brokerage firm was recoded as a strong buy. It is possible that this type of case reflects the erroneous retroactive application of a broker's new rating scale to its historical data. Kadan et al. (2005) show that many

[17] Thomson Financial claims that the causal factors for the additions, alterations, and deletions are "contributor rating scale changes, contributor code mergers, and the removal of Rankings Only contributors." As detailed in Table VIII and the Appendix, these factors cannot fully explain the patterns we see. Moreover, they do not appear to address additions.
[18] Only 6,295 of the 19,204 additions (32.8%) can be found in First Call when matching on standardized broker name, historical CUSIP, and date (allowing for a two-week window either side of the I/B/E/S date). The match rate is similarly low for the entire 2002 I/B/E/S tape: Only 46.8% of the 280,463 I/B/E/S recommendations can be found in First Call.
[19] Only 1,033 out of the 19,204 additions (5.4%) correspond to an expansion of historical coverage in the database due to the introduction of "new" historical records covering new brokers, new analysts, or new tickers.

brokerage firms adopted a three-point rating scale at various points in 2002 and 2003, though there is no logical reason why they should have applied their new scales to their historical I/B/E/S records. In many other cases, some but not all records with the same rating are recoded, indicating other reasons for the alterations than the adoption of a new rating scale. Often, alterations apply not just to the I/B/E/S rating code ("strong buy" and so on), but also to the original broker rating ("long term buy" and so on). Our Investext analysis identifies 130 exact matches by broker/ticker/date, none of which appears to be a valid data correction.

Overall, our random searches suggest that anonymizations, alterations, and deletions are likely *not* simply the result of attempts to correct data errors on the 2002 tape, while the status of additions remains unclear.

I.D Can the Changes Easily Be Undone?

It is impossible for users to undo the deletions or additions to the I/B/E/S historical recommendations database without access to a historic snapshot of the data, such as our 2002 tape. In theory, there are ways to potentially un-do anonymizations and alterations, but as we argue more fully in Appendix A, such fixes are incomplete and cannot be accomplished without introducing errors into the data. Furthermore, regardless of whether the changes can or will be undone, they have affected research conducted over the last three or four years, as shown in the next two sections.

II. The Impact of the Data Changes on Recommendation-level Analysis

It is difficult to overstate the significance of the changes to the I/B/E/S historical recommendations database outlined in the previous section. The alterations, deletions, and additions combine to make the industry-wide distribution of recommendations, the recommendation distributions for individual stocks, and those for individual brokerage firms look considerably more conservative than they did according to the 2002 tape. They also affect historical "trading signals" such as upgrades and downgrades as well as the level of the historical consensus. Each of these is at

the heart of a separate line of research. In this section, we document the potential effects of the I/B/E/S changes for research, while bearing in mind that they may also affect the work of regulators, legislators, and litigators, all of whom rely on archival databases such as I/B/E/S.

II.A Effects on the Distribution of Stock Recommendations

As we saw in Section I, the distributions of altered, dropped, and added recommendations are highly unusual: Altered records are disproportionately optimistic on the 2002 tape and become more pessimistic on the 2004 tape; dropped records too are unusually optimistic; whereas added records are uncommonly pessimistic. Panel A of Table V shows the net effect of these changes on the overall distribution of historic stock recommendations over the 1993-2002 period. Overall, the changes make the distribution appear more conservative in 2004 than it did in 2002. The net difference between the two tapes is heavily skewed towards holds, sells, and strong sells, which collectively account for 82.4% of the net changes; for comparison, pessimistic ratings account for only 34.7% of the original 2002 tape.

Panel A understates the effect of the changes on the overall distribution, because the effect turns out to be concentrated in a relatively small number of stocks. Panel B focuses on changes in annual stock-level distributions. The 2002 tape contains 49,097 ticker-years, with an average of 5.7 recommendations per ticker and year. Overall, as in Panel A, we see that the distribution of recommendations for the average ticker-year has clearly become more conservative in the wake of the alterations, deletions, and additions: For the average ticker, the proportion of buys (including strong buys) decreases by one percentage point, while the proportion of holds and sells (including strong sells) increases by 0.4 and 0.6 percentage points, respectively. But the majority of tickers experience no change in their recommendation distribution. For the subset of stocks that do, the shift is large: The 24% of the total stock universe covered by analysts in I/B/E/S that are affected by the changes now show a decidedly more conservative distribution of recommendations over the

1993-2002 period. For example, at the height of the bull market in 2000, the proportion of buys and strong buys for the average affected stock decreases by more than six percentage points, from 68.0% to 61.7%, with a corresponding increase in holds and, especially, sells.

Barber et al. (2006) show that broker-level recommendation distributions can be used to predict the profitability of stock recommendations. The underlying idea is that a strong buy from a brokerage firm that relatively rarely issues strong buys is more informative, and hence more profitable to trade on, than a strong buy from a generally more optimistic broker. As Panel C of Table VI shows, broker-level recommendation distributions also change significantly as a result of the alterations, deletions, and additions to the I/B/E/S historical recommendations database.

Following Barber et al. (2006), we rank brokerage firms every quarter based on the fraction of their end-of-quarter outstanding recommendations that are buys or strong buys and group them into quintiles, using data from either the 2002 tape or the 2004 tape. Overall, 1,194 of the 6,540 broker-quarters (18.3%) are assigned to different quintiles on the two tapes. For instance, 18.7% of the most bullish brokers on the 2002 tape migrate into another quintile on the 2004 tape. Clearly, these migrations, caused by the changes to the I/B/E/S historical recommendations database, have the potential to affect the replicability of broker-level research.

II.B Effects on Trading Signals

As important as the effects on the overall, stock-level, and broker-level distributions of recommendations levels are the effects of the alterations, deletions, and additions on the distribution of recommendation changes or “trading signals”, the key inputs for a vast literature on the profitability of analyst recommendations (see Ramnath, Rock, and Shane (2005) for a review). We construct trading signals for broker/ticker pairs using a twelve-month look-back window. For instance, a downgrade is defined as a negative change from a recommendation issued by the same broker for the same I/B/E/S ticker within the previous twelve months. If the previous

recommendation was issued more than twelve months ago, the current recommendation is defined to be a reinitiation. In the absence of a prior recommendation, the current recommendation is defined to be an initiation.

Panel A of Table VI provides a breakdown of the distribution of trading signals for the 2002 tape, each of the three types of changes, and the resulting 2004 tape. The effect of the alterations is to increase the number of reiterations at the expense of upgrades and downgrades, blunting the original trading signals. Deleted records were disproportionately upgrades, while added records are disproportionately downgrades. The combined effect of the changes is to increase the fraction of downgrades and reiterations on the 2004 tape.[20] While not shown, the effect becomes even more pronounced once we exclude unaffected stocks, as in the previous table.

Panel B provides a transition matrix for the changed trading signals from the 2002 to the 2004 tape. Of the 56,464 records originally classified as downgrades on the 2002 tape, 2,981 (5.3%) are classified differently on the 2004 tape: 137 now appear as upgrades, 1,797 as reiterations, 263 as initiations, and 181 as reinitiations, while 603 have been deleted. Similarly, 6.2% of the original upgrades, 11% of the original reiterations, 4.7% of the original initiations, and 4.8% of the original reinitiations have migrated to a different trading signal category on the 2004 tape. When we take the additions into account, as many as 34,804 (12.4%) of the original trading signals for the 1993-2002 period have changed or been dropped on the 2004 tape.

Figure 1 reveals an interesting time trend to the trading signal changes, by plotting the fraction of affected records per year. For each type of trading signal, the alterations, deletions, and additions have the largest effect among the more recent recommendations, and especially among those issued in 2002: 7.8% of original year-2002 downgrades have changed, as have 12.3% of upgrades, 21.7%

[20] The net number of changed trading signals is less than the sum of the trading signals that are changed due to alterations, deletions, and additions, as some of these changes cancel each other out.

of reiterations, 13.1% of initiations, and 5.5% of reinitiations. On net, 11% of year-2002 trading signals are classified differently on the 2002 and 2004 tapes.[21]

II.C Effects on Consensus Recommendations

Consensus recommendations are commonly employed in quantitative trading strategies, following evidence that sorting based on consensus recommendations (Barber et al. (2001)), and particularly on *changes* in consensus recommendations (Jegadeesh et al. (2004)), is a profitable strategy. We examine the impact of the alterations, deletions, and additions on a popular strategy that trades on changes in consensus recommendations in the pre-2000 period, as Barber et al. (2003) show that strategies based on consensus recommendations perform poorly after 2000.[22] Our goal is to assess whether the changes to the I/B/E/S database affect back-tests of a key stylized fact in the literature; it is not to question the validity of any particular finding.

We employ a standard portfolio classification technique that forms quintiles each month based on the lagged quarterly change in consensus recommendations. Recommendations are reverse-scored from 5 (strong buy) to 1 (strong sell). The consensus recommendation for a ticker equals the mean outstanding recommendation at the end of a calendar quarter, based on a minimum of three recommendations. Firms are grouped into quintiles at the beginning of the next quarter based on the change in consensus. Panel A of Table VII reports summary statistics on the consensus change in each quintile using the 2002 I/B/E/S tape. Over the 1993-1999 period, analysts were slightly more likely to downgrade a firm than upgrade it, as the mean quarterly consensus change equals -0.02.

Panels B and C illustrate the effect of using the 2004 tape instead of the 2002 tape. Panel B reports the fraction of ticker/quarter observations within each quintile (and for the full sample) that are classified in a *different* quintile when using the 2004 tape. On average, a striking 17.4% of the

[21] These numbers are based on our standardized brokerage firm names. If we use I/B/E/S's own brokerage firm names (i.e., "brkcd"), the fraction of misclassified trading signals increases; see the final graph of Figure 1.
[22] We have verified this fact in unreported results.

total ticker/quarter observations, including 13% of the observations in quintiles 1 and 5, migrate to a different quintile on the 2004 tape.

