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Regulations and Brain Drain: Evidence from Wall Street Star Analysts' Career Choices

Abstract

The Global Settlement, along with related regulations in the early 2000s, prohibit the use of investment banking revenue to fund equity research and compensate equity analysts. We find that all-star analysts from investment banks are more likely to exit the profession or move to the buy side after the regulations. The departed star analysts' earnings revisions and stock recommendations are more informative than those of the remaining analysts who followed the same companies. To the extent that star analysts are superior to their non-star counterparts in terms of research ability and ability to inform the market, the exit of star analysts represents a brain drain in the sell-side equity research industry. These results are consistent with the view that the regulations introduced to protect equity investors have unintended adverse effects on the investors due to a brain drain in investment banks.

JEL classification:

Keywords: analysts, turnover, brain drain, the Global Settlement, Sarbanes-Oxley Act, policy and regulations, investment banks

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1. Introduction

Sell-side analysts from investment banks have long been suspected of issuing overly optimistic stock research in exchange for investment banking business, especially during the Internet bubble period in the late 1990s (e.g., Becker 2001; Morgenson 2001). Regulators implemented a series of reforms from 2002 to 2003 to address the conflicts of interest in equity research. One of the provisions of the Global Research Analyst Settlement and Section 501 of the Sarbanes-Oxley Act require investment banks to physically separate their investment banking and research departments and to restrict interaction between them. In particular, banks' senior management must set the budget of the research department without input from investment bankers and without tying the budget to investment banking revenue. Investment bankers cannot take part in evaluating analysts' job performance or determining their compensation. Research analysts are prohibited from participating in investment banking activities or receiving compensation related to investment banking.

The restrictions imposed in the above reforms have led to a significant reduction in the bonuses and total compensation of sell-side analysts. For example, Groysberg et al. (2011) show that the median real bonuses for sell-side analysts in a big investment bank decreased from $940,007 in 2001 to $450,000 in 2005, although median real base salaries stayed roughly at $175,000 during the same period. Such a decrease in compensation may cause a brain drain in investment banks and the sell-side research profession if high-ability

analysts exit sell-side research to pursue other lucrative opportunities in other industries (Institutional Investor 2007; O'Leary 2007; Pizzani 2009).

In this study, we examine whether star analysts depart from the sell-side investment research industry as a consequence of the reforms. Star analysts have been substantially affected by such regulations, as they are mostly involved with their firms' investment banking activities and their compensation, especially bonuses, was largely tied to investment banking revenue (Krigman et al. 2001; Groysberg et al. 2011). With a significant cutoff in their compensation, it is likely that star analysts would exit sell-side equity research to pursue other lucrative career opportunities. We treat star analysts as a representative group of the best performers in the profession and, hence, we consider their departure as evidence of a brain drain in the sell-side investment research industry.[1]

Over the period from 1995 through 2007, we find that the percentage of investment bank star analysts leaving the sell side increases from 5.1% before the regulations to 11.8% afterward. Investment bank star analysts are more likely than their non-star counterparts to leave sell-side research in the post-reform period, holding constant the analysts' forecast accuracy, optimism, experience, and affiliation. This result is robust to controlling for the confounding effects of the decrease in the investment banking revenue of banks and the change in investors' sentiment. These findings suggest that it has become more difficult for investment banks and the sell-side research industry to retain star analysts since the

[1] "Brain drain," a term of British origin, often refers to the departure of skilled professionals who leave their native lands to seek more promising opportunities elsewhere (Kwok and Leland 1982). We use this term to describe star analysts leaving equity research for other industries. In this paper we focus on the *Institutional Investor* (II) ranking to identify star analysts. The II magazine has published the All-America Research Team ranking since 1972. Many prior studies have examined II star analysts. We follow this stream of the literature to examine the career choices of star analysts who are considered to be superior in certain dimensions (see Section 2.2). We believe that the loss of star analysts who possess superior skills represents a brain drain to the equity research industry. Section 6 discusses empirical evidence consistent with investors valuing the research of star analysts more than that of their peers.

reforms. To further investigate the loss of investment banking bonuses as an explanation for the departure of star analysts, we test whether the reforms have a more pronounced effect on star analysts specialized in industries with a high level of investment banking activities. We observe that the likelihood and propensity of star analysts to exit sell-side research is positively associated with investment banking revenue in the core industry of the star analysts.

The final test of our conjecture involves tracking the career choices of the departed star analysts. We document that after the reforms, there is a significant jump in the percentage of investment bank star analysts moving to buy-side hedge funds, private equity firms, or venture capital firms. In particular, 31.1% of the departed star analysts moved to the buy side after the reforms, compared with 24.1% in the pre-reform period. We repeat the same set of empirical analyses on a sample of star analysts from non-investment banks, including independent research firms, brokerage firms, and syndicate banks.[2] As non-investment banks have no or very little investment banking business, they are less affected by the reforms. We do not find an increase in the likelihood of non-investment bank star analysts exiting the sell side or moving to the buy side after the reforms. These findings provide triangulating evidence that the loss of investment-banking-related bonuses is a reason for the departure of investment bank star analysts.

The departure of star analysts is potentially harmful to the investors who use the analysts' research (Mattlin 2007; Pizzani 2009). We compare the informativeness of the earnings forecast revisions and stock recommendations issued by the departed star analysts with those issued by other analysts following the same companies or the analysts from the

[2] Syndicate bank analysts are only involved in distribution and, hence, face few investment banking incentives. The results are unchanged if syndicate bank analysts are excluded.

same brokerage firms replacing the departed star analysts. The informativeness of earnings forecast revisions and stock recommendations is measured by the short-term market responses to these revisions or recommendations. We show that the departed star analysts provide more informative research than both benchmarking groups. Specifically, the market reacts more positively (negatively) to the upward (downward) forecast revisions and recommendation changes issued by the departed star analysts than those issued by replacing analysts. We also find that departing star analysts are more likely to issue industry recommendations. In addition, the market reacts more positively (negatively) to the upward (downward) industry recommendation changes issued by departed star analysts than those issued by other analysts. The results are consistent with departing star analysts having more industry knowledge. Collectively, these findings suggest that star analysts contribute to the informational efficiency of the capital market and that their departure caused by the reforms may lead to the loss of the information generated by the analysts from being fully impounded into stock prices.[3]

We add to the overall understanding of the economic consequences of the regulations in the equity research industry. Prior research has shown that these regulations have made analysts' stock recommendations less upwardly biased (e.g., Barber et al. 2006; Kadan et al. 2009; Guan et al. 2012) and more consistent with valuation based on analysts' earnings forecasts (Barniv et al. 2009; Bradshaw 2009; Chen and Chen 2009), and have also reduced

[3] Although the buy-side firms that hire the star analysts would trade on the research conducted by the star analysts, the informational efficiency of the capital market may be affected. Specifically, if these buy-side firms make trades that are not large enough to fully impound the information into stock prices, the stock market will become less efficient with respect to the information that is privy to the buy-side firms. Moreover, brain drain may benefit large investors and their clients on the buy side (e.g., hedge funds) but certain investors (e.g., individuals) who rely on high-quality equity research from sell-side analysts may be harmed. This may lead to wealth transfer from small investors to their larger counterparts. Such a wealth transfer effect is implicit compared to the direct wealth transfer due to the misleading behavior of some analysts documented in De Franco, Lu, and Vasvari (2007).

security mispricing (Lee et al. 2014). However, Boni and Womack (2002) and Boni (2006) suggest that the reforms cause research departments to reduce their coverage and the quality of their research. As Mehran and Stulz (2007) point out, it is important to identify and measure all of the costs and benefits to conduct a fair and comprehensive evaluation of the regulations.[4] In this study, we identify an unintended economic consequence of the reforms, namely that the regulations are associated with a brain drain in investment banks and the sell-side equity research industry. We believe the brain drain effect should be considered in an overall assessment of the efficacy of the reforms.

This study also contributes to the stream of literature investigating the career concerns of financial analysts. Prior studies have shown that analysts' career outcomes are affected by their forecast accuracy, optimism, and experience (Mikhail et al. 1999; Hong et al. 2000; Hong and Kubik 2003; Wu and Zang 2009). We show that compensation is a factor that leads to the departure of the best analysts from the sell-side investment research profession. Annual pay for top analysts fell to approximately one quarter by 2008 from its peak in 2000 (Robinson 2009). We provide systematic evidence supporting the notion that the reforms affect the career choices of star analysts when the reforms reduce the earnings potential of sell-side analysts. More broadly, our study adds to the labor economics literature by demonstrating how regulations and compensation shocks affect human capital flows. Deuskar et al. (2011) and Kostovetsky (2017) examine whether good mutual fund managers would leave for hedge funds and reach different conclusions. Our study contributes to the debate by showing that a brain drain indeed occurs following a

[4] The Securities and Exchange Commission (SEC) once joined sanctioned investment banks in seeking the removal of the required separation of investment banking and research departments, suggesting that the SEC acknowledged the adverse effects imposed on investment banks. The motion was rejected in court (Craig and Scannell 2010). See also Brakke (2010).

compensation shock in the investment research industry. In the mutual fund industry, good managers can be retained by allowing them to manage a hedge fund concurrently (Deuskar et al. 2011). Such an alternative may be difficult to find in the investment research industry.

Section 2 discusses the institutional background and hypothesis development. Section 3 describes our sample and data. Section 4 presents our analysis modeling the propensity of the star analysts to depart from the sell-side research industry after the reforms. Section 5 investigates the career choices of star analysts after leaving sell-side research. Section 6 examines the potential loss to investors who rely on the research of the departed star analysts. Section 7 provides additional analyses and robustness tests to rule out the effect of Regulation FD. Section 8 concludes the paper.

2. Institutional Background and Hypothesis Development

2.1 The Global Settlement and Related Reforms

The decade of the 1990s is often referred to as the "Age of the Analysts" (Nocera 1997; Cole 2001; Hong and Kubik 2003). Both individual investors and institutional fund managers relied on the research of financial analysts to trade or generate deals. It was a common practice for investment banks to compensate research analysts if they helped the banks generate deals through their research. However, growing conflict-of-interest concerns led Congress to hold "Analyzing the Analysts" hearings to protect investors from losing money as a result of biased research reports (Kane 2002; Hong and Kubik 2003; Kadan et al. 2009).

Following the hearings, regulators implemented a series of reforms to address the conflicts of interest in equity research. In May 2002, the U.S. Securities and Exchange

Commission (SEC) approved amendments to New York Stock Exchange Rule 351 (reporting requirements) and Rule 472 (communications with the public) and the National Association of Securities Dealers' new Rule 2711 (Research Analysts and Research Reports). These new amendments established stringent restrictions on analyst compensation, the relationships between research and investment bank divisions, the communications with the companies that analysts cover, and personal trading by analysts. For example, the amendments prohibit analyst compensation that is based on specific investment banking deals or any promise of favorable research for the receipt of business or compensation. In addition, the amendments require analysts to disclose all conflicts of interest, such as whether they were compensated based on the revenue from investment banking divisions and whether their employers received or expected to receive compensation for any investment banking services from the companies that research analysts cover. All financial analysts must also report the percentage recommendations in "sell," "hold /neutral," and "buy" categories (Kadan et al. 2009).

In July 2002, the U.S. Congress passed the Sarbanes-Oxley Act, Section 501 of which also addresses analysts' conflicts of interest. Investment banks must separate their investment banking and research departments and restrict interaction between them. In particular, banks' senior management must set the budget of the research department without using input from investment bankers and without tying the budget to investment banking revenues. Investment bankers cannot take part in evaluating analysts' job performance or determining their compensation. Research analysts are also prohibited from participating in investment banking activities or receiving compensation related to investment banking.

The SEC further proposed enforcement actions against 10 top U.S. investment banks in December 2002 and the Global Research Analyst Settlement was finalized in April 2003. The investigations of these sanctioned banks started in June 2001, when many well-known research analysts, such as Mary Meeker and Henry Blodget, were criticized for issuing favorable ratings that contributed to the stock price crash of Internet companies. All of the sanctioned investment banks were found to have had inappropriate influences on their research analysts. These investigations ultimately led to sanctions on the investment banks and the Global Settlement, including $1.435 billion in penalties and fines.

Prior studies suggest that these reforms have had a significant effect on the capital market. For example, Kadan et al. (2009) document that the overall informativeness of analyst recommendations has decreased since the Global Settlement. Sell-side analysts are more likely to issue neutral and pessimistic recommendations, which became less informative during the post-reform period. Consistent with their findings, Clarke et al. (2011) and Dong and Hu (2016) question the overall benefit for investors by showing that sell-side analysts are less likely to issue informative recommendations after the reforms. In addition, Mahaney-Walter (2015) finds that the Global Settlement causes many investment banks to lose their market share in equity issuance.

2.2 Hypothesis Development

The series of conflict-of-interest regulations has significantly reduced the compensation of sell-side analysts. Using compensation data from a leading Wall Street investment bank, Groysberg et al. (2011) document that median analyst compensation (expressed in 2005 dollars) declined from the peak of $1,148,835 in 2001 to $647,500 in 2005. Although median real base salaries stayed roughly the same ($175,000), median bonuses decreased

from $940,007 in 2001 to $450,000 in 2005. This significant drop in compensation may cause a brain drain in the sell-side research and investment banking profession if high-quality analysts leave the sell-side research industry to pursue other lucrative opportunities.[5]

Star analysts are voted by institutional investors based on a number of features, such as industry knowledge, special services, earnings reports, and stock recommendations (Bagnoli et al. 2008). Prior research has presented evidence that star analysts are superior to their non-star peers. In addition to broader industry knowledge, star analysts provide more accurate and timely earnings forecasts (e.g., Stickel 1992; Gleason and Lee 2003; Bonner et al. 2007; Leone and Wu 2007). Their status and coverage affect the market share of equity offerings of investment banks, and their forecasts suffer less from conflicts of interest due to their concerns for their personal reputations (e.g., Dunbar 2000; Krigman et al. 2001; Clarke et al. 2007; Bagnoli et al. 2008; Fang and Yasuda 2009).[6]

Consistent with the notion that star analysts possess higher ability (or are valued more by their employers), Groysberg et al. (2011) find that star analysts receive 61% higher

[5] Actual compensation data for both sell- and buy-side industries are not publicly available. Hence, we rely on anecdotal evidence and survey data to infer whether compensation is higher on the buy side than the sell side. A 2007 CFA member compensation survey (Institutional Investor 2007) suggests that the three highest paid positions are portfolio managers ($456,000), investment bankers ($275,000), and sell-side research analysts ($195,000). *Institutional Investor* (II 2007), *Investment Dealer Digest* (O'Leary 2007), *Bloomberg Markets* (Robinson 2009), and *CFA Magazine* (Pizzani 2009) discuss a decrease in sell-side analyst compensation and expect sell-side analysts to move to the buy side.

[6] We focus solely on *Institutional Investor* (II) star analysts, who have been studied extensively in the literature and are based on votes submitted by buy-side professionals. If their research and services were valued by a large number of buy-side professionals, their departure would be a loss to these buy-side professionals (i.e., they are the immediate victims of brain drain). *The Wall Street Journal* (WSJ) publishes the "Best on the Street" analyst ranking, which is based on the performance of analyst stock recommendations. Emery and Li (2009) examine both the II and WSJ rankings. They find that both rankings are largely based on the visibility of the analysts, rather than the performances of their stock recommendations and earnings forecasts. Their latter finding is consistent with II putting more weight on analyst industry knowledge and special services for buy-side clients than on stock recommendations and earnings forecasts (Bagnoli et al. 2008).

total compensation and 100% higher bonuses than their unranked counterparts. Although higher compensation may simply reflect that star analysts usually take part in their firms' investment banking activities (Krigman et al. 2001), their involvement in investment banking activities is an indication that they have certain attributes that are considered desirable by both the investment banks and their clients.

Preventing analysts from receiving bonuses related to investment banking revenue is expected to lead to a significant reduction in the total compensation of star analysts and may therefore cause them to leave the sell side for other, more profitable opportunities. We treat star analysts as a representative group of the best performers in the profession and, hence, their departure is considered a brain drain in the sell-side investment research profession.[7] However, investment banks can also try to retain their star analysts by increasing their compensation, transferring them to another division with higher firm-wide bonuses, or promoting them to managerial positions. In this case, we may not be able to observe a significant increase in the departure of star analysts from the sell-side investment research industry as a consequence of the series of reforms.

Summarizing the preceding discussions, we state our hypothesis in an alternative form as follows.

Hypothesis: Star analysts who work at investment banks are more likely to exit sell-side research firms during the post-Global Settlement period than non-star analysts.

3. Sample and Data

[7] The II ranking is based on the votes of buy-side professionals. As their research and services are valued by a large number of buy-side professionals, the departure of star analysts is a loss to these buy-side professionals (the immediate victims of brain drain).

Our initial sample comes from the I/B/E/S and covers the period from January 1995 to December 2007. We divide the sample period into two sub-periods: the pre-reform period (January 1995 to December 2001) and the post-reform period (January 2004 to December 2007). We examine the effect of the reforms on analysts' career choices between the pre- and post-reform periods. The reforms became effective from 2002 to 2003. In our robustness checks, we repeat our analyses, including 2002 and 2003 to the post-reform period, and the results are robust.[8]

We retrieve all analysts' earnings forecast and stock recommendation data from Thomson Financial's I/B/E/S database. We use the 2006 I/B/E/S translation file to identify the affiliation of each equity analyst and the name of each brokerage firm, which provides us with a sample spanning from January 1995 through December 2007.[9]

We define an analyst as a star if he/she is on *Institutional Investor*'s All-America Research Team in a particular year or in at least one of the last two years (Soltes 2014).[10] *Institutional Investor* publishes the list annually in its October issue and the ranking is based on the votes of buy-side portfolio managers.

Our final sample consists of the equity analysts from both investment banks and non-investment banks. Although the main focus of this study is on investment bank star analysts, we use star analysts from non-investment banks to provide counterfactual evidence to supplement our main tests. Investment banks are firms classified as investment

[8] We discuss our results using different sample periods in Section 7.2.

[9] The I/B/E/S stopped providing the translation file for academic research after 2006. We use the 2006 translation file to identify analyst affiliations in 2007. Hence, we may lose new investment banks (and their analysts) that were added to the I/B/E/S in 2007. For our research question, the effect of including 2007 is minimized unless we anticipate new analysts joining the profession, winning the star analyst title, and leaving the profession in the same year.

[10] In robustness tests, we redefine star analyst using a one-year or a two-year window (current and previous year). Our finding is robust. See the online appendix.

banks by Nelson's Directory of Investment Research and identified as lead or co-lead underwriters by Thomson Financial's SDC database. Non-investment banks include independent research firms, brokerage firms, and syndicate banks. Independent research firms are firms listed as such by Nelson and are not found in the SDC database as lead/co-lead underwriters or manager/co-managers. Brokerage firms are firms classified by Nelson as major institutional brokers, major or small regional brokers, or investment banks/brokers that are not identified as lead/co-lead underwriters or managers/co-managers by the SDC database. Syndicate banks are firms listed by Nelson as either investment banks or brokers and identified by the SDC database as managers or co-managers, but not as lead or co-lead underwriters. Syndicate banks are only involved in distribution of new stocks and hence face few investment banking incentives.