Panel C reports monthly portfolio returns for a simple trading strategy ("Spread") that each month buys stocks in the highest quarterly change quintile (Q5) and shorts stocks in the lowest quarterly change quintile (Q1), with a one-month holding period. We calculate abnormal portfolio returns in two ways: 1) By estimating a "four-factor" alpha (as in Carhart (1997)), and 2) by estimating a "four-factor plus industry" alpha. Four-factor alpha returns (α_j) are computed from the following monthly time-series regression for each portfolio *j*:

$$R_t^j - R_{ft} = \alpha_j + \beta_j (R_{mt} - R_{ft}) + s_j SMB_t + h_j HML_t + u_j UMD_t + \varepsilon_{jt}, \qquad (1)$$

where R_t^j is the month *t* return on portfolio *j*, R_{ft} is the month *t* risk-free rate, R_{mt} is the month *t* return on the CRSP value-weighted index, SMB_t is the month *t* return on a value-weighted portfolio of small stocks minus the month *t* return on a value-weighted portfolio of big stocks, HML_t is the month *t* return on a value-weighted portfolio of high book-to-market stocks minus the month *t* return on a value-weighted portfolio of stocks with low book-to-market, and UMD_t is the month *t* return on a value-weighted portfolio of stocks with high returns from month *t*-12 to month *t*-2 minus the month *t* return on a value-weighted portfolio of stocks with low returns from month *t*-12 to month *t*-2. The "4-factor plus industry alpha" is the intercept from a regression of the monthly portfolio spread return on the four factors above plus industry excess returns (value-weighted excess returns for each of ten industry segments as defined by Kenneth French).

We execute the strategy identically on the 2002 tape and the 2004 tape, and report the differences in results for the two tapes in Panel C. Consistent with prior evidence, the "spread" strategy is a profitable one up until 2000, on both the 2002 and 2004 tapes. Interestingly, however, the strategy performs significantly *better* on the 2004 tape than on the 2002 tape, despite the fact

that the strategy is back-tested here over the exact same time-period. The magnitude of this difference is large: Between 14 and 20 basis points a month, which translates into an improvement of 15.9% to 42.4% on the 2004 tape relative to the performance found on the 2002 tape.

In unreported tests, we find that most of the apparent improvement in the "spread" strategy is due to the additions. Thus, a hypothetical investor who had access to the additions in real time would have outperformed a hypothetical investor who only relied on publicly available recommendations data, such as the I/B/E/S historical recommendations database.

III. The Impact of the Data Changes on Analyst-level Analysis

Recent research highlights potential conflicts of interest in the production of investment research due to the competing roles sell-side analysts play in financial markets. Analysts may respond to institutional incentives such as pressure from investment bankers (Lin and McNichols (1998), Michaely and Womack (1999), Hong and Kubik (2003)), a desire to maintain ties to senior management at the companies they cover (Francis and Philbrick (1993), Lim (2001)), or a desire to generate commissions (Irvine (2004), Jackson (2005)). What is usually cited as the mechanism to keep analysts in check is their incentive to maintain their reputations for accuracy, objectivity, and independence (Stickel (1992), Hong, Kubik, and Salomon (2000), Ljungqvist et al. (2006)). Reputable analysts generate more commission income for their employers (Irvine (2004), Cowen, Groysberg, and Healy (2003), Jackson (2005)), receive higher compensation (Kothari (2001)), and are more likely to be hired by the most prestigious brokerage firms (Hong and Kubik (2003), Hong, Kubik, and Solomon (2000)). Poorly performing analysts, on the other hand, generate less commission income and are more likely to lose their jobs (Mikhail, Walther, and Willis (1999)).

Ultimately, an analyst's reputation is informed by her track record. In this section we investigate the impact of the changes to the I/B/E/S historical recommendations database on the track records and career outcomes of individual analysts.

III.A Pattern Analysis

The alterations, deletions, additions, and anonymizations form a diverse set of patterns at the analyst level, reported in Table VIII. We define a "history" as a sequence of recommendations by analyst *i* for ticker *k*, ordered in calendar time. The most common pattern – accounting for 32% of the 10,698 alterations, 32% of the 4,923 deletions, and 40.4% of the 19,204 additions – is the selective change of individual records within a given history. For instance, we might find that the third and seventh recommendation in a history have been altered, or that the penultimate record has been dropped. By contrast, it is relatively rare that an entire history has been altered, deleted, or added. Nor do the changes typically affect records only at the beginning or only at the end of a history. It is in this sense that alterations, deletions, and additions look selective, which in turn will affect the trading signals an analyst generates and hence her track record.

A majority of anonymizations represent the removal of *entire* histories: 11,642 (8,670+2,972) cases where an analyst's entire history for a ticker has been anonymized (including cases where the analyst covered a ticker only once), and 1,210 cases where every recommendation by an analyst has been anonymized. In addition, 31.7% of the 19,904 anonymized recommendations affect selective parts of an analyst's history, including 1,017 cases where names are missing intermittently.

III.B Track Records of Analysts: Portfolio Returns to Anonymized Recommendations

In this section, we explore the consequences of these distortions to analysts' track records. Specifically, we examine the stock return performance of anonymized and non-anonymized recommendations, for the sample of analysts for whom some but not all of their past recommendations are anonymized. We focus our analysis here on the anonymizations, since our pattern analysis above indicates that the anonymizations are associated with particularly large changes to a given analyst's historical track record; but we also discuss related tests for the other three types of changes below. We formally test the hypothesis that anonymized recommendations

perform differently from non-anonymized recommendations by computing calendar-time buy-and-hold portfolio returns as in Barber, Lehavy, and Trueman (2005) and Barber et al. (2006). For each type of recommendation (anonymized or non-anonymized), we form two portfolios: (1) An "upgrade" portfolio, consisting of all stocks that at least one analyst upgraded to buy or strong buy, from a previous hold, sell, or strong sell recommendation, or initiated coverage on with a buy or strong buy rating; and (2) a "downgrade" portfolio, comprised of all stocks that at least one analyst downgraded to hold, sell, or strong sell, from a previous buy or strong buy recommendation, or initiated coverage on with a hold, sell, or strong sell rating. We include holds in the downgrade portfolio since the distribution of recommendations suggests that many analysts effectively rated stocks on a three-point scale (hold/buy/strong buy).

The construction of these portfolios closely follows the methodology in Barber, Lehavy, and Trueman (2005) and Barber et al. (2006). For each recommendation that is eligible for the upgrade portfolio, for example, the recommended stock enters the portfolio at the close of trading on the day the recommendation is announced. This approach explicitly excludes the announcement day return, on the assumption that many investors likely become aware of recommendation changes only with a delay. Each recommended stock remains in the portfolio until either the stock is downgraded or dropped from coverage by the analyst, for up to one calendar year (after which time the stock is automatically removed from the portfolio). If more than one analyst recommends a particular stock on a given date, the stock will appear multiple times in the portfolio on that date (once for each buy or strong buy recommendation).

Assuming an equal dollar investment in each recommendation, the portfolio return on date t is given by $\sum_{i=1}^{n_t} R_{it} x_{it} / \sum_{i=1}^{n_t} x_{it}$, where R_{it} is the date t return on recommendation i, n_t is the number of recommendations in the portfolio, and x_{it} is the compounded daily return of recommended stock i

from the close of trading on the day of the recommendation through day t-1. (The variable x_{it} equals one for a stock recommended on day t-1.) The portfolio is updated daily, so that stocks that are downgraded or dropped from coverage are taken out of the portfolio at the close of trading on the day of the downgrade/drop. Calendar-time daily returns for the downgrade portfolio are computed in the same manner. We calculate abnormal portfolio returns exactly as in Section II.D, with the exception that the analysis here employs daily returns instead of monthly returns.[23]

Panel A of Table IX presents the average daily abnormal returns to the upgrade portfolios of anonymized and non-anonymized recommendations. Over the entire 1993-2002 sample period, anonymized recommendations significantly underperform non-anonymized recommendations. The abnormal return on a long-short portfolio that goes long non-anonymized recommendations and short anonymized recommendations is statistically significant and economically important, earning alphas of between 1.4 and 1.5 basis points per day (3.6% and 3.8% annualized).

We next divide the sample into two sub-periods: (1) The period of the late 1990s bull market (i.e., the period ending March 10, 2000, the date of the NASDAQ market peak), and (2) the period of the bear market (i.e., the period beginning on March 10, 2000 and extending to the end of our sample). This division reveals an interesting picture, and one that complements recent evidence that analysts were issuing overly optimistic recommendations and forecasts with little regard to fundamentals at the height of the dot-com frenzy (see Hong and Kubik (2003) and Barber, Lehavy, and Trueman (2005)). As columns (5) and (6) of Panel A show, the poor performance of anonymized upgrades-to-buy is particularly pronounced in the post-bubble period, with daily risk-adjusted underperformance ranging from an economically large 2.4 to 2.7 basis points (6.1% to 6.8% annualized). Meanwhile, underperformance by non-anonymized upgrades-to-buy in this

[23] Factors are obtained from Kenneth French's website. In addition to the factors listed in eq. (1), we include one lag of each independent variable in all regressions to control for nonsynchronous trading (Scholes and Williams (1977)).

period is minimal, and statistically insignificant. Abnormal returns on long-short portfolios designed to capture this differential performance between anonymized and non-anonymized upgrades-to-buy are again statistically significant and economically large: Up to 6.6% annualized.

We next refine our tests by focusing on analysts who remain active in the profession after 2002. Panel B of Table IX reports results for this sub-sample of analysts and indicates that, once again, anonymized upgrades-to-buy significantly underperform their benchmarks and their non-anonymized counterparts.[24] The corresponding long-short portfolio earns between 1.5 and 1.6 basis points in daily abnormal returns over the full sample period (3.8% to 4.0% annualized), and between 2.7 and 2.9 basis points in the bear market period (6.7% to 7.4% annualized); the *t*-statistics range between 2.36 and 3.10.