Table 1 reports the number of analysts, investment banks, and companies covered each year in our sample period for investment banks. Columns (1) to (3) show that the number of investment bank analysts ranges from a high of 3,536 in 2002 to a low of 2,218 in 1995 and stays at approximately 3,100 from 2004 to 2007. The number of investment banks is also quite stable and ranges from a high of 131 in 1999 to a low of 91 in 1995. The number of companies covered by investment banks increases from 5,024 in 1995 to 6,830 in 1998 and then decreases to 4,735 in 2003. It increases gradually afterward. The pattern reflects the change of the concentration of analysts following over time.[11]

Columns (4) to (6) report the same information for non-investment banks. Although there are more non-investment banks than investment banks during the sample period

[11] The change in the number of brokers can drive the change in the number of analysts. To rule out this possibility, we use a sample with a constant group of brokers in both the pre- and post-reform periods and our results are robust (see the online appendix).

(1,622 versus 1,446, respectively), the number of analysts from non-investment banks is smaller than that from investment banks. As a result, non-investment banks cover fewer stocks than investment banks (42,285 versus 72,802 firm-years, respectively).

4. Effects of the Regulations on Star Analysts' Career Choices

We examine the departure of star analysts from the sell-side investment research industry as a consequence of the reforms. An analyst is identified to have left the sell-side research profession in a particular year if he/she made earnings forecasts in that year but stopped issuing forecasts the following year, according to data from the I/B/E/S. We further verify and confirm his/her departure from sell-side research using Nelson's Directory of Investment Research.

Panel A of Table 2 presents summary statistics on the number of star analysts by year and firm type. This panel also reports the number and percentage of star analysts who left the sell-side investment research industry. The number of investment bank star analysts increases from 220 in 1995 to 394 in 2003, but starts decreasing afterward and reaches 301 in 2007. Column (3) shows that the percentage of investment bank star analysts who left the industry is less than 8% in the first seven years of our sample period (i.e., the pre-reform period), peaks at 14.3% in 2002, and stays relatively high thereafter. Panel B indicates that an average of 5.1% and 11.8% of star analysts left the industry during the pre- and post-reform periods, respectively. In contrast, we observe no change in the percentage of star analysts from non-investment banks leaving the sell-side research profession in the post-reform period. Specifically, column (6) of Panel B reports that 12.5% of non-investment bank star analysts left the sell side in the pre-reform period, compared with 12.4% in the

post-reform period. Excluding the first three years, which have no star analysts, the percentage of star analysts from non-investment banks actually drops from 23.3% to 12.4%. Overall, these preliminary statistics are consistent with the reforms having a differential effect on the career choices of investment bank and non-investment bank star analysts.[12]

We conjecture that the rise in the percentage of star analysts who left investment banks and sell-side research after the reforms may be attributable to the loss of bonuses tied to investment banking revenue. We note that Wu and Zang (2009) investigate the effect of 76 mergers in the financial industry from 1994 to 2004 on the career outcomes of sell-side analysts. They find that accurate analysts are more likely to turn over and star analysts are more likely to be promoted to executive positions. However, only three, one, and two mergers were completed in 2002, 2003, and 2004, respectively. Hence, our results are probably not driven by the phenomenon documented by Wu and Zang (2009).[13]

4.1 Logistic Regression Analysis of Star Analysts' Propensity to Exit

To formally examine the effect of the reforms on the loss of star analysts from the sell-side research industry, we use logistic regression analysis to estimate the propensity of analysts to exit sell-side research firms. The regression model is specified as follows:

$$Pr(LeftSell\text{-}Side = 1) = \alpha_0 + \alpha_1 \times D + \alpha_2 \times STAR + \alpha_3 \times D \times STAR + \alpha_4 \times TOPACCU + \alpha_5 \times BOTACCU + \alpha_6 \times RFOPT + \alpha_7 \times EXPERIENCE + \alpha_8 \times BROKERSIZE + \alpha_9 \times NIND + \alpha_{10} \times NFIRM + \alpha_{11} \times SANCTIONED + \alpha_{12} \times LOGFEE + \alpha_{13} \times SENTIMENT + \varepsilon, \quad (1)$$

[12] The number of II star analysts varies across years, as the number of industries covered by the magazine varies across years. The II magazine does not cover the same set of industries, as some industries go in and out of coverage over time.

[13] To rule out the possibility that the decrease in the number of investment banks explains analyst departures, we rerun the regressions using a constant sample of brokers over our sample period. The untabulated results show that our conclusion is not affected by holding the sample of brokers constant (see Section 7.3 for details).

where *LeftSell-Side* is an indicator variable that equals 1 in the last year that an analyst makes a forecast in I/B/E/S and 0 otherwise. *D* is an indicator variable that equals 1 in the post-reform period and 0 otherwise. *STAR* is an indicator variable that equals 1 for analysts who are on the *Institutional Investor* All-America Research Team in the current year or in at least one of the last two years and 0 otherwise.[14]

Equation (1) is a difference-in-differences regression model, which is used to address potential confounding time effects that affect all analysts. In particular, it allows us to compare the change in the propensity of star analysts to leave sell-side research in the post-reform period with that of their non-star counterparts. The positive coefficient of *D*×*STAR*, the difference-in-differences estimate, is consistent with star analysts exhibiting a larger increase, relative to their non-star peers, in their propensity to leave the sell side in the post-reform period.

We control for other factors that may affect the propensity of analysts to leave the sell-side research industry. Mikhail et al. (1999) and Hong et al. (2000) find that forecast accuracy and experience are associated with job separation. Hong and Kubik (2003) also show that forecast optimism affects job separation, especially for analysts who cover stocks underwritten by their firms. Hence, we control for annual earnings forecast accuracy, forecast optimism, and forecast experience in the logistic regression.

In particular, accurate forecasters may leave the industry for other lucrative opportunities and poorly performing analysts may be fired. Following Hong and Kubik (2003) and Wu and Zang (2009), we include *TOPACCU* and *BOTACCU* in the logistic regression. *TOPACCU* (*BOTACCU*) is an indicator variable that equals 1 if the analyst's

[14] Our results are robust if we define the leaving year as the first year that an analyst does not have a forecast in I/B/E/S (see the online Appendix).

relative forecast accuracy score is in the top 10% (bottom 10%) of all analysts and 0 otherwise. Similar to these studies, we measure relative forecast accuracy for each analyst *i* as the analyst's average forecast accuracy in year *t*, $Accuracy_{it}$. $Accuracy_{it}$ is computed by averaging $Accuracy_{ijt}$ across all companies followed by analyst *i* in period *t*:

$$Accuracy_{ijt} = 100 - 100 \times \left\{ \frac{Rank_{ijt} - 1}{NumberFollowing_{jt} - 1} \right\},$$

where $Rank_{ijt}$ is analyst *i*'s forecast accuracy rank for company *j* in period *t*. $NumberFollowing_{jt}$ is the number of analysts following company *j* in period *t*. We use the last forecast made by each analyst for the same company and forecast period. By construction, this measure controls for differences in the composition of companies followed by the analysts and for differences in the forecasting period.

We calculate the relative annual forecast optimism, *RFOPT*, as in Cowen et al. (2006), using the following equation:

$$RFOPT_{ijt}^{t-k} = \frac{FORECAST_{ijt}^{t-k} - \overline{FORECAST_{jt}^{t-k}}}{STDDEV(FORECAST_{jt}^{t-k})},$$

where $FORECAST_{ijt}^{t-k}$ is analysts *i*'s forecast of company *j*'s performance for period *t*, as of *t-k*. $\overline{FORECAST_{jt}^{t-k}}$ and $STDDEV(FORECAST_{jt}^{t-k})$ are, respectively, the average and standard deviation of all forecasts for company *j* and period *t*, as of *t-k*.[15] We only compute $RFOPT_{ijt}^{t-k}$ for companies that are followed by at least three analysts, and we only use the first forecast made by each analyst for the same company and forecast period. $RFOPT_{ijt}^{t-k}$

[15] We winsorize forecast optimism at the 1st and 99th percentiles, as some standard deviations (i.e., the deflator) are extremely small. The results are qualitatively similar if we scale this measure by stock price.

is then averaged across all companies followed by analyst *i* in period *t* to compute analyst *i*'s average relative forecast optimism at period *t*, $RFOPT_{it}^{t-k}$. By construction, this measure controls for company- and time-specific factors that affect forecast optimism across analysts.

Analyst experience, *EXPERIENCE*, is the average number of years an analyst has issued earnings forecasts or recommendations for the companies he/she follows. Broker size, *BROKERSIZE*, is the natural logarithm of the number of analysts employed by the sell-size firm. *NIND* is the natural logarithm of the number of two-digit SIC industries that the analyst follows. *NFIRM* is the natural logarithm of the number of firms the analyst follows. *SANCTIONED* is an indicator variable that equals 1 for analysts affiliated with a sanctioned investment bank and 0 otherwise.[16] The reforms target these sanctioned banks, so analysts from these banks may react to the reforms differently as a result of their visibility.

Two confounding factors may also explain the brain drain phenomenon. First, investment banks faced decreasing performance in the post-reform period, as the profitability of their trading division was adversely affected by a decrease in soft dollar arrangements, trading volumes, and commission rates (Goldstein et al. 2009). As a result, bonuses tied to firm-wide profit were adversely affected, making it difficult to use firm-wide bonuses to retain star analysts. Second, investor sentiment varies substantially in our

[16] The sanctioned investment banks include Bear Stearns, Credit Suisse First Boston, Deutsche Bank Securities Inc., Goldman Sachs, Lehman Brothers, J.P. Morgan Securities, Merrill Lynch, Morgan Stanley, Citigroup Global Markets (formerly Salomon Smith Barney), UBS Warburg, U.S. Bancorp Piper Jaffray, and Thomas Weisel Partners LLC. Deutsche Bank Securities Inc. and Thomas Weisel Partners LLC. joined the Global Settlement in 2004 (SEC 2004).

sample period (Cen et al. 2013). The sentiment affects trading commissions, which in turn may lead to the brain drain phenomenon (Groysberg et al. 2011).