Since our results in Table IV indicate that bolder recommendations are more likely to be anonymized, we also examine the return performance of a sub-sample of "bold" upgrades-to-buy. Specifically, we restrict the sample to recommendations that deviate in absolute terms from the average recommendation for the stock that year by at least one notch (e.g., if the consensus is a hold, a buy recommendation by an analyst would be flagged as bold). Panel C of Table IX shows that anonymized upgrades that are bolder in nature are particularly poor performers, with average underperformance relative to the benchmarks as high as 2.6 basis points in the full sample period (6.7% annualized) and 4.7 basis points in the bear market period (11.9% annualized). Non-anonymized bold upgrades also underperform their benchmarks, but not nearly as dramatically; as a result, the corresponding long-short portfolio earns up to 2.1 basis points in the full sample period (5.2% annualized), and 3.6 basis points in the bear market period (9.1% annualized).

Panel D presents a different picture. In the full sample, and within each sub-period, a portfolio

[24] Screening out analysts with very few or very many anonymizations yields similar results, as does "un-restricting" the sample by comparing the full sample of anonymizations to the full sample of non-anonymized recommendations.

of anonymized downgrades to hold/sell does *not* perform in a statistically or economically different manner from a portfolio of non-anonymized downgrades.[25]

In unreported tests we also replicate these tests for the deletions, additions, and alterations. We find that altered upgrades-to-buy perform significantly worse than non-altered upgrades-to-buy, but the economic significance of this result is modest. We also find some evidence that additions perform better than non-additions (particularly for upgrades in the pre-bubble period), but these results are only marginally statistically significant. Lastly, we find no evidence that the performance of deleted recommendations differs significantly from non-deleted recommendations. Interestingly, searching over a wide variety of specifications, we could not identify a single case where any of the four types of changes was economically or statistically significant in the direction that would *worsen* the track records of the affected analysts. All of these findings could prove problematic for studies of stock-picking skill persistence (see Mikhail, Walther, and Willis (2004)).

III.C Career Outcomes of Analysts

The evidence in Tables IV and IX suggests that it is the boldest, worst performing recommendations that were most prone to be anonymized. As a consequence, the track records of the analysts concerned now look better than they should. In this section, we extend this analysis to study analyst job movements and show that the growing body of academic research into the career concerns of analysts will be affected by the changes we document in the I/B/E/S historical recommendations database.

Our analysis closely follows previous work by Hong, Kubik, and Solomon (2000) and Hong and Kubik (2003) which relates career outcomes (such as changes of employer, promotions, demotions, and exit from the profession) to a total of five measures of analyst ability (forecast accuracy,

[25] Results (not shown) for the sub-sample that excludes potential retirees and for the sub-sample of bold hold recommendations are similar.

forecast optimism, forecast boldness, all-star ranking, and seniority).[26] We add to this list of explanatory variables four indicators identifying analysts whose recommendations have partially been altered, dropped, added to, or anonymized.[27] To the extent that these changes (and in particular, the anonymizations) make an analyst's track record less transparent, we expect some analysts to experience more favorable career outcomes than their characteristics and abilities would ordinarily warrant.

We focus on the group of U.S. based analysts who contributed earnings forecasts to I/B/E/S in 2002 (that is, the individuals whose recommendations are most likely to have changed between the 2002 and 2004 tapes) and follow their career progressions through December 2005. This results in 7,696 analyst-years. Like Hong, Kubik, and Solomon (2000) and Hong and Kubik (2003), we do not observe whether an analyst is fired, demoted, or promoted. We can, however, observe breaks in an analyst's contributions to I/B/E/S (which Hong, Kubik, and Solomon interpret as an adverse career outcome) as well as moves to another employer. We follow Hong, Kubik, and Solomon in calling a promotion a move from a small (fewer than 25 analysts) to a large (25 or more analysts) brokerage firm, and vice versa for a demotion.[28] We also track whether an analyst is rated the top stick picker in her sector in the following spring's *Wall Street Journal* "Best on the Street" awards, which are exclusively based on recommendations data supplied by Thomson Financial and vetted

[26] Hong, Kubik, and Solomon's (2000) relative forecast accuracy is defined as in Section I, while their relative forecast boldness is the scaled rank of the analyst's average *absolute* deviation from the earnings forecast consensus. It is constructed analogously to relative forecast accuracy. For Hong and Kubik's (2003) relative forecast optimism, we set a dummy variable to one if an analyst's forecast for a stock between January 1 and July 1 of year *t* exceeds the consensus forecast; and zero otherwise. The analyst's relative forecast optimism is then defined as the average of the dummy variables over all stocks followed by the analyst in years *t*-2 through *t*.

[27] We conservatively impose a 5% filter on the anonymization indicator variable, such that it equals one if 5% or more of the analyst's recommendations were anonymized. Our results are not sensitive to this coding. They are also not sensitive to the inclusion of anonymizations dating back to the 1990s.

[28] Hong and Kubik report that results are generally robust to other definitions of "high status" employers (including the number of all-star analysts employed and the reputation of the brokerage firm in the IPO market).

by the analysts and brokerage firms.[29]

We code an analyst as leaving the profession if she contributed forecasts to I/B/E/S in year *t* but not in year *t*+1. (Our coding allows the analyst to return in, say, year *t*+2 and so identifies periods of unemployment as temporary exits from the profession.) We similarly track job moves by comparing the identity of the analyst's employer at the end of years *t* and *t*+1. The dataset thus consists of an unbalanced annual panel tracking analysts across brokerage firms over the years 2003 to 2005. To ensure we are tracking the right individuals, we correct thousands of errors in the I/B/E/S Broker Translation ("bran") file primarily using the NASD *BrokerCheck* service and *Nelson's* Directory of Investment Research. The most common error involves an analyst being assigned a new identifier after she has moved to a new employer.[30] Without these corrections, the number of exits from the industry would be vastly overstated while the number of job moves would be understated. We are also careful to take mergers among brokerage firms into account. Mergers result in analysts at the target being assigned to the acquirer's I/B/E/S broker code after the merger, giving the false appearance of a job move.

The aforementioned five measures of analyst ability that Hong, Kubik, and Solomon (2000) and Hong and Kubik (2003) explore are practically orthogonal to each other, with two exceptions: Relatively more accurate analysts tend to be bolder (correlation: 23.5%) and all-stars tend to have been in the industry for longer (correlation: 19.2%). We thus depart from Hong, Kubik, and Solomon by simultaneously including all five measures in our empirical specifications rather than

[29] The *Wall Street Journal* reports, "The data on which the rankings are based were subjected to a rigorous verification process […]. For example, Thomson Financial created a special Web site that allowed analysts to see the underlying data on which they were to be evaluated and request changes in any information they considered inaccurate." (5/12/03)

[30] We make four types of corrections: (1) Around 3,000 cases where an analyst is assigned multiple identifiers, often following a job move or name change; (2) more than 200 cases where two people are assigned the same identifier; (3) nearly 1,000 analysts who have data credited under an incorrect broker code, creating the impression that they moved back and forth between employers; and (4) around 60 cases where the wrong analyst is credited with a recommendation. We also ensure that analyst identifiers are consistent between the recommendations and earnings forecast tapes. Because our merge of the 2002 and 2004 tapes does not condition on analyst identifiers, none of these data clean-ups cause the changes we document, though they allow us to measure analyst characteristics and job moves cleanly.

including them one by one. We do so to conserve space; our results are not sensitive to this choice. We estimate multivariate probits that in addition control for year fixed effects, the log number of stocks the analyst covered in year *t*, and the log number of analysts who covered the analyst's average stock. The latter two variables are included based on Hong, Kubik, and Solomon's argument that analysts who cover few companies, and who face less competition from other analysts, are more likely to score in the tails of the distribution of accuracy, boldness, and optimism.

Table X reports the results. The dependent variable in the first column is an indicator variable equal to one if the analyst changed employers between *t* and *t*+1. The unconditional probability of a job move is 11.5% in our sample. At the means of the other covariates, this increases by a statistically and economically significant 26.6% (to 14.5%) for analysts whose track record through July 2002 has been partly anonymized, and by 16.9% for analysts with data additions. Neither deletions nor alterations affect the likelihood of a job move significantly. Analysts who are more senior, who are bolder relative to their peers in the same sector, who cover more stocks, and whose stocks are covered by fewer rival analysts are significantly less likely to move jobs. The predicted probability of an all-star moving employers in our time period is close to zero (2.2% versus 11.5% for the sample as a whole). The pseudo-R^2 of 3.8% indicates that a substantial portion of the variation in outcomes remains unexplained, though the R^2 rises to 11.3% when we include random brokerage firm effects (not tabulated).[31]

We conclude that analysts with anonymizations and additions are more likely to move jobs, but a job move could be good or bad news depending on whether it amounts to a promotion or a demotion. In the next two columns we focus on moves to a large brokerage firm as a proxy for a favorable career outcome. Controlling for the fact that analysts are less likely to move to a large

[31] Hong, Kubik, and Solomon (2000) and Hong and Kubik (2003) include a full set of brokerage firm fixed effects. As fixed effects probit results in biased coefficient estimates, we have instead investigated random-effects panel probits. Our results are virtually identical statistically and economically whether or not we include random effects.

brokerage firm if they most recently worked for a small brokerage firm (p=0.057), the specification in column (2) shows that the probability of being hired by a large brokerage firm is positively and significantly related to both anonymizations and additions (p<0.001). Economically, anonymization status is the second most significant determinant in this specification (after all-stars, who we saw earlier hardly move anywhere during our sample period): It increases the likelihood of moving to a large brokerage firm by 2.8 percentage points, an increase of 53.5% from the unconditional likelihood of 5.2%.[32] Additions increase that likelihood by 36.1%. More senior analysts, those who make relatively bolder forecasts, and those covering under-researched stocks are significantly less likely to move to a large brokerage firm.

In column (3), we restrict the sample to analysts who work for a small brokerage firm in year t and ask whether anonymization helps them move up to a large brokerage firm in t+1. The relevant sample size here is 2,468 analyst-years. Because all-star status perfectly predicts such a move (every "promotion" involves an all-star) we cannot include it in this specification. If anything, anonymization status now has an even greater effect than before. Analysts whose I/B/E/S records were changed see their chances of moving up to a large brokerage firm improve by 63.5%, from 4.7% to 7.7% (p=0.006). This effect is easily larger than any other in this model, followed by additions, which improve the likelihood by 47.6%.

Columns (4) and (5) repeat the analysis shown in columns (2) and (3) for moves to small brokerage firms. The coefficients estimated for anonymization and addition status are slightly positive but both statistically and economically insignificant in either model. Thus, while a changed track record is associated with promotions, it is unrelated to demotions. Interestingly, analysts whose recommendations were altered are between 20% and 30% more likely to be demoted (with

[32] In unreported tests, we find that the probability of moving to a large brokerage firm peaks when 20 to 30 of an analyst's records have been anonymized.

p=0.05 in column (4) and *p*=0.023 in column (5)). Among the controls, we find that all-stars virtually never move to a small brokerage firm whereas more optimistic analysts and those who cover fewer stocks that are more widely covered are more likely to end up at a smaller house.

In column (6), we investigate temporary or permanent departures from the industry. Analysts are significantly more likely to suffer unemployment or retire from Wall Street if they are not all-stars, or top stock pickers, have been in the industry for longer, or have a reputation for relatively inaccurate research, consistent with the findings reported in Hong, Kubik, and Solomon (2000) and Hong and Kubik (2003). On the other hand, relatively more productive analysts, measured by the number of companies covered, are more likely to remain in employment, especially if there is more competition from other analysts. Controlling for these factors, we find that changes to an analyst's historic recommendations have no effect on the likelihood of leaving the profession.

The final model, reported in column (7), shows that an analyst is more likely to be rated the top stock picker in her sector if some of her recommendations have been dropped (*p*=0.043) or added to (*p*=0.048), increasing her chances by 47.8% and 40.4%, respectively. The effect of anonymizations is large as well, at 41%, but only marginally statistically significant (*p*=0.067).[33] Beyond these, there are only two significant determinants of *WSJ* status: Top stock pickers cover more stocks, and cover stocks that fewer rivals cover, though these effects are somewhat smaller economically.

IV. Conclusions

Our main contribution is to alert researchers to widespread, and previously undocumented, ex post changes to an important financial database. Comparing two snapshots of the entire I/B/E/S analyst stock recommendations database, taken in 2002 and 2004 but each covering the same time period 1993-2002, we identify tens of thousands of changes. We isolate four particular types of

[33] However, the *p*-value becomes 0.047 if we define anonymizers using only recent (2000-2002) anonymizations.

changes which we term alterations, deletions, additions, and anonymizations. Collectively, we identify 54,729 changes to a database originally containing 280,463 observations. The changes appear to affect brokerage firms, analysts, and tickers in a non-random manner.

We demonstrate that the changes have a large and significant effect on several features of the data that are routinely used by academics and practitioners, including: 1) The distribution of recommendations across all stocks and for individual stocks; 2) the bullishness of recommendations at the level of individual brokerage firms; 3) the classification of trading signals such as upgrades and downgrades; 4) consensus recommendations in individual stocks; and 5) the performance track records of individual analysts. We further illustrate the significance of these changes by showing how they affect back-tests of a popular trading strategy and analysts' career outcomes in the three years since the changes occurred.

Much like problems in other financial databases such as CRSP and Compustat have been shown to cause biases in academic research, our findings have important ramifications for existing and future empirical studies of equity analysts.

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Appendix A.

This appendix demonstrates the difficulty of "undoing" the changes we document in the paper. A researcher using today's version of the I/B/E/S historical recommendations database (downloaded on November 13, 2006) could obviously not undo the deletions or additions without access to a historic snapshot of the data, such as our 2002 tape. In theory, there are ways to potentially undo the anonymizations and alterations, but such fixes are incomplete and cannot be accomplished without introducing errors into the data.

A. Anonymizations

Thomson Financial have stated that users of the recommendations database can repopulate the missing analyst names from the I/B/E/S earnings forecast database. The feasibility of this procedure requires: 1) Consistent coverage across the databases; 2) consistent analyst codes; and 3) that the relevant observations are not also anonymized on the earnings tape. When we simulate this procedure, we find that only 48.7% of the anonymized recommendations have a named earnings forecast for the same standardized broker name, ticker, and date, 4.2% of which are incorrect matches compared to the historical 2002 tape. Widening the match window results in further matches but also increases the error rate. Within a 180-day (30-day) window either side of the recommendation date, names can be found for 80.1% (52.5%) anonymized recommendations, 7.2% (4.4%) of which are incorrect matches. Thus, around a quarter of anonymized recommendations cannot be reliably identified using the I/B/E/S earnings forecast database.

Thomson Financial have informed us that they will repopulate the missing analyst names in response to our enquiries, but the data on WRDS do not yet reflect this as of December 18, 2006.

B. Alterations

As noted in the text, the broker recommendation text field does not always change when an I/B/E/S recommendation level is altered. In these cases, it may be possible to use the broker text to

recreate the original 2002 recommendation. However, there is an inherent difficulty with this approach in that there is no one-to-one mapping between broker text categories and I/B/E/S recommendation levels *even among non-altered recommendations*. (38% of brokers without altered records map more than one broker text category to a single I/B/E/S recommendation level.)

Ignoring this practical difficulty, by virtue of the fact that we *know* which recommendations were actually altered, we find that 25.7% of the alterations are accompanied by broker text changes.

C. Deletions

The text documents the removal of 4,923 historical recommendations as of 2004. Surprisingly, by 2006, approximately one-half of these deletions have been *reversed* and thus re-appear in the current database. On the other hand, there are an additional 6,268 deletions of records from the 1993-2002 period that occurred between 2004 and 2005. Most of these (93%) result from the removal of five brokers from the database.

The frequent adding and deleting of historical records imply that the recommendations database has been unstable over time, making comparisons across time difficult.

Figure 1. Changes to Trading Signals.

The 2002 I/B/E/S tape contains 280,463 investment recommendations issued between October 1993 and July 18, 2002. We match up the 2002 and 2004 tapes by standardized broker name, I/B/E/S ticker, and recommendation date. Observations on the 2004 tape dated after July 18, 2002 are ignored. Trading signals are constructed on a per-broker and per-I/B/E/S-ticker basis using a twelve-month look-back window. For instance, an upgrade (downgrade) is defined as a positive (negative) change from a recommendation issued by the same broker for the same I/B/E/S ticker within the previous twelve months. Reiterations are repeated recommendations at the same recommendation level. If the previous recommendation was issued more than twelve months ago, the current recommendation is defined to be a reinitiation. If there is no previous recommendation, the current recommendation is defined to be an initiation. The graphs show the annual fraction of trading signals that are classified differently if the 2004 tape is used instead of the 2002 tape. Initiations and reinitiations are included in the two "All trading signals…" graphs, which differ from each other depending on whether recommendations are arranged by our standardized broker name, or the I/B/E/S brokerage firm code ("brkcd").

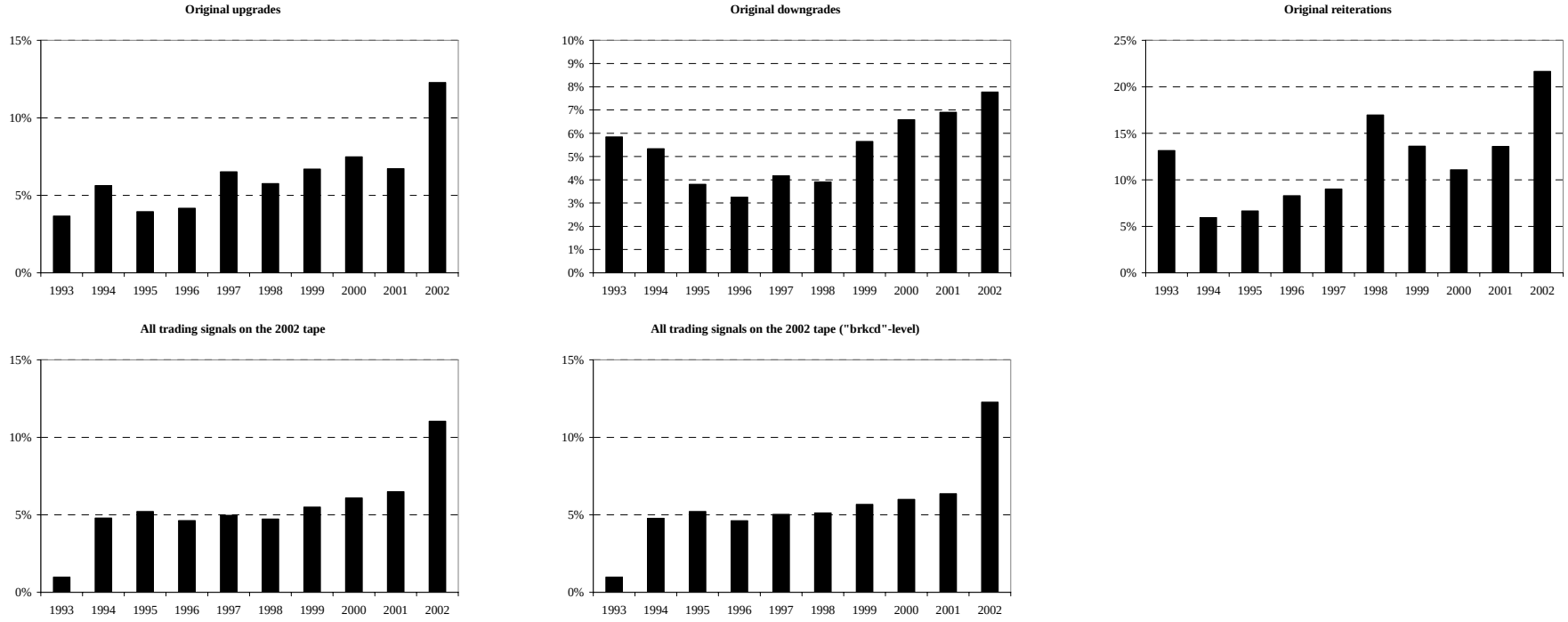

Table I. Summary Statistics for Alterations, Deletions, Additions, and Anonymizations.