We control for these two factors by including *LOGFEE* and *SENTIMENT* in the logistic regressions. *LOGFEE* is a firm's investment banking revenue from participating in initial public offering (IPO) and seasoned equity offering (SEO) businesses. In particular, we collect the fee proceeds for each SEO or IPO issuance and the names of its book runner, and all other managers from the SDC database. We then manually match the broker names to our sample. If the broker is the book runner of the issuance, we assume that the broker takes all of the fee proceeds. If the broker is one of the other managers for the issuance, we assume that the broker takes 50% of the fee proceeds. The results are robust if we include the fee proceeds for the book runner only. *SENTIMENT* is the lagged value of Baker and Wurgler's (2006) annual index.

Columns (1) to (4) of Table 3 present summary statistics for the explanatory variables of the logistic regression for the sample of investment bank analysts and the subsample of star analysts by sub-period. In both sub-periods, approximately 13% of all of the analysts are star analysts. The average *TOPACCU* is approximately 10% in both sub-periods for all of the analysts in the sample, but less than 10% for the star analyst subsample. This result is consistent with forecast accuracy not being a main factor in the ranking criteria of star analysts (Bagnoli et al. 2008). The mean and median of relative forecast optimism, *RFOPT*, of all investment bank analysts is -0.01, lower than that of star analysts in the pre-reform period. In the post-reform period, the relative forecast optimism of star analysts is reduced and becomes the same as that of all of the investment bank analysts. In terms of experience, the mean experience of star analysts is approximately 13.0

years in the pre- and 16.7 years in post-reform period, much greater than that of all of the investment bank analysts, which is approximately 10 years. The majority of the star analysts are from the 12 sanctioned investment banks in both the pre- and post-reform periods, constituting 75% and 87%, respectively. Finally, the average investment banking fee revenues of the firms employing the analysts are higher in the post-reform period than in the pre-reform period for both the full sample and star analyst subsample.

Columns (5) to (8) of Table 3 show the same information for non-investment banks. Most of the summary statistics for the non-investment bank analysts are similar to those for the investment bank analysts with several exceptions. The average *BOTACCU* is higher for the non-investment banks than the investment banks in both sub-periods, indicating that non-investment bank analysts are less accurate than their investment bank counterparts. Regarding forecast optimism, *RFOPT*, non-investment bank analysts are relatively more optimistic than other analysts who followed the same companies, consistent with the results of Cowen et al. (2006).

4.2 Logistic Regression Results

Table 4 summarizes the results of the logistic regression (1), which are based on a sample of 21,834 and 5,290 analyst-year observations from investment banks and non-investment banks, respectively. Columns (1) to (2) of Table 4 show that the estimated coefficient of *D* is positive, suggesting that investment bank analysts, on average, are more likely to leave the profession in the post-reform period. The estimated coefficients of the *STAR* variable are significantly negative, suggesting that star analysts are less likely than their non-star colleagues to leave the profession during the pre-reform period. However, the estimated coefficients of the interactive term *D*×*STAR*, our main variable of interest, are positive and

statistically significant, suggesting that the increase in propensity of star analysts to leave the sell-side research profession after the reform is more than the corresponding increase for non-star analysts. The latter supports our conjecture that more star analysts left the sell side in the post-reform period, after accounting for the confounding events that affect both star and non-star analysts from investment banks. [17]

We obtain the aforementioned results after controlling for other determinants of the job separation, promotion, or demotion of sell-side analysts (Mikhail et al. 1999; Hong et al. 2000; Hong and Kubik 2003; Wu and Zang 2009). Relative forecast optimism, *RFOPT*, has little effect on the propensity of analysts to leave the profession. However, analyst experience, *EXPERIENCE*, significantly reduces the propensity to exit sell-side research.

We also control for the sanctioned dummy in regression; however, the Global Settlement might have affected the 12 sanctioned banks differently depending on their business mixes. For example, a sanctioned bank may be more affected by the decrease in investment banking business and hence exhibit a higher departure rate. We allow for sanctioned bank fixed effects to control for unobservable heterogeneity across the 12 sanctioned investment banks. We replace the sanctioned bank dummy with individual sanctioned bank dummies. The results (untabulated) for our main variable of interest, *D*×*STAR*, remain unchanged. We also re-estimate the regression model after controlling for the fee proceeds of investment banking business (IPOs and SEOs) and investor

[17] In robustness tests, we use propensity-score matching to narrow down the non-star benchmark sample to make it more similar to the star sample. For each star analyst, we find two non-star analysts who have the closest propensity score within a caliper of 0.25 times the standard deviation of propensity score (Rosenbaum and Rubin 1985). We re-estimate equation (1) using this propensity-score matched control sample and report the estimation results in the online appendix. Our main inference continues to hold. This test helps to mitigate the concern for endogeneity, although it is hard to fully rule it out. In addition, we conduct one test to show that the results are not driven by any specific years. We add a dummy variable for each year, *D2002*, *D2003*, *D2004*, *D2005*, *D2006*, and *D2007*. The interactions between *STAR* and these dummies are consistently positive and significant (see the online appendix).

sentiment. As shown in column (2), neither *LOGFEE* nor *SENTIMENT* exhibits a significant effect on the likelihood of an analyst leaving the sell-side industry. Nevertheless, the estimated coefficients of our variable of interest, *D*×*STAR*, remain statistically positive, suggesting that the key results are not attributable to these potentially confounding factors.[18] If the aforementioned results for investment bank star analysts were driven by the loss of investment banking-related compensation, we would expect the reforms to have less of an effect on the exit of non-investment bank star analysts. We present the corresponding regression results in columns (3)–(4) of Table 4.[19] As reported, non-investment bank analysts are generally not more likely to leave the sell-side research industry in the post-reform period. Furthermore, in contrast to their investment bank counterparts, star analysts at non-investment banks appear to be less likely than their non-star peers to leave the sell-side research industry in the post-reform periods. The estimated coefficient of *D*×*STAR* is negative and significant.[20] To formally test the difference in the departure pattern between investment banks and non-investment banks, we combine the two samples and regress the departure dummy on *D*×*STAR*×*IB dummy*, along with other control variables. The coefficient of *D*×*STAR*×*IB dummy* is significantly positive with a t-

[18] As our main variable of interest is an interaction term in a nonlinear (logistic) model, we follow the method of Ai and Norton (2003) and Norton et al. (2004) to estimate the observation-specific interaction effects of *D* and *STAR*. The untabulated results support the hypothesis that star analysts have a significantly greater propensity to leave the sell-side profession in the post-reform period. We report this analysis for information purposes only. We do not tabulate these results due to the debate surrounding how to interpret the coefficients of interaction terms in logistic regressions (Greene 2010; Kolasinski and Siegel 2010).

[19] In Table 4 column (4), we exclude *LOGFEE* from the model because there is not enough variation after controlling for *LOGFEE* and thus, our main variable D×STAR is automatically dropped.

[20] In our setting, it mitigates confounding events that would affect all investment bank analysts over the sample period, leaving only the incremental effect of the regulation on investment bank star analysts over their non-star counterparts. Hence, if the dot-com bubble and a rising stock market in the late 1990s reduced the incentives for sell-side analysts to leave the industry, they would have the same effect on star and non-star investment bank analysts. Similarly, the NASDAQ crash in 2000 and the subsequent market downturn would make both star and non-star investment bank analysts more likely to leave the industry. In a robustness test, we find robust results after controlling for market return and investment banking industry revenue (see the online appendix).

value of 5.36. This finding lends further support to the conjecture that the reforms induced investment bank star analysts to leave the sell-side research industry.

4.3 Effect of Investment Banking Business in an Analyst's Core Industry on Propensity to Exit

In the regression analyses above, we control for investment banking revenue. To strengthen our argument that the departure of star analysts is indeed due to investment banking incentives, we conduct two additional analyses. We consider that the level of investment banking activities in an analysts' core industry has two effects on the analysts' career choices.

First, the post-reform period (2004–2007) coincides with a downturn in investment banking market activities. Hence, our findings that the likelihood and propensity of star analysts to leave the investment research industry increase after the reform may be attributable to the decreasing demand for their services after investment banking deals dried up shortly after the reforms. To investigate how the IPO and SEO markets have changed in the post-reform period, we extract the numbers of IPOs and SEOs and the corresponding proceeds from *Thomson Financial's* SDC database for our sample period (1995–2007). Untabulated statistics show that IPO and SEO proceeds were low in 2002 and 2003, but recovered in 2004 and surpassed the 1999 levels in 2007. The latter indicates that the increase in the percentage of investment bank star analysts who left the sell-side research industry in the post-reform period is not attributable to investment banking market conditions (although this might have been the case in 2002 and 2003).[21]

[21] We note that this explanation would require analysts and their banks to work around the rule prohibiting research analysts from participating in investment banking businesses after the reforms (O'Leary 2007). Otherwise, investment banking market conditions should have no effect on the demand for sell-side research analysts after the reforms.

Second, we argue that star analysts are more likely to leave sell-side research after the opportunity to earn investment banking-related compensation is cut off by the reforms. If our conjecture is correct, we expect the reforms to have a more pronounced effect on analysts who are specialized in industries with a high level of investment banking activities.[22] We test this implication by examining whether the level of investment banking activities in an analyst's core industry is associated with the likelihood and propensity of analysts to leave the sell side after the reforms. We define an analyst's core industry (based on the two-digit SIC) as the one from which the majority of the companies covered by the analyst come. We retrieve from the SDC database the IPO and SEO proceeds raised by companies in each two-digit SIC industry over our sample period and use it to capture the level of investment banking activities for each analyst's core industry.

We first report summary statistics on the percentage of departing star analysts by industry quartiles formed by ranking industry-level IPO and SEO proceeds in both the pre- and post-reform periods. Panel A of Table 5 shows that the mean proceeds for industries in the lowest and highest quartiles are $233 million and $22.478 billion, respectively, in the pre-reform periods. The corresponding figures are $509 million and $24.318 billion, respectively, in the post-reform period. During the post-reform period, the percentage of departing star analysts increases from 8.39% for star analysts from a core industry in the lowest quartile of investment banking activities to 12.96% for those in the highest quartile.

In Panel B, we use an alternative classification scheme to obtain a more balanced number of star analysts in each industry quartile. Specifically, we classify the star analysts into quartiles based on the total IPO and SEO proceeds in the core industry of the analyst.

[22] Industries with high levels of investment banking activities are also likely to exhibit high stock market activities, which attracts buy-side firms.

Similar to Panel A, we find that in the post-reform period, the percentage of departing star analysts increases with the level of investment banking activities in the analysts' core industries. It ranges from 9.59% for star analysts in the lowest industry quartile to 13.41% for those in the highest quartile. However, there is no such pattern in the pre-reform period. Overall, the results in Table 5 further support our conjecture that the increased likelihood of star analysts leaving the profession is due to prohibiting the compensation of analysts based on a firm's investment banking revenue.

To test the effect of investment banking fee proceeds on star analysts' career choices, we include *LOGFEE* and *D×STAR×LOGFEE* in logistic regression Equation (1) for the investment bank sample. The variable *LOGFEE* is defined earlier in Section 4.1. Table 6 presents the regression results. We find a statistically positive coefficient for *D×STAR×LOGFEE* in both regressions, suggesting that the relative increase in the propensity of star analysts to exit sell-side research increases with the level of investment banking fee proceeds from SEO and IPO activities. Overall, these results provide further support for our conjecture that the brain drain effect is associated with the loss of funding support from investment banking business.

5. Career Choices of Star Analysts Who Exited the Sell-side Research Industry

Although the results presented in Section 4 strongly suggest an increase in the percentage and propensity of star analysts to depart from sell-side research after the reforms, they do not address whether they are forced out due to funding cuts or leave voluntarily to pursue other opportunities. However, both are consistent with our conjecture that the reforms lead to a brain drain in investment banks.

To further investigate why star analysts leave the sell-side research industry, we keep track of all 259 investment bank star analysts and 21 non-investment bank star analysts who left the sell-side investment research industry during our sample period from 1995 through 2007. We first use the I/B/E/S translation file to extract the initials and last name of these star analysts. We then look up the full names of these analysts from Nelson's Directory of Investment Research and the corresponding issues of the *Institutional Investor*. Given their full names, we check Nelson's Directory to determine whether these star analysts indeed left the sell-side research industry or were promoted to managerial positions in their firms or other sell-side research firms. Finally, we search *Factiva* and *Google* to identify the first job the departed star analysts took after leaving the sell-side equity research industry.

Based on the information collected, we classify these departed star analysts into one of the following eight categories.

(A) Promoted to a managerial position within the firm or at another firm. This category includes analysts listed as key executives in Nelson's Directory of Investment Research. For example, Benjamin Bowler of Merrill Lynch was promoted to Co-Head of Global Equity Research.

(B) Transferred laterally to a different department within the firm. This category includes analysts who stayed with the same firm after leaving the sell-side research industry (i.e., no longer found in the I/B/E/S), but are not listed as analysts or key executives in Nelson's Directory. For example, Anatol Feygin of Bank of America Securities became the firm's Head of Global Commodity Strategy.

(C) Moved to a buy-side, hedge fund, private equity, or venture capital firm. This category includes analysts who either moved to or started their own asset management, hedge fund, private equity, or venture capital firms. For example, William Julian left Smith Barney Citigroup in 2003 to become the founding partner of Calimar Capital Management, a hedge fund focused on small cap stocks.

(D) Started their own investment research firm or moved to another research firm not covered by the I/B/E/S. For example, John Tumazos left Prudential Equity Group in 2008 to found Very Independent Opinions, LLC.

(E) Moved to a non-financial industry. This category includes analysts who left the financial industry. For example, Mark Rowen left Prudential Equity Group to join eBay as its Vice President of Investor Relations.

(F) Retired or fired for cause. In addition to those who announced retirement, this category also includes a few analysts who were banned from the financial services industry (e.g., Henry Blodget of Merrill Lynch) or fired for cause (e.g., Peter Caruso of Merrill Lynch was fired for tipping off clients).

(G) Still a sell-side analyst but not found in the I/B/E/S. Some analysts are no longer covered by the I/B/E/S, but their names were found in the Nelson directory. Not all investment research firms are covered by the I/B/E/S.

(H) Not enough information to classify. We were not able to find enough information on 56 analysts to classify them into one of the preceding categories. This category includes these unclassified analysts.

Table 7 presents the number and percentage of the departing star analysts in each of the preceding categories by sub-period. In particular, we are interested in investigating

whether the percentage of star analysts moving to these categories changed after the reforms and whether the change is consistent with star analysts moving to more lucrative careers. Elite analysts are known to leave the sell-side research industry to manage money as portfolio managers on the buy side (e.g., Groysberg et al. 2008). It is generally believed that money managers on the buy side can earn more than sell-side star analysts. This is especially true after the reforms, which prohibited tying analyst compensation to investment banking revenues (Institutional Investor 2007; O'Leary 2007; Pizzani 2009). Hence, we consider an increase in the percentage of departed star analysts who moved to the buy side as evidence that star analysts left the sell-side research industry to pursue more lucrative opportunities. We define the buy side to include asset management, hedge fund, private equity, or venture capital firms.

Panel A in Table 7 reports the findings for departed star analysts from investment banks. Columns (1) and (2) show that a total of 108 star analysts left the sell-side profession in the pre-reform period (1995–2001): 17.6% were promoted to a managerial position, 6.5% were transferred to a different department in the same firm, 24.1% moved to the buy side, and 14.8% moved to a non-financial industry. Columns (3) and (4) present the corresponding statistics for the post-reform period (2004–2007), and column (5) shows the change relative to the pre-reform period. Specifically, columns (3) and (4) show that of the 151 star analysts who left the sell-side research industry in the post-reform period, 31.1% moved to the buy side, a significant 7% point increase relative to that in the pre-reform period.[23] This is also the largest percentage point increase among the eight categories. If

[23] Under the null hypothesis that the reforms have no effect on the career choices of star analysts, the percentage changes are zero. We assume that the percentage changes of these eight categories are drawn from a student's *t*-distribution, with a zero mean. Hence, we estimate the standard error for statistical inference

potential compensation is higher on the buy side, this finding is consistent with star analysts leaving the sell-side research industry to pursue more lucrative opportunities on the buy side after the reforms. If star analysts were valuable for the investment banks in other capacities, the investment banks would make an effort to keep their star analysts by promoting them to managerial positions in the research department or transferring them to different departments with higher earning potential (e.g., investment banking or asset management). Panel A provides little support that investment banks are able to retain star analysts in this capacity. Specifically, the percentage of star analysts who were promoted or moved to another department (Categories A and B) increases by 1.1% which is not distinguishable from zero.

To further support our conjecture that the reforms caused brain drain in investment banks, we perform the same analysis on non-investment banks. Under our conjecture, non-investment banks should be affected the least. Column (5) of Panel B shows a significant 13.6% reduction in the percentage of non-investment bank star analysts who moved to the buy side during the post-reform period. We also find a significant decrease in the percentage of non-investment bank star analysts who were promoted to a managerial position. However, the results presented in Panel B should be interpreted with caution, given the small sample of star analysts who departed from non-investment banks. In addition, non-investment bank analysts likely had less opportunity to move to the buy side because their performance is worse than investment bank analysts. As seen in Table 3, non-investment bank analysts are less accurate and more optimistic than investment bank analysts.

using the standard deviation of the percentage changes across these eight categories. We also try more finely defined categories. The findings (untabulated) are qualitatively similar to those reported here.

Taken together, the evidence documented in this section suggests that the sell-side equity research profession lost more of its star analysts to the buy side after the reforms. We attribute the brain drain phenomenon to the series of regulations that banned analysts from participating in activities related to investment banking.

6. Potential Effect of Brain Drain on Investors

Star analysts are voted by institutional investors each year and are considered to be the most valuable analysts in the profession. Their departure arguably suggests a loss of human capital in the industry. In this section, we examine one aspect of the value of star analysts, which can be measured directly with public data. Specifically, we investigate the adverse effect of the brain drain in the investment research industry on the investors who relied on the research of the departed star analysts. We compare the informativeness of research conducted by the departed star analysts to: 1) that of other analysts who covered the same companies and remained in the sell-side research industry; 2) that of the replacing analysts who followed the companies covered by the departed star analysts and came from the same brokerage firms of the departed star analysts. We measure informativeness by the three-day market-adjusted abnormal returns, CAR(–1,+1), from day –1 to day +1, where day 0 is the day the analysts revised their annual earnings forecasts, issued their stock recommendations, or issued industry research reports.