The 2002 I/B/E/S tape contains 280,463 investment recommendations issued between October 1993 and July 18, 2002. We match up the 2002 and 2004 tapes by standardized broker name, I/B/E/S ticker, and recommendation date. Observations on the 2004 tape dated after July 18, 2002 are ignored. We define an alteration as a record that has a different recommendation level according to the two tapes (i.e., a change from strong buy, buy, hold, underperform, sell); a deletion as a record that appears on the 2002 tape but not on the 2004 tape; an addition as a record that appears on the 2004 tape but not on the 2002 tape; and an anonymization as a record attributed to a specific analyst on the 2002 tape whose name is missing on the 2004 tape (and whose *amaskcd* identifier has been set to zero). We exclude from our analysis 22,240 additions by brokerage firms that did not contribute data to I/B/E/S according to the 2002 tape, appeared on the 2004 tape, and have since been dropped from I/B/E/S again. On closer inspection, these are quantitative research shops which produce algorithmic recommendations that are constrained to be symmetrically distributed.

Panel A: Breakdown of Types of Change By Year

	Entire 2002 sample	Alterations		Deletions		Altered or deleted	Additions		Anonymizations		Total changes ex post
	No.	No.	%	No.	%	%	No.	%	No.	%	No.
Total	280,463	10,698	3.8%	4,923	1.8%	5.6%	19,204	6.8%	19,904	7.1%	54,729
1993	14,428	754	5.2%	91	0.6%	5.9%	1,459	10.1%	1,045	7.2%	3,349
1994	28,204	961	3.4%	313	1.1%	4.5%	2,773	9.8%	2,006	7.1%	6,053
1995	29,364	954	3.2%	330	1.1%	4.4%	2,206	7.5%	2,276	7.8%	5,766
1996	28,260	1,027	3.6%	365	1.3%	4.9%	1,946	6.9%	2,118	7.5%	5,456
1997	28,885	933	3.2%	417	1.4%	4.7%	1,454	5.0%	2,161	7.5%	4,965
1998	33,453	1,302	3.9%	682	2.0%	5.9%	1,513	4.5%	2,335	7.0%	5,832
1999	34,879	1,174	3.4%	748	2.1%	5.5%	2,572	7.4%	2,435	7.0%	6,929
2000	30,868	1,248	4.0%	602	2.0%	6.0%	2,147	7.0%	2,395	7.8%	6,392
2001	30,339	1,337	4.4%	511	1.7%	6.1%	2,557	8.4%	1,928	6.4%	6,333
2002	21,783	1,008	4.6%	864	4.0%	8.6%	577	2.6%	1,205	5.5%	3,654

Panel B: Breakdown of Distribution of Recommendations by Type of Change

			Alterations									
	2002 tape		Pre-alteration		Post-alteration		Deletions		Additions		Anonymizations	
Rec. level	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
All	280,463		10,698		10,698		4,923		19,204		19,904	
1 (strong buy)	80,260	28.6	3,314	31.0	4,432	41.4	2,586	52.5	3,923	20.4	5,896	29.6
2	102,904	36.7	5,302	49.6	3,413	31.9	1,363	27.7	4,738	24.7	7,204	36.2
3	88,199	31.4	1,486	13.9	1,205	11.3	883	17.9	9,166	47.7	6,108	30.7
4	4,644	1.7	136	1.3	1,093	10.2	28	0.6	951	5.0	367	1.8
5 (strong sell)	4,456	1.6	460	4.3	555	5.2	63	1.3	426	2.2	329	1.7
Mean	2.11		1.98		2.06		1.70		2.44		2.10	

Panel C: Breakdown of Alterations by Direction of Alteration

	No. of alterations	Mean alteration	Distribution of alterations (negative = downgrade)					Ratio: downgrade/ upgrade
			-2	-1	1	2	3	
Total	10,698	-0.075	749	4,630	5,311	7	1	1.01
1993	754	-0.050	114	225	415			0.82
1994	961	-0.101	118	352	491			0.96
1995	954	0.149	86	277	591			0.61
1996	1,027	-0.046	94	396	537			0.91
1997	933	-0.076	90	367	476			0.96
1998	1,302	-0.131	96	592	614			1.12
1999	1,174	0.068	69	444	660	1		0.78
2000	1,248	-0.119	53	619	575	1		1.17
2001	1,337	-0.108	17	716	603	1		1.21
2002	1,008	-0.304	12	642	349	4	1	1.85

Table II. Summary Statistics: Brokerage Firm Characteristics.

The 2002 I/B/E/S tape contains 280,463 investment recommendations issued between October 1993 and July 18, 2002 by 7,817 separate named analysts working for 385 distinct brokerage firms. For each of the four types of changes to the 1993-2002 recommendations data, we split the 385 brokerage firms into two groups depending on whether any of their recommendations have been altered, deleted, added to, or anonymized. (Sixteen firms already only had anonymous recommendations on the 2002 tape, leaving 369 brokerage firms whose recommendations could be subject to anonymization.) Equity underwriting market share is used as a proxy for the size of the firm's investment banking operations and is based on data from Thomson Financial/SDC's U.S. New Issues database. The number of analysts at each brokerage firm is used as a proxy for the size of the firm's research department and is based on the number of separate named analysts who contribute recommendations to I/B/E/S in 2002. A brokerage firm is deemed to have exited sell-side research if by 2002 it no longer contributes data to I/B/E/S. Sanctioned brokerage firms are the 12 firms that were subject to the 2003 Global Settlement.

	Alterations?		Deletions?		Additions?		Anonymizations?	
	Yes	No	Yes	No	Yes	No	Yes	No
Number of brokerage firms	64	321	118	267	130	255	239	130
Brokerage firm size in 2002								
mean equity underwriting market share	1.3%	0.0%	0.8%	0.0%	0.7%	0.0%	0.4%	0.0%
mean # analysts at brokerage firm	42.3	5.6	32.9	2.3	21.4	1.3	18.4	0.8
Exited sell-side research by 2002?								
Yes	1	104	7	98	11	94	0	89
No	63	217	111	169	119	161	239	41
Sanctioned in Global Settlement?								
Yes	9	3	12	0	12	0	12	0
No	55	318	106	267	118	255	227	130
Investment banking operations in 2002?								
Yes	29	37	48	18	57	9	61	4
No	35	284	70	249	73	246	178	126

Table III. Summary Statistics: Analyst Characteristics.

The 2002 I/B/E/S tape contains 280,463 investment recommendations issued between October 1993 and July 18, 2002 by 7,817 separate named analysts working for 385 distinct brokerage firms. For each of the four types of changes to the 1993-2002 recommendations data, we split the 7,817 analysts into two groups depending on whether any of their recommendations have been altered, deleted, added to, or anonymized. The number of analysts at each brokerage firm is used as a proxy for the size of the firm's research department and is based on the number of separate named analysts who contribute recommendations to I/B/E/S in 2002. Equity underwriting market share is used as a proxy for the size of the firm's investment banking operations and is based on data from Thomson Financial/SDC's U.S. New Issues database. Sanctioned brokerage firms are the 12 firms that were subject to the 2003 Global Settlement. Analyst characteristics are reported as of 2002 or the date of the analyst's retirement (exit from I/B/E/S) if earlier. All-stars are analysts ranked as a top-three or runner-up analyst in their sector by *Institutional Investor*. A *Wall Street Journal* top stock picker is the first-ranked analyst in each industry. Relative forecast accuracy is a measure of the analyst's average forecast accuracy across the stocks she has covered in the three years to July 2002 (or in the three years to the date of her retirement, if she has left the industry before July 2002) relative to the other analysts covering the same stocks. It is constructed as in Hong, Kubik, and Salomon (2000) and ranges from 0 to 1, with a higher number indicating greater forecast accuracy. As a proxy for seniority, we compute the number of years since the analyst first appeared in the I/B/E/S database. Analysts are deemed to remain in the profession post-2002 if they contribute recommendations to I/B/E/S in 2003 through 2005. This may undercount the number of analysts who remain in the profession. We use *** and ** to denote significance at the 0.1% and 1% level, respectively, in *t*-tests of differences in means or proportions, as appropriate. NM = "not meaningful".

	Alterations?			Deletions?			Additions?			Anonymizations?		
	Yes	No	*t*-test	Yes	No	*t*-test	Yes	No	*t*-test	Yes	No	*t*-test
Number of analysts	940	6,877		870	6,947		1,874	6,059		2,137	5,680	
Panel A: Number of recommendations												
Number of changed recommendations per analyst												
Mean	10.9	0	NM	5.5	0	NM	7.7	0	NM	9.3	0	NM
Min	1	0	NM	1	0	NM	1	0	NM	1	0	NM
Median	5	0	NM	2	0	NM	3	0	NM	2	0	NM
Max	128	0	NM	103	0	NM	138	0	NM	311	0	NM
Fraction of analyst's recommendations changed												
Mean	31.7%	0	NM	17.6%	0	NM	40.2%	0	NM	29.5%	0	NM
Median	22.2%	0	NM	6.7%	0	NM	13.0%	0	NM	12.9%	0	NM
Panel B: Employer characteristics												
Mean # analysts at brokerage firm in 2002	70.0	98.6	***	85.1	96.4	***	58.9	68.9	***	96.7	94.5	-
Mean 2002 equity underwriting market share	1.9%	3.8%	***	3.0%	3.7%	***	2.8%	3.9%	***	3.6%	3.6%	-
Fraction working at a sanctioned brokerage firm	23.6%	42.6%	***	34.6%	41.0%	***	40.1%	41.3%	-	39.7%	40.5%	-

Table III. Continued.