In Table 8, Panel A summarizes our findings on the comparison of the informativeness of earnings revisions, stock recommendation changes, and industry research report issuance between departed and other analysts. We first regress three-day abnormal returns around earnings revision dates on *DESTAR*, an indicator variable that

equals 1 for a departed star analyst, and the interaction of *DESTAR* and *Revision*, an earnings forecast revision variable defined as the change of forecast scaled by the last forecast made by the same analyst for the same firm. Column (1) presents the results, showing that the coefficient of the interaction term *DESTAR*×*Revision* is positive but insignificant. Column (2) of Panel A presents the results of regressing the three-day abnormal returns around stock recommendation dates on *DESTAR*, an indicator variable that equals 1 for a departed star analyst, and the interaction of *DESTAR* and *RecREV*, a stock recommendation change variable defined as the I/B/E/S recommendation upgrade from the same analyst. The I/B/E/S quantifies analyst recommendations from 1 to 5, where 1 represents strong buy and 5 represents strong sell. Our *RecREV* is the negative value of the I/B/E/S recommendation changes. For example, if an analyst's recommendation changes from 4 (sell) to 1 (strong buy), *RecREV* equals 3. The coefficient of the interaction term *DESTAR*×*RecREV* is significantly positive (0.616) with a t-value of 7.00. It strongly suggests that the market reacts more to the stock recommendation changes issued by the departed star analysts than to those issued by other analysts. The risk factors size and book-to-market ratio are controlled for in both regressions. We further control for analyst general experience (*EXP*), firm experience (*FIRMEXP*), brokerage firm size (*BROKERSIZE*), number of firms followed (*NFIRM*), and number of industries followed (*NIND*) based on the earnings forecast accuracy literature (e.g., Clement 1999; Jacob et al. 1999; Lim 2001; Clement and Tse 2003). Taken together, these results are consistent with stock recommendation changes made by star analysts being more informative than those made by other analysts following the same set of companies.

To further support our argument that the departure of star analysts is a loss to the information environment of the firms they covered, we compare the informativeness of earnings revisions and stock recommendation changes of the departed star analysts to that of the replacing analysts. Replacing analysts are the analysts assigned by the brokerage firms to cover the companies that were previously followed by the departed star analysts. Not all firms covered by the departed star analysts have replacing analysts. In our sample, we find that 57% of firms eventually have a replacing analyst within one year, whereas the remaining companies suffer from the loss of analyst coverage. We do not explore the effect on the firms losing analyst coverage, but losing analysts in general is a negative shock to the information environment of firms being covered (Kelly and Ljungqvist 2012).

Columns (1) and (2) of Panel B present the results of regressing the three-day market responses on earnings revisions and stock recommendation changes, respectively. The significant positive coefficients of the variables *DESTAR×Revision* (with a t-value of 3.63) and *DESTAR×RecREV* (with a t-value of 2.09) suggest that both earnings revisions and stock recommendation changes issued by the departed star analysts are more informative than those of the replacing analysts.

Overall, Panel B complements the findings in Panel A. Both panels provide consistent evidence that the departed star analysts are a group of better performing analysts. The loss of these analysts was a brain drain to the equity research industry. The number of departed star analysts might have been small, but it was a hint of a serious issue, suggesting that the regulations provided incentives to better performers to leave the industry.[24]

[24] The departed star analysts do not have to be the best among all the star analysts for us to consider their departure to be a brain drain. We do find a stronger market reaction to the earnings forecast revisions made by the departed star analysts than by the star analysts who stayed on the sell side. However, we find no

7. Additional Analyses

7.1 Effect of Regulation Fair Disclosure

Regulation Fair Disclosure (Reg FD) came into effect in October 2000. The regulation eliminates the channel for many analysts to gain private information, so the potential confounding effect must be examined. We conduct two robustness tests to rule out the effect of Reg FD. First, we use October 2000 to 2001 as the pre-reform period. Second, we conduct a robustness test controlling for the education tie between analysts and managers.[25] Prior studies have suggested that analysts with education ties to managers have more private information (Cohen et al. 2010). If Reg FD is the main driving factor, we would expect that 1) analysts with education ties to managers would be more likely to exit sell-side and that 2) our main results would be subsumed by this additional control (i.e., the coefficient on $D \times STAR$ turns insignificant). Our results are robust to these two alternative tests.

7.2 Sample Period

We end our sample in 2007 in the primary analysis because I/B/E/S provides translation files with analyst names only through 2006. We conduct several robustness checks with different definitions of the pre- and post-reform periods. In our first robustness check, we include 2002 and 2003 in the post-reform period. SOX Section 501 may have had an immediate effect on the career choices of star analysts, whose paychecks were significantly cut. Although the Global Settlement was finalized in April 2003, investigations into the

significant difference in the market reaction to recommendation revisions made by these two groups of star analysts (see the online appendix).

[25] We thank Lauren Cohen, Andrea Frazzini, and Chris Malloy for generously sharing their education tie data with us. The online appendix provides more details.

sanctioned banks started in June 2001. More importantly, in May 2002, the SEC approved amendments to New York Stock Exchange Rule 351, Rule 471, and the National Association of Securities Dealers' Rule 2711. These new amendments placed stringent restrictions on analyst compensation and the relationship between research and investment banks. In our second robustness check, we exclude 2006 and 2007 from the post-reform period as analysts may have departed the sell side quickly. In our third robustness check, we exclude 1995 to 1997 from the pre-reform period to get a more balanced sample period. In our fourth robustness check, we include 2002 and 2003 but exclude 2006 and 2007 from the post-reform period as SOX Section 501 may have had an immediate effect on star analysts' career choices. Our results are robust to these alternative definitions of the pre- and post-reform periods.

7.3 Investment Bank Mergers

We observe a decrease in the number of investment banks during the post-reform period, as seen in Table 1. There were 76 mergers in the financial industry between 1994 and 2004 (Wu and Zang 2009), which partly explains the decrease in the number of investment banks over our sample period. To rule out the possibility that the drop in the number of investment banks explains analyst departures, we re-run the regressions using a constant sample of brokers over our sample period. The untabulated results show that our main conclusion is not affected by holding the sample of brokers constant.

7.4 Voluntary vs. Mandatory Departures

The departure of star analysts represents a brain drain in the sell-side equity research industry. These departures can be voluntary or mandatory. On the one hand, a decrease in compensation encourages high-ability analysts to exit the sell side to pursue other

opportunities. On the other hand, investment bank research departments can potentially terminate highly paid star analysts to cut costs. In the latter case, the number of companies followed per analyst should increase and the number of companies covered by brokers should decrease. Using our main sample and a constant sample of brokers, we find that the evidence is not consistent with the budget-cutting story. The number of companies followed per analyst (the number of firms covered per broker) decreased (increased) after the regulations were enacted (see the online appendix). However, we do not have data to entirely rule out the budget-cutting story (i.e., the new analysts may be paid a lower salary). Nevertheless, both voluntary and mandatory departures represent brain drain.

7.5 Industry Reports

The ranking of *Institutional Investor* (II) is based on industry knowledge, special services, earnings reports, and stock recommendations, with the first two attributes receiving increasing weights over time (Bagnoli et al. 2008). To the extent that II's weighting scheme reflects what buy-side investors value from sell-side analysts, we examine the value of the sell side's industry knowledge and special services. We do not have data on the special services provided by sell-side analysts (only a few studies have addressed this issue), but we have data on sell-side industry reports from I/B/E/S. We use the industry recommendations issued by sell-side analysts to examine whether departing star analysts have more industry knowledge. Following Kadan et al. (2009), we identify analyst industry recommendations from the I/B/E/S recommendation file. We find that departed star analysts are more likely than other analysts to issue industry reports. We also find that the market reacts significantly more to the departed star analysts' industry reports than to other

analysts' reports. This finding is consistent with departing star analysts having more industry knowledge than other analysts.

The additional tests discussed in Section 7 are reported in the online appendix.

8. Concluding Remarks

We examine the effects of a series of regulations on the career choices of star analysts. In the post-reform period, we find a significant increase in the percentage and likelihood of investment bank star analysts leaving the sell-side investment research profession for the buy side. We suggest that such a movement is due to the decrease in earning potential at investment banks as a result of the reforms and that the regulations unintentionally cause a brain drain in the equity research industry. We also show that the forecast revisions and recommendation changes issued by the departed star analysts are more informative than those of the other analysts covering the same set of companies and the replacing analysts from the same brokerage firms. The loss of star analysts may thus adversely affect the consumers of these analysts' research and the companies covered by these analysts. In summary, we provide the first evidence supporting the concern that the Global Settlement along with related regulations led to a brain drain in investment banks and the corresponding sell-side equity research industry.

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Table 1

Statistics on the number of equity analysts, securities firms, and companies being covered

The sample consists of the analysts from investment and non-investment banks from January 1995 to December 2007. The sell-side analyst data are from Thomson Financial's I/B/E/S database. An analyst is considered a star in a particular year if he/she is on the *Institutional Investor* All-America Research Team list in that year or in at least one of the last two years. The investment banks are those listed as investment banks by Nelson's Directory of Investment Research and identified as lead or co-lead underwriters by Thomson Financial's SDC database. The non-investment banks include independent research firms, brokerage firms, and syndicate banks.

	Investment Banks			Non-investment Banks		
	Number of analysts (1)	Number of securities firms (2)	Number of companies covered (3)	Number of analysts (4)	Number of securities firms (5)	Number of companies covered (6)
1995	2,218	91	5,024	420	54	2,422
1996	2,479	96	5,686	494	66	2,810
1997	2,854	109	6,107	614	89	3,060
1998	3,014	122	6,830	678	108	3,763
1999	3,310	131	6,647	703	124	3,671
2000	3,382	121	6,103	720	125	3,366
2001	3,379	112	5,172	662	119	2,749
2002	3,536	105	4,851	621	106	2,601
2003	3,289	111	4,735	744	130	2,939
2004	3,070	114	5,090	835	177	3,360
2005	3,118	116	5,339	927	192	3,719
2006	3,185	112	5,525	863	175	3,880
2007	3,218	106	5,693	858	157	3,945
Total	40,052	1,446	72,802	9,139	1,622	42,285

Table 2

Statistics on star analysts who left the sell-side equity research industry by year and sub-period

This table presents the number and percentage of star analysts who left the sell-side equity research industry. An analyst is considered a star analyst in a particular year if he/she is on the *Institutional Investor* All-America Research Team list in that year or in at least one of the last two years. An analyst is said to have left the sell-side research industry in a particular year if he/she made earnings forecasts in the current year but stopped issuing forecasts the following year and if his/her departure is confirmed based on information in Nelson's Directory of Investment Research.