	Alterations?			Deletions?			Additions?			Anonymizations?		
	Yes	No	*t*-test	Yes	No	*t*-test	Yes	No	*t*-test	Yes	No	*t*-test
Panel C: Analyst characteristics												
Fraction of analysts ranked all-stars	10.5%	15.3%	***	16.8%	14.4%	-	17.2%	13.7%	***	16.6%	14.0%	**
Fraction of analysts ranked top stock pickers	1.2%	0.5%	**	1.1%	0.5%	***	0.9%	0.4%	**	0.9%	0.4%	**
Mean relative forecast accuracy	47.9%	47.5%	-	48.0%	47.5%	-	48.9%	47.0%	***	48.8%	47.1%	**
Mean seniority (years in I/B/E/S database)	7.9	7.1	***	7.7	7.1	**	8.1	6.9	***	7.9	6.9	***
Mean # recommendations in I/B/E/S	56.4	31.9	***	64.3	31.2	***	52.4	28.8	***	54.0	27.7	***
Panel D: Post-2002 career paths												
Fraction of analysts remaining in profession post-2002	69.9%	51.1%	***	75.6%	50.7%	***	58.8%	50.8%	***	70.8%	46.9%	***
Fraction of changed recommendations originally made by analysts who remain in the industry post-2002	65.5%	n.a.	NM	71.3%	n.a.	NM	49.1%	n.a.	NM	84.7%	n.a.	NM

Table IV. Characteristics of Altered, Dropped, Added, or Anonymized Recommendations.

The unit of observation in this table is a recommendation, issued between October 1993 and July 18, 2002. The dependent variable is an indicator variable that equals one (1) if the record has been altered (i.e., it has a different recommendation level according to the two tapes); (2) if the record has been deleted (i.e., it appears on the 2002 tape but not on the 2004 tape); (3) if the record is an addition (i.e., it appears on the 2004 tape but not on the 2002 tape); or (4) if the record has been anonymized (i.e., if the name of the recommending analyst was disclosed on the 2002 I/B/E/S tape but no longer appears on the 2004 I/B/E/S tape); and zero otherwise. Boldness, defined as the absolute difference between the level of the recommendation and the consensus, is measured using the 2002 data (i.e., before alterations, deletions, or additions); it is thus not defined for additions. Whether the brokerage firm has exited sell-side research by 2002 is a perfect predictor of anonymization, and hence is not included in column (4). Other explanatory variables are defined in Tables II and III. All models are estimated using probit MLE and include random brokerage firm effects. Intercepts and dummies identifying the year in which the recommendation was originally made are not shown. Standard errors are shown in italics. Note that random-effects probit does not support a White or cluster adjustment for heteroskedasticity. We use ***, **, and * to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

	Alter-ations (1)	Deletions (2)	Additions (3)	Anonymi-zations (4)
Analyst characteristics				
relative forecast accuracy	-0.183	-0.200*	0.091	-0.487***
	0.129	*0.087*	*0.065*	*0.059*
=1 if analyst is ranked an *Inst. Investor* all-star in Oct 2001	-0.779***	-0.088*	-0.123**	0.280***
	0.067	*0.034*	*0.043*	*0.038*
=1 if analyst is top stock picker in *WSJ* in June 2002	0.038	-0.039	0.314***	0.156**
	0.099	*0.099*	*0.067*	*0.054*
seniority (log years in I/B/E/S)	0.092**	0.058*	0.192***	0.049**
	0.035	*0.024*	*0.021*	*0.019*
ln(analyst's no. of recommendations)	0.045*	0.001	-0.238***	-0.104***
	0.021	*0.016*	*0.012*	*0.012*
=1 if analyst still active post-2002	-0.017	0.222***	0.247***	0.674***
	0.045	*0.033*	*0.023*	*0.021*
Brokerage firm characteristics				
investment banking size (% eq. underwriting mkt share, 2002)	0.003	-0.043	-0.028**	-0.057
	0.014	*0.033*	*0.010*	*0.389*
size of research department (log no. analysts at broker in 2002)	0.294***	0.326***	0.181***	0.169***
	0.038	*0.065*	*0.032*	*0.050*
=1 if brokerage firm sanctioned in Global Settlement	-1.209***	-0.481	-0.311***	-0.079
	0.183	*0.408*	*0.055*	*0.074*
=1 if brokerage firm exited sell-side research by 2002	-0.646*	0.583*	-0.092***	
	0.292	*0.232*	*0.257*	
Characteristics of company/recommendation				
boldness of original recommendation	0.380***	-0.078***		0.041**
	0.024	*0.021*		*0.013*
=1 if company has IB relationship with brokerage firm	-0.040	-0.062	-0.178*	-0.023
	0.085	*0.051*	*0.079*	*0.081*
ln(aggregate amount of capital company raised in prior 5 years)	0.004	-0.006	-0.020***	0.001
	0.005	*0.004*	*0.003*	*0.003*
Diagnostics				
Pseudo R^2	75.8 %	55.3 %	60.8 %	47.3 %
Wald test: all coefficients=0 (χ^2)	1,113***	1,009***	1,031***	1,510***
Likelihood ratio test: all random effects = 0 (p-vale of χ^2 test)	<0.001	<0.001	<0.001	<0.001
Number of observations	258,587	258,587	283,227	258,587

Table V. Effect of Alterations, Additions, and Deletions on the Distribution of Recommendations for 1993-2002 History.

The 2002 I/B/E/S tape contains 280,463 investment recommendations issued between October 1993 and July 18, 2002. We match up the 2002 and 2004 tapes by standardized broker name, I/B/E/S ticker, and recommendation date. Observations on the 2004 tape dated after July 18, 2002 are ignored. We define an alteration as a record that has a different recommendation level according to the two tapes (i.e., a change from strong buy, buy, hold, underperform, sell); a deletion as a record that appears on the 2002 tape but not on the 2004 tape; and an addition as a record that appears on the 2004 tape but not on the 2002 tape. Panel A provides a breakdown of the distribution of recommendations by the strength of the rating (using the I/B/E/S five-point scale) for the 2002 tape, each of the three types of changes, and the resulting 2004 tape. The mean recommendation level shown in the final row is computed as the frequency weighted recommendation. The distribution of changes shown in the final column refers to the distribution of the net differences between the 2002 and the 2004 tapes. In Panel B we compute the proportion of recommendations for a given I/B/E/S ticker in a given year that are buys (including strong buys), holds, or sells (including strong sells). There are 49,097 ticker-years on the 2002 tape, with an average of 5.7 recommendations per ticker and year. All entries in this table refer to the average company in a given year. Results for the median company are similar. As the first block of Panel B shows, the recommendation distribution for the average ticker-year becomes more conservative in the wake of the alterations, additions, and deletions to the 2002 tape: For the average ticker, the proportion of buys decreases by one percentage point, while the proportion of holds and sells increases by 0.4 and 0.6 percentage points, respectively. In a given year, the majority of tickers experience no change in their recommendation distribution; see the middle block of Panel B. The third block shows the change in the proportion of buys, holds, or sells conditional on each such change. For instance, the proportion of sells increased by 11 percentage points among the 11.7% of tickers with changes in the proportion of sells in 1993. Thus, by construction, the mean conditional changes in the proportion of buys, holds, and sells in the third block do not add up to zero. Panel C shows the effect of the changes on the distribution of recommendations at the level of individual brokerage firms. We rank brokerage firms every quarter based on the fraction of their end-of-quarter outstanding recommendations that are buys or strong buys and group them into quintiles, using data from either the 2002 tape or the 2004 tape. The Panel traces the migrations into different quintiles when we switch from the 2002 tape to the 2004 tape. For instance, 18.7% of the most bullish brokers on the 2002 tape migrate into another quintile on the 2004 tape. The unequal numbers of quintile constituents are caused by ties.

Panel A: Effect of Changes on Overall Distribution

	Distribution of 1993-2002 history on 2002 tape		Distribution of 1993-2002 history on 2004 tape		Distribution of net differences between 2002 and 2004 tape	
Rec. level	No.	%	No.	%	Net difference	% of net difference
All	280,463		294,744		14,281	
1 (strong buy)	80,260	28.6%	82,715	28.1%	2,455	17.2%
2	102,904	36.7%	104,390	35.4%	1,486	10.4%
3	88,199	31.4%	96,201	32.6%	8,002	56.0%
4	4,644	1.7%	6,524	2.2%	1,880	13.2%
5 (strong sell)	4,456	1.6%	4,914	1.7%	458	3.2%
Mean	2.11		2.14		2.75	

Panel B: Effect of Changes on Ticker-Level Distributions

		Mean percentage point change in proportion of			Fraction of I/B/E/S tickers with changes in proportion of			Mean conditional percentage point change in proportion (conditional on change in proportion) of		
	No. tickers	buys	holds	sells	buys	holds	sells	buys	holds	sells
1993	3,629	-0.6	-0.7	1.3	26.7%	29.4%	11.7%	-2.3	-2.3	11.0
1994	4,610	-0.5	-0.3	0.7	29.1%	30.8%	14.1%	-1.6	-0.9	5.2
1995	4,903	-0.2	-0.4	0.6	26.8%	28.1%	11.2%	-0.9	-1.3	5.4
1996	5,430	-0.7	0.2	0.5	22.7%	24.2%	8.5%	-3.0	0.9	5.5
1997	5,627	-1.5	0.9	0.6	18.0%	19.7%	5.8%	-8.4	4.6	10.4
1998	5,773	-1.4	0.9	0.4	18.9%	20.5%	5.4%	-7.2	4.5	8.0
1999	5,623	-1.3	0.7	0.6	25.8%	27.4%	8.3%	-5.0	2.6	6.8
2000	5,114	-1.6	1.1	0.5	25.1%	26.6%	6.4%	-6.4	4.2	7.3
2001	4,481	-1.6	1.1	0.5	30.9%	31.5%	9.0%	-5.3	3.6	5.4
2002	3,907	-0.2	-0.1	0.3	19.1%	19.5%	6.9%	-1.0	-0.7	4.9
1993-2002	49,097	-1.0	0.4	0.6	24.1%	25.5%	8.5%	-4.1	1.6	6.8

Panel C: Migrations in Quarterly Broker-recommendation Quintiles (2002 tape vs. 2004 tape)

	2002 tape	All changes		**Quintile according to 2004 tape**				
	No.	No.	%	Q1	Q2	Q3	Q4	Q5
Quintile as of 2002 tape								
Q1 (most bullish)	1,644	307	18.7%		114	85	67	41
Q2	1,001	194	19.4%	85		44	45	20
Q3	1,309	290	22.2%	13	214		36	27
Q4	1,352	257	19.0%	10	23	181		43
Q5 (most conservative)	1,234	146	11.8%	6	13	25	102	
All broker-quarters	6,540	1,194	18.3%	114	364	335	250	131

Table VI. Effect of Alterations, Additions, and Deletions on Trading Signals and Broker-level.

The 2002 I/B/E/S tape contains 280,463 investment recommendations issued between October 1993 and July 18, 2002. We match up the 2002 and 2004 tapes by standardized broker name, I/B/E/S ticker, and recommendation date. Observations on the 2004 tape dated after July 18, 2002 are ignored. We define an alteration as a record that has a different recommendation level according to the two tapes (i.e., a change from strong buy, buy, hold, underperform, sell); a deletion as a record that appears on the 2002 tape but not on the 2004 tape; and an addition as a record that appears on the 2004 tape but not on the 2002 tape. Panel A provides a breakdown of the distribution of trading signals for the 2002 tape, each of the three types of changes, and the resulting 2004 tape. Trading signals are constructed on a per-broker and per-I/B/E/S-ticker basis using a twelve-month look-back window. For instance, a downgrade is defined as a negative change from a recommendation issued by the same broker for the same I/B/E/S ticker within the previous twelve months. If the previous recommendation was issued more than twelve months ago, the current recommendation is defined to be a reinitiation. If there is no previous recommendation, the current recommendation is defined to be an initiation. Note that the net number of changed trading signals is less than the sum of the trading signals that are changed due to alterations, additions, and deletions, as some changes cancel each other out. The distribution of changes shown in the final column of Panel A refers to the distribution of the net differences between the 2002 and the 2004 tapes. Panel B provides a transition matrix for the changed trading signals from 2002 to 2004.

Panel A: Effect of Changes on the Distribution of Trading Signals

	Distribution of 2002 tape		Distribution of alterations				Distribution of deletions		Distribution of additions		Distribution of 2004 tape		
			Pre-alteration		Post-alteration								
Trading signal	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	Net changes
All signals	280,463		10,698		10,698		4,923		19,204		294,744		
downgrade	56,464	20.1%	1,568	14.7%	1,063	9.9%	603	12.2%	5,215	27.2%	60,316	20.5%	27.0%
upgrade	46,843	16.7%	1,525	14.3%	580	5.4%	1,211	24.6%	2,312	12.0%	49,271	16.7%	17.0%
reiteration	21,950	7.8%	834	7.8%	2,284	21.4%	966	19.6%	1,794	9.3%	25,622	8.7%	25.7%
initiation	103,235	36.8%	4,673	43.7%	4,673	43.7%	1,357	27.6%	6,794	35.4%	105,774	35.9%	17.8%
reinitiation	51,971	18.5%	2,098	19.6%	2,098	19.6%	786	16.0%	3,089	16.1%	53,760	18.2%	12.5%

Panel B: Migrations in Trading Signals (2002 tape vs. 2004 tape)

	2002 tape	All changes		Trading signal according to 2004 tape					
Trading signal as of 2002 tape	No.	No.	%	downgrade	upgrade	reiteration	initiation	reinitiation	deleted
downgrade	56,464	2,981	5.3%		137	1,797	263	181	603
Upgrade	46,843	2,913	6.2%	68		1,581	11	42	1,211
reiteration	21,950	2,420	11.0%	457	935		22	40	966
initiation	103,235	4,811	4.7%	902	1,014	630		908	1,357
reinitiation	51,971	2,475	4.8%	365	942	271	111		786
added in 2004		19,204		5,215	2,312	1,794	6,794	3,089	
all signals on 2002 tape	280,463	34,804	12.4%	7,007	5,340	6,073	7,201	4,260	4,923

Table VII. Effect of Alterations, Additions, and Deletions on Consensus Recommendations.

This table reports descriptive statistics based on consensus analyst recommendations for the pre-2000 period. We use all I/B/E/S recommendations that have been outstanding for less than one year. Recommendations are reverse-scored from 5 (strong buy) to 1 (strong sell). The consensus recommendation for a ticker equals the mean outstanding recommendation at the end of a calendar quarter, based on a minimum of three recommendations. Firms are grouped into quintiles at the beginning of the next quarter based on the change in consensus. Panel A reports summary statistics on the consensus change in each quintile using the 2002 I/B/E/S tape (all "no change" observations are included in Q3). Estimates are formed once a quarter, in cross section. We aggregate the quarterly estimates and report the time-series mean. Panel B reports the fraction of ticker/quarter observations in each change quintile (and for the full sample) that are classified in a *different* quintile when using the 2004 I/B/E/S tape. Panel C reports monthly portfolio returns for a simple trading strategy ("Spread") that each month buys stocks in the highest change quintile (Q5) and shorts stocks in the lowest change quintile (Q1), with a one-month holding period. The "4-factor alpha" is the intercept from a regression of monthly portfolio spread returns on (i) the excess of the market return over the risk-free rate, (ii) the difference between the monthly returns of a value-weighted portfolio of small stocks and one of large stocks (SMB), (iii) the difference between the monthly returns of a value-weighted portfolio of high book-to-market stocks and one of low book-to-market stocks (HML), and (iv) the difference between the monthly returns of a value-weighted portfolio of high price momentum stocks and one of low price momentum stocks (UMD). The "4-factor plus industry alpha" adds industry excess returns to the regression (i.e., value-weighted excess returns for each of ten industry segments as defined by Kenneth French). The strategy is performed separately on the 2002 tape and the 2004 tape, and differences between the two tapes are reported. *t*-statistics are in parentheses.

Panel A: Consensus Recommendation Change Quintiles (Change = Current – Prior)

Quintile on 2002 tape	Mean no. obs	Mean	Std dev	Minimum	Maximum
Best=Increase (Q5)	536.30	0.43	0.043	0.32	0.49
Q4	439.65	0.11	0.018	0.07	0.14
Q3	644.48	-0.00	0.006	-0.02	0.00
Q2	516.83	-0.14	0.032	-0.21	-0.08
Worst=Decrease (Q1)	516.04	-0.52	0.058	-0.64	-0.36
Mean of 23 quarterly samples	2653.30	-0.02	0.021	-0.09	0.02

Panel B: Migrations in Quarterly Consensus Change Quintiles (2002 tape vs. 2004 tape)

	2002 tape	All changes		**Quintile according to 2004 tape**				
Quintile on 2002 tape	No.	No.	%	Q5	Q4	Q3	Q2	Q1
Q5 (=increase)	12,335	1,605	13.0%		1,082	350	97	76
Q4	10,112	2,367	23.4%	1,004		689	599	75
Q3	14,823	2,436	16.4%	376	828		930	302
Q2	11,887	2,646	22.3%	103	624	878		1,041
Q1 (=decrease)	11,869	1,544	13.0%	84	58	248	1,154	
All ticker-quarters	61,026	10,598	17.4%	1,567	2,592	2,165	2,780	1,494

Panel C: Monthly Portfolio Returns (in %) from Consensus Change Quintiles (2002 tape v. 2004 tape)

	Consensus increase (Q5) portfolio return	Consensus decrease (Q1) portfolio return	Spread (Q5-Q1) in raw returns	Spread (Q5-Q1) in 4-factor a	Spread (Q5-Q1) in4-factor plus industry a
2002 tape	1.872	0.98	0.892	0.482	0.462
	(-3.06)	(-1.53)	(-5.60)	(-3.82)	(-3.05)
2004 tape	1.882	0.847	1.034	0.65	0.658
	(-3.08)	(-1.32)	(-6.25)	(-4.70)	(-4.08)
Difference (2004 minus 2002)			0.142	0.168	0.196
			(-2.08)	(-2.14)	(-2.15)
% difference rel. to 2002 tape			15.9%	34.9%	42.4%

Table VIII. Patterns of Changes at the Analyst-ticker Level.

The table examines the patterns of the alterations, deletions, additions, and anonymizations at the analyst level. We define a "history" as a sequence of recommendations by analyst *i* for ticker *k*, ordered in calendar time. Reported percentages do not sum to 100% because histories consisting of two recommendations are excluded in this table if only one of the two records is affected by the changes.

		Alterations		Deletions		Additions		Anonymizations	
	row	No.	%	No.	%	No.	%	No.	%
All affected records		10,698		4,923		19,204		19,904	
Affected records represent:									
all I/B/E/S records by the analyst	(1)	418	3.9%	382	7.8%	622	3.2%	1,210	6.1%
instances where an analyst covered a ticker only once	(2)	2,617	24.5%	543	11.0%	2,324	12.1%	2,972	14.9%
an analyst's entire history for a ticker	(3)	1,181	11.0%	770	15.6%	2,407	12.5%	8,670	43.6%
an analyst's history for a ticker after a certain date	(4)	975	9.1%	793	16.1%	1,584	8.2%	1,724	8.7%
an analyst's history for a ticker before a certain date	(5)	750	7.0%	394	8.0%	2,201	11.5%	3,572	17.9%
selective records from an analyst's history for a ticker	(6)	3,419	32.0%	1,573	32.0%	7,757	40.4%	1,017	5.1%

Table IX. Portfolio Performance of Anonymized and Non-Anonymized Recommendations.