	Investment Banks			Non-investment Banks		
	Number of star analysts (1)	Number of departing star analysts (2)	Percentage of departing star analysts (3)	Number of star analysts (4)	Number of departing star analysts (5)	Percentage of departing star analysts (6)
Panel A. Statistics by year						
1995	220	4	1.8%	10	0	0%
1996	254	9	3.5%	14	0	0%
1997	295	10	3.4%	13	0	0%
1998	280	10	3.6%	13	1	7.7%
1999	327	22	6.7%	11	2	18.2%
2000	353	24	6.8%	10	4	40.0%
2001	378	29	7.7%	9	3	33.3%
2002	391	56	14.3%	12	2	16.7%
2003	394	56	14.2%	17	2	11.8%
2004	350	44	12.6%	17	2	11.8%
2005	321	28	8.7%	25	4	16.0%
2006	308	39	12.7%	26	4	15.4%
2007	301	40	13.3%	21	1	4.8%
Panel B. Statistics by period						
Pre-reform (1995–2001)	2107	108	5.1%	80	10	12.5%
Post-reform (2004–2007)	1280	151	11.8%	89	11	12.4%

Table 3

Descriptive statistics of regression variables

STAR is an indicator variable that equals 1 for analysts on the *Institutional Investor* All-America Research Team list in a particular year or in at least one of the last two years. *TOPACCU* (*BOTACCU*) is an indicator variable that equals 1 for analysts whose relative forecast accuracy scores are in the top 10% (bottom 10%) and 0 otherwise. Relative annual earnings forecast accuracy and relative forecast optimism, *RFOPT*, are calculated as described in the text. *EXPERIENCE* is the forecasting experience of an analyst and is defined as the number of years that analyst appears in the I/B/E/S database. *BROKERSIZE* is brokerage firm size, which is calculated as the natural logarithm of the number of analysts employed by the sell-side firm in year *t*. *NFIRM* is the natural logarithm of the number of firms the analyst follows in year *t*. *NIND* is the natural logarithm of the number of two-digit SIC industries that the analyst follows in year *t*. *SANCTIONED* is an indicator variable that equals 1 if the analyst is affiliated with a sanctioned investment bank and 0 otherwise. The sanctioned investment banks include Bear Stearns, Credit Suisse First Boston, Goldman Sachs, Lehman Brothers, J.P. Morgan Securities, Merrill Lynch, Morgan Stanley, Citigroup Global Markets (formerly Salomon Smith Barney), UBS Warburg, U.S. Bancorp Piper Jaffray, Deutsche Bank Securities, and Thomas Weisel Partners. *LOGFEE* is the logarithm of 1 plus the fee proceeds of the investment banking businesses (IPOs and SEOs) of the brokerage firm for which each individual analyst works.

	Investment Banks				Non-investment Banks			
	Star analysts		All analysts		Star analysts		All analysts	
	Mean (1)	Std. Dev. (2)	Mean (3)	Std. Dev. (4)	Mean (5)	Std. Dev. (6)	Mean (7)	Std. Dev. (8)
Panel A. Pre-reform period (1995–2001)								
STAR	1.00	0.00	0.13	0.34	1.00	0.00	0.02	0.16
TOPACCU	0.05	0.22	0.10	0.30	0.05	0.23	0.09	0.28
BOTACCU	0.02	0.14	0.09	0.29	0.08	0.27	0.13	0.33
RFOPT	0.01	0.35	-0.01	0.48	0.07	0.35	0.00	0.49
EXPERIENCE	12.99	4.47	9.64	5.48	10.55	4.85	8.68	5.42
BROKERSIZE	3.73	1.77	3.31	1.49	3.28	0.31	2.33	1.08
NFIRM	2.81	0.52	2.39	0.74	2.56	0.59	2.35	0.83
NIND	1.68	0.38	1.53	0.46	1.60	0.38	1.60	0.52
SANCTIONED	0.75	0.43	0.40	0.49	0.00	0.00	0.00	0.00
LOGFEE	6.09	2.22	5.27	2.23	4.90	1.19	3.70	1.59
Panel B. Post-reform period (2004–2007)								
STAR	1.00	0.00	0.13	0.34	1.00	0.00	0.03	0.18
TOPACCU	0.04	0.19	0.10	0.30	0.09	0.29	0.10	0.30
BOTACCU	0.02	0.13	0.08	0.28	0.06	0.24	0.14	0.35
RFOPT	-0.02	0.34	0.00	0.48	0.11	0.34	0.03	0.54
EXPERIENCE	16.67	6.51	11.39	7.63	10.22	6.92	9.68	7.62
BROKERSIZE	3.68	2.02	3.47	1.51	3.48	0.44	2.25	1.13
NFIRM	2.78	0.39	2.36	0.74	2.14	0.36	2.16	0.75
NIND	1.60	0.39	1.41	0.46	1.18	0.30	1.38	0.50
SANCTIONED	0.87	0.34	0.43	0.49	0.00	0.00	0.00	0.00
LOGFEE	6.46	2.01	5.62	2.00	3.90	0.00	3.03	1.60

Table 4

Logistic regressions of analysts who left the sell-side investment research industry

D is an indicator variable that equals 1 in the post-reform period (January 2004 to December 2007) and 0 in the pre-reform period (January 1995 to December 2001). *STAR* is an indicator variable that equals 1 for analysts on the *Institutional Investor* All-America Research Team list in a particular year or in at least one of the last two years. *TOPACCU* (*BOTACCU*) is an indicator variable that equals 1 for analysts whose relative forecast accuracy scores are in the top 10% (bottom 10%) and 0 otherwise. Relative forecast accuracy and relative forecast optimism, *RFOPT*, are calculated as described in the text. *EXPERIENCE* is the forecasting experience of an analyst and is defined as the number of years that analyst appears in the I/B/E/S database. *BROKERSIZE* is brokerage firm size, which is calculated as the natural logarithm of the number of analysts employed by the sell-side firm in year *t*. *NFIRM* is the natural logarithm of the number of firms the analyst follows in year *t*. *NIND* is the natural logarithm of the number of two-digit SIC industries that the analyst follows in year *t*. *SANCTIONED* is an indicator variable that equals 1 if the analyst is affiliated with a sanctioned investment bank and 0 otherwise. The sanctioned investment banks include Bear Stearns, Credit Suisse First Boston, Goldman Sachs, Lehman Brothers, J.P. Morgan Securities, Merrill Lynch, Morgan Stanley, Citigroup Global Markets (formerly Salomon Smith Barney), UBS Warburg, U.S. Bancorp Piper Jaffray, Deutsche Bank Securities, and Thomas Weisel Partners. *LOGFEE* is the logarithm of 1 plus the fee proceeds of the investment banking businesses (IPOs and SEOs) of the brokerage firm for which each individual analyst works. *SENTIMENT* is the investor sentiment index of Baker and Wurgler (2006). Standard errors are clustered by securities firm. The *t*-statistics are reported in parentheses beneath the coefficients. *, **, and *** denote statistical difference from zero at the 10%, 5%, and 1% levels, respectively, using a two-sided test.

	Dependent Variable: Pr(Left Sell-Side = 1)			
	Investment Banks		Non-investment Banks	
	(1)	(2)	(3)	(4)
Intercept	0.359	0.409*	0.683**	0.460
	(1.460)	(1.734)	(2.554)	(1.421)
D	0.147**	0.207**	-0.063	0.133
	(1.968)	(2.214)	(-0.430)	(1.013)
STAR	-0.624***	-0.622***	-0.578***	-0.563***
	(-6.532)	(-5.768)	(-3.451)	(-3.314)
D×STAR	0.909***	0.956***	-0.232*	-0.250*
	(5.339)	(4.846)	(-1.742)	(-1.818)
TOPACCU	-0.444***	-0.434***	-0.588***	-0.591***
	(-7.309)	(-6.189)	(-4.158)	(-4.197)
BOTACCU	-0.341***	-0.305***	-0.264**	-0.272**
	(-5.604)	(-4.301)	(-2.224)	(-2.277)
RFOPT	-0.035	-0.070	-0.180***	-0.192***
	(-0.906)	(-1.528)	(-2.652)	(-2.780)
EXPERIENCE	-0.009**	-0.012**	-0.016**	-0.018**
	(-2.166)	(-2.499)	(-1.985)	(-2.172)
BROKERSIZE	0.189***	0.137**	0.190**	0.189*
	(3.251)	(2.143)	(1.992)	(1.937)
NIND	-0.159**	-0.143	-0.074	-0.060
	(-2.087)	(-1.636)	(-0.551)	(-0.431)
NFIRM	-1.101***	-1.116***	-1.042***	-1.052***
	(-17.073)	(-15.642)	(-8.780)	(-8.875)
SANCTIONED	-0.382***	-0.437***		
	(-2.905)	(-3.106)		
LOGFEE		0.028		
		(1.447)		
SENTIMENT		0.124***		0.336**
		(2.744)		(2.465)
N	21,834	16,536	5,290	5,290
Pseudo-R^2 (%)	0.121	0.124	0.109	0.116
Area under ROC curve	0.752	0.752	0.737	0.743

Table 5

The relationship between star analysts' career choices and the investment banking businesses of their core industries

This table presents the number and percentage of star analysts who left the sell-side equity research industry for the quartiles classified based on the total proceeds of IPOs and SEOs. Panel A classifies the star analysts into quartiles based on the total proceeds of the IPOs and SEOs of their core industries. Panel B classifies the core industries into quartiles based on the total proceeds of IPOs and SEOs and assigns the star analysts to each quartile accordingly.