This table reports average daily percentage buy-and-hold abnormal returns for portfolios of upgraded buy recommendations (which includes upgrades to buy or strong buy from a previous hold, sell, or strong sell recommendation, and initiations with a buy or strong buy rating) and portfolios of downgraded hold/sell recommendations (which includes downgrades to hold, sell, or strong sell from a buy or strong buy, and initiations with a hold, sell, or strong sell rating), for all anonymized recommendations and non-anonymized recommendations by analysts who anonymized at least one of their recommendations (but not all). Corresponding *t*-statistics are in parentheses. Panel A reports the results for the full sample of upgrade recommendations, Panel B reports the results for the sub-sample of recommendations by those analysts who by 2002 had not left the industry, and Panel C reports the results for the sub-sample of recommendations that are "bold" (i.e., they deviate in absolute terms from the consensus by at least one notch). Panel D reports the results for the full sample of downgrade recommendations. Columns (1) and (2) report the average daily abnormal returns for the entire sample period (October 29, 1993 to July 18, 2003); Columns (3) and (4) and columns (5) and (6) report the average daily abnormal returns for the period through March 10, 2000 (the date of the NASDAQ market peak) and the period subsequent to March 10, 2000, respectively. The "4-factor alpha" is the intercept from a regression of the daily portfolio excess return on (i) the excess of the market return over the risk-free rate, (ii) the difference between the daily returns of a value-weighted portfolio of small stocks and one of large stocks (SMB), (iii) the difference between the daily returns of a value-weighted portfolio of high book-to-market stocks and one of low book-to-market stocks (HML), and (iv) the difference between the daily returns of a value-weighted portfolio of high price momentum stocks and one of low price momentum stocks (UMD). The "4-factor plus industry alpha" is the intercept from a regression of the daily portfolio excess return on (i)-(iv) plus (v) industry excess returns (value-weighted excess returns for each of ten industry segments as defined by Kenneth French). To control for non-synchronous trading, all regressions also include one-day lags of each of the independent variables.

	10/29/1993 to 07/18/2003		10/29/1993 to 03/10/2000		03/11/2000 to 07/18/2003	
	4-factor α	4-factor plus Industry α	4-factor α	4-factor plus industry α	4-factor α	4-factor plus industry α
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Upgrades to buy, all analysts with at least one anonymized recommendation						
Anonymized (a)	-0.0107	-0.0100	0.0001	-0.0006	-0.0269	-0.0243
	(-1.78)	(-1.71)	(0.02)	(-0.09)	(-2.09)	(-1.90)
Non-Anonymized (b)	0.0043	0.0042	0.0100	0.0084	-0.0033	0.0017
	(0.98)	(1.00)	(2.29)	(2.12)	(-0.34)	(0.18)
(b) – (a)	0.0149	0.0142	0.0099	0.0089	0.0236	0.0260
	(2.97)	(2.87)	(1.96)	(1.78)	(2.12)	(2.38)
Panel B: Upgrades to buy, all analysts with at least one anonymized recommendation (excluding possible retirees)						
Anonymized (a)	-0.0083	-0.0099	0.0006	-0.0020	-0.0214	-0.0207
	(-1.40)	(-1.72)	(0.10)	(-0.36)	(-1.69)	(-1.65)
Non-Anonymized (b)	0.0074	0.0053	0.0104	0.0076	0.0053	0.0085
	(1.60)	(1.21)	(2.18)	(1.83)	(0.54)	(0.90)
(b) – (a)	0.0157	0.0152	0.0098	0.0097	0.0267	0.0292
	(3.10)	(3.06)	(1.95)	(1.94)	(2.36)	(2.65)
Panel C: "Bold" upgrades to buy, all analysts who anonymized at least one recommendation						
Anonymized (a)	-0.0257	-0.0264	-0.0191	-0.0191	-0.0419	-0.0474
	(-2.89)	(-3.01)	(-2.12)	(-2.15)	(-2.16)	(-2.45)
Non-Anonymized (b)	-0.0052	-0.0089	-0.0059	-0.0066	-0.0059	-0.0121
	(-1.01)	(-1.86)	(-1.13)	(-1.40)	(-0.55)	(-1.19)
(b) – (a)	0.0206	0.0176	0.0132	0.0125	0.0360	0.0354
	(2.35)	(2.01)	(1.49)	(1.41)	(1.90)	(1.84)
Panel D: Downgrades to hold/sell, all analysts who anonymized at least one recommendation						
Anonymized (a)	-0.0067	-0.0132	-0.0079	-0.0121	-0.0160	-0.0236
	(-1.04)	(-2.18)	(-1.26)	(-2.06)	(-1.18)	(-1.78)
Non-Anonymized (b)	-0.0029	-0.0061	-0.0071	-0.0079	-0.0041	-0.0092
	(-0.68)	(-1.50)	(-1.88)	(-2.29)	(-0.42)	(-0.98)
(b) – (a)	0.0038	0.0072	0.0008	0.0042	0.0119	0.0144
	(0.72)	(1.39)	(0.14)	(0.80)	(1.08)	(1.30)

Table X. The Effect of Alterations, Deletions, Additions, and Anonymizations on Subsequent Career Outcomes, 2003-2005.

This table estimates the effect of alterations, deletions, additions, and anonymizations on analysts' subsequent career outcomes. The unit of analysis is an analyst-year. We focus on analysts on the 2002 I/B/E/S tape; analysts who entered the profession after 2002 are ignored. The dependent variable equals one if the analyst that year changed jobs (col. (1)), moved to a 'large' brokerage firm employing 25 or more analysts (cols. (2) and (3)), moved to a 'small' brokerage firm with fewer than 25 analysts (cols. (4) and (5)), exited the industry (i.e., ceased to contribute research to I/B/E/S the following year; col. (6)), or was rated the top stock picker in her sector in the following year's *Wall Street Journal* "Best on the Street" survey (col. (7)). The sample in col. (7) is restricted to analysts who are eligible for the WSJ survey, which we approximate as analysts who cover a minimum of five stocks in the relevant calendar year. Relative forecast accuracy and boldness are defined as the analyst's scaled rank (relative to other analysts covering the same stocks) of deviations between forecast and subsequent earnings realization and of the absolute deviation from the earnings forecast consensus, respectively, while relative forecast optimism is defined using a dummy variable = 1 if the analyst's forecast for a stock exceeds consensus. Each measure is averaged across stocks she covers in years *t*-2 through year *t*; see Hong, Kubik, and Solomon (2000) and Hong and Kubik (2003). Other explanatory variables are defined in Tables II-IV. All models are estimated using probit. To conserve space, intercepts and year fixed effects are not shown. Results are robust to including random brokerage firm effects to control for otherwise omitted heterogeneity arising from differences across brokerage firms. Standard errors, shown in italics, are clustered by analyst (i.e., observations are assumed to be independent across analysts but not necessarily within). We use ***, **, and * to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

Table X. Continued.

	Changes jobs	Promotion: Moves to large brokerage firm from …		Demotion: Moves to small brokerage firm from …		Exits industry	Becomes WSJ top stock picker
		… any firm	… small firm	… any firm	… small firm		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
=1 if analyst's recommendations were …							
… altered	0.058	-0.035	0.062	0.128*	0.188*	0.009	0.084
	0.054	*0.070*	*0.119*	*0.065*	*0.083*	*0.057*	*0.106*
… dropped	-0.014	-0.089	-0.224	0.056	0.104	0.032	0.192*
	0.056	*0.075*	*0.133*	*0.065*	*0.089*	*0.056*	*0.095*
… added	0.104*	0.181***	0.243*	0.009	0.035	0.076	0.172*
	0.046	*0.057*	*0.101*	*0.058*	*0.079*	*0.048*	*0.087*
… anonymized	0.159***	0.254***	0.305**	0.033	0.036	-0.008	0.170
	0.050	*0.062*	*0.112*	*0.061*	*0.079*	*0.052*	*0.093*
=1 if analyst is ranked *II* all-star	-0.740***	-0.387***		-1.400***	-1.385***	-0.658***	-0.091
	0.098	*0.104*		*0.308*	*0.313*	*0.093*	*0.115*
=1 if analyst is top stock picker	-0.271	-0.289	-0.178	-0.158	-0.088	-1.045**	
	0.187	*0.251*	*0.451*	*0.231*	*0.310*	*0.382*	
seniority (log years in I/B/E/S)	-0.083*	-0.214***	-0.230**	0.032	-0.007	0.135***	-0.040
	0.034	*0.045*	*0.080*	*0.040*	*0.054*	*0.033*	*0.069*
relative forecast accuracy	-0.026	0.278	0.473	-0.198	-0.140	-0.359*	0.556
	0.170	*0.227*	*0.400*	*0.196*	*0.237*	*0.156*	*0.371*
relative forecast optimism	0.165	-0.019	0.053	0.227	0.282	-0.041	-0.216
	0.107	*0.141*	*0.256*	*0.126*	*0.159*	*0.099*	*0.255*
relative boldness	-0.596***	-0.570*	-0.295	-0.451*	-0.362	-0.182	0.558
	0.178	*0.226*	*0.400*	*0.211*	*0.259*	*0.171*	*0.366*
ln(analyst's no. of stocks covered)	-0.157***	0.030	0.067	-0.262***	-0.359***	-0.914***	0.325***
	0.033	*0.044*	*0.083*	*0.037*	*0.049*	*0.034*	*0.100*
ln(no. of analysts covering same stocks)	0.214***	0.274***	0.427***	0.138**	0.244***	0.266***	-0.294***
	0.039	*0.051*	*0.084*	*0.046*	*0.067*	*0.040*	*0.075*
= if analyst worked at small broker in *t*-1		-0.104		0.277***			
		0.055		*0.047*			
Diagnostics							
Pseudo R^2	3.8 %	3.8 %	6.3 %	6.2 %	8.5 %	17.0 %	3.7 %
Wald test: all coefficients=0 (χ^2)	166.2***	109.4***	60.6***	159.1***	117.7***	876.5***	44.2***
Number of observations	7,696	7,696	2,468	7,696	5,228	7,696	6,804