	Industry Quartile	Mean Total Proceeds (million dollars)	Number of Star Analysts	Number of Departing Star Analysts	Percentage of Departing Star Analysts
Panel A. Classify the star analysts into quartiles based on the total proceeds of the IPOs and SEOs of their core industries					
Pre-reform period	4	22,478	1,006	54	5.37%
1995–2001	3	4,120	556	25	4.50%
	2	1,102	270	8	2.96%
	1	233	240	9	3.75%
Post-reform period	4	24,318	733	95	12.96%
2004–2007	3	5,702	237	17	7.17%
	2	1,895	232	28	12.07%
	1	509	143	12	8.39%
Panel B. Classify the core industries into quartiles based on the total proceeds of IPOs and SEOs					
Pre-reform period	4	32,809	418	17	4.07%
1995–2001	3	14,912	582	34	5.84%
	2	4,640	522	27	5.17%
	1	803	550	18	3.27%
Post-reform period	4	38,459	261	35	13.41%
2004–2007	3	18,321	369	53	14.36%
	2	6,864	350	29	8.29%
	1	1,337	365	35	9.59%

Table 6

Effect of the investment banking business of an analyst's brokerage firm

All of the variables are defined in Table 4. Standard errors are clustered by securities firm. The *t*-statistics are reported in parentheses beneath the coefficients. *, **, and *** denote statistical difference from zero at the 10%, 5%, and 1% levels, respectively, using a two-sided test.

	Investment Banks			
	Dependent Variable: Pr(Left Sell-Side = 1)			
	(1)		(2)	
Intercept	0.321		0.262	
	(1.332)		(1.091)	
D	0.472	**	0.527	***
	(2.375)		(2.660)	
D×STAR×LOGFEE	0.125	**	0.133	**
	(1.995)		(2.166)	
STAR	-0.214		-0.166	
	(-0.790)		(-0.617)	
D×STAR	0.255		0.216	
	(0.690)		(0.595)	
LOGFEE	0.055	**	0.054	**
	(2.088)		(2.013)	
D×LOGFEE	-0.065	*	-0.062	
	(-1.698)		(-1.586)	
STAR×LOGFEE	-0.074		-0.083	*
	(-1.517)		(-1.689)	
TOPACCU	-0.425	***	-0.427	***
	(-5.991)		(-5.995)	
BOTACCU	-0.301	***	-0.301	***
	(-4.234)		(-4.211)	
RFOPT	-0.070		-0.071	
	(-1.524)		(-1.547)	
EXPERIENCE	-0.012	**	-0.012	**
	(-2.382)		(-2.486)	
BROKERSIZE	0.149	**	0.143	**
	(2.442)		(2.322)	
NIND	-0.152	*	-0.142	
	(-1.727)		(-1.624)	
NFIRM	-1.115	***	-1.119	***
	(-16.010)		(-15.950)	
SANCTIONED	-0.441	***	-0.442	***
	(-3.187)		(-3.165)	
SENTIMENT			0.122	***
			(2.633)	
N	16,536		16,536	
Pseudo-R^2 (%)	12.4		12.5	
Area under ROC curve	0.751		0.752	

Table 7

Descriptive statistics on the career choices of star analysts who left the sell-side research industry

We identify the star analysts who left the sell-side research profession from 1995 through 2007 and classify their career choices into one of eight categories: (A) Promoted to a managerial position within the firm or at another firm; (B) Transferred laterally to a different department within the firm; (C) Moved to a buy-side, hedge fund, private equity, or venture capital firm; (D) Started own investment research firm or moved to another research firm that is not covered by the I/B/E/S; (E) Moved to a non-financial industry; (F) Retired or fired for cause; (G) Still a sell-side analyst but not found in the I/B/E/S; and (H) Not enough information to classify. We first use Nelson's Directory of Investment Research to verify that the analysts have left sell-side research and to check whether they have been promoted to a managerial position in investment research. Next, we search Factiva and Google to identify the first job these analysts took after they left the sell-side research industry. To compute the *t*-statistics, we estimate the standard error using the standard deviation of the percentage changes across these eight categories, assuming that the percentage changes from these eight categories are drawn from a normal distribution with a zero mean.

Category	Pre-reform period 1995–2001		Post-reform period 2004–2007		Difference	
	# who left (1)	% who left (2)	# who left (3)	% who left (4)	(4)–(2) (5)	t-stat (6)
Panel A. Investment banks						
A. Promoted	19	17.6	21	13.9	-3.7	-2.6
B. To another department	7	6.5	17	11.3	4.8	3.3
C. To buy side	26	24.1	47	31.1	7	4.8
D. To another research	5	4.6	6	4.0	-0.6	-0.4
E. To non-financial	16	14.8	20	13.2	-1.6	-1.1
F. Retired or fired	9	8.3	14	9.3	1	0.7
G. Not on I/B/E/S	6	5.6	1	0.7	-4.9	-3.4
H. Lack information	20	18.5	25	16.6	-1.9	-1.3
Total	108	100.0	151	100.0		
Panel B. Non-investment banks						
A. Promoted	3	30.0	1	9.1	-20.9	-4.3
B. To another department	0	0.0	1	9.1	9.1	1.9
C. To buy side	5	50.0	4	36.4	-13.6	-2.8
D. To another research	0	0.0	1	9.1	9.1	1.9
E. To non-financial	0	0.0	2	18.2	18.2	3.7
F. Retired or fired	0	0.0	1	9.1	9.1	1.9
G. Not on I/B/E/S	0	0.0	0	0	0	0.0
H. Lack information	2	20.0	1	9.1	-10.9	-2.2
Total	10	100.0	11	100.0		

Table 8

Short-window market responses to earnings revisions and stock recommendations

Panels A and B present the market responses to revisions of annual earnings forecasts and changes in the stock recommendations of departed star analysts and two groups of benchmark analysts. Panel A (B) includes departed star analysts and other analysts who followed the same companies in the year before the star analysts left sell-side equity research (analysts from the same brokerage firms who replaced the departed star analysts in the year after the star analysts left sell-side equity research). CAR(–1,+1) is the market-adjusted abnormal returns from day –1 to day +1, where day 0 is the date on which the analysts revise their earnings forecasts (recommendations). *Revision* is the earnings forecast revision deflating by the last forecast made by the same analyst for the same firm and fiscal year. *RecREV* is the I/B/E/S stock recommendation changes made by the same analyst for the same firm. *DESTAR* is an indicator variable that equals 1 for a departed star analyst. *SIZE* is the logarithm of 1 plus a firm's total assets. *BM* is a firm's book-to-market ratio. *EXPERIENCE* is the forecasting experience of an analyst and is defined as the number of years that analyst appears in the I/B/E/S database. *FIRMEXP* is firm-specific experience, which is defined as the number of years in which the analyst has issued at least one earnings forecast for firm *i* before year *t*. *BROKERSIZE* is brokerage firm size, which is calculated as the natural logarithm of the number of analysts employed by the sell-side firm in year *t*. *NFIRM* is the natural logarithm of the number of firms the analyst follows in year *t*. *NIND* is the natural logarithm of the number of two-digit SIC industries that the analyst follows in year *t*. The *t*-statistics are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Other analysts

	Dependent Variable: CAR(-1,+1)	
	REV=Revision	REV=RecREV
VARIABLES	(1)	(2)
Intercept	-1.102***	-3.517***
	(-9.780)	(-14.025)
REV	2.531***	2.026***
	(55.683)	(67.835)
DESTAR	0.131***	0.636***
	(2.977)	(5.889)
DESTAR×REV	0.163	0.616***
	(1.157)	(6.997)
SIZE	0.099***	0.278***
	(13.013)	(13.757)
BM	-0.124***	0.210***
	(-6.883)	(5.260)
EXPERIENCE	0.002	-0.102***
	(0.555)	(-3.061)
FIRMEXP	0.006	0.001
	(1.470)	(0.187)
BROKERSIZE	-0.037***	0.046***
	(-2.910)	(4.097)
NFIRM	0.066**	0.091
	(2.032)	(1.239)
NIND	0.009	0.106
	(0.251)	(1.056)
N	318,980	57,076
Adj R^2	0.012	0.093

Table 8 (Cont.)

Panel B. Replacing analysts

	Dependent Variable: CAR(–1,+1)	
	REV=*Revision*	REV=*RecREV*
VARIABLES	(1)	(2)
Intercept	-1.500***	-1.972**
	(-3.264)	(-2.336)
REV	1.768***	2.195***
	(7.924)	(17.015)
DESTAR	0.253***	0.158
	(2.727)	(0.906)
DESTAR×REV	0.943***	0.309**
	(3.632)	(2.091)
SIZE	0.098***	0.189***
	(4.908)	(4.757)
BM	0.000	-0.302*
	(0.731)	(-1.797)
EXPERIENCE	0.033	-0.343**
	(0.456)	(-2.483)
FIRMEXP	0.001	0.016
	(0.091)	(1.061)
BROKERSIZE	0.017	0.065***
	(1.572)	(3.124)
NFIRM	-0.016	0.366**
	(-0.160)	(2.066)
NIND	0.076	0.077
	(0.713)	(0.375)
N	43,548	11,189
Adj R^2	0.012	0.121