WHAT DRIVES SELL-SIDE ANALYST COMPENSATION AT HIGH-STATUS INVESTMENT BANKS?

Boris Groysberg[*]
Paul Healy[**]
David Maber[***]

Harvard Business School

This Draft:
December 11, 2008

This research was funded by the Division of Research at Harvard Business School. We wish to thank *I/B/E/S* for analyst data, and especially the anonymous financial services firms that provided us with their financial analysts' compensation data. Helpful comments were provided by Mark Bagnoli, Jasmijn Bol, Folkert Botma, Jan Bouwens, Pat O'Brien, Fabrizio Ferri, Joseph Gerakos, Kai Li, Steve Orpurt, Eddie Riedl, Jenny Tucker, Susan Watts, Michael Welker, and seminar participants at the 2008 Ball & Brown Tribute Conference at the University of New South Wales, the 2008 CAAA Doctoral Consortium, the 19th Annual Conference on Financial Economics and Accounting at the University of Texas at Austin, Harvard University, the 2008 Financial Management Annual Meeting, the 2008 London Business School Trans-Atlantic Doctoral Conference, Purdue, Tilburg, the University of British Columbia, the University of Technology, Sydney, and the Washington Area Finance Conference.

[*] Email: bgroysberg@hbs.edu Phone: (617) 496-2784 Fax: (617) 496-6554
[**] Email: phealy@hbs.edu Phone: (617) 495-1283 Fax: (617) 496-7387
[***] Email: dmaber@hbs.edu Phone: (617) 495-6921 Fax: (617) 496-7387

What Drives Sell-Side Analyst Compensation at High-Status Investment Banks?

ABSTRACT

Prior research has investigated sell-side analysts' incentives by examining the relation between analyst performance measures and either star analyst ratings or analyst turnover. Using propriety data from a large financial institution, we complement these studies by investigating factors that are associated with analysts' direct compensation. We find that total compensation is positively related to ranking among the top analysts in an industry by *Institutional Investor*, covering a stock that generates investment banking business for the firm, and covering stocks with large trading volume. We find no evidence that earnings forecast accuracy and stock recommendation performance are directly related to analysts' compensation. To assess the generality of our findings, we test the same relations using compensation data from a second large financial institution and find similar evidence.

JEL Classification: G24, G29, J33, J44, L84, M41, M52

Keywords: Performance measurement, incentive compensation, financial analysts, Institutional Investor ratings, investment banking.

What Drives Sell-Side Analyst Compensation at High-Status Investment Banks?

Prior research has examined the performance and behavior of sell-side analysts.[1] However, the reward structure for sell-side analysts remains an important and as yet unresolved issue (Kothari (2001) and Beaver (2002)). In this paper, we use eighteen years of compensation data from a large, high-status investment bank[2] to investigate the association between analyst remuneration and its hypothesized economic determinants.[3]

We perform two types of analyses of the compensation data. The first focuses on between-analyst variation in analyst compensation; the second on within-analyst variation. The cross-sectional findings indicate that three factors are related to analyst total and bonus compensation: being highly rated by institutional clients, covering current investment banking clients, and the aggregate trading volume of the stocks covered. Holding other factors constant, analysts with a top three or runner-up rating in *Institutional Investor (II)* magazine received 61% (100%) higher total (bonus) compensation than their unranked peers. Analysts who covered a current investment banking client earned 8% (12%) higher total (bonus) compensation.[4] And

[1] See Ramnath, Rock, and Shane (2008) and Bradshaw (2008) for recent reviews of this literature.

[2] Our sample bank is rated as "high status" or "top tier" based on a variety of criteria, including the Carter-Manaster ten-tier "tombstone" ranks provided in Carter, Dark, and Singh (1998), the size-based categorization provided in Hong, Kubik, and Solomon (2000), and *Institutional Investor's* annual buy-side polls.

[3] Although our empirical analyses are informed by the various branches of agency theory and we discuss the relation between these theories and our results, we do not attempt to formally test agency theory. Given that this paper is the first empirical investigation of sell-side analyst remuneration, current knowledge of analyst compensation systems, including the interrelationships between these systems and other (implicit) incentive mechanisms, is not yet at a stage to permit such an inquiry. Consequently, such a test is left for future research. See Baker (1987), Rosen (1992), Prendergast (1999 and 2002), and Bushman and Smith (2001) for discussions of the many empirical challenges that must be overcome in order to conduct a meaningful test of agency theory. See van Lent (2007) for a discussion of the challenges involved in testing incomplete theories in complex and uncertain environments.

[4] The sample firm requested us not to examine the impact of the Global Settlement on investment banking bonuses. Our tests therefore reflect the average investment banking effect over the sample period.

analysts who covered stocks at the third trading volume quartile earned 48% (64%) higher total (bonus) compensation than analysts at the first quartile.

Key factors associated with salary compensation in the cross-sectional analysis include being ranked highly by institutional clients, the size of an analyst's portfolio, experience, and being hired from another firm (versus being homegrown). All-Star analysts received 16% higher salary than lower ranked peers. Analysts at the third trading volume quartile earned 15% higher salaries than their peers at the first quartile. A 10% increase in experience is accompanied by a 0.7% increase in salary. Finally, homegrown analysts earn 11% lower salaries than those hired away from another firm.

The longitudinal models include an analyst fixed effect to capture innate analyst ability. Variation in analyst compensation is therefore driven by time-series changes in the variables of interest. Two factors are associated with changes in total and bonus compensation: being ranked by *II* and investment banking transactions. Analysts who became *II* All-Stars received 26% (46%) higher total (bonus) compensation. And analysts who covered a banking client received 6% (9%) higher total (bonus) comp. For salary awards, only two variables were significant, *II* ranking and the aggregate trading volume of stocks covered.

Although it is impossible to draw definitive conclusions regarding the generality of our findings, there are several reasons to expect them to extend to other top-tier, full service investment banks. First, the objectives of full-service investment banks are generally quite similar (Cowen, Groysberg, and Healy (2006)). Second, our interviews with the research directors and analysts at eleven top-tier, full service investment banks suggest that job-hopping and compensation benchmarking have led to diffusion in compensation practices among top-tier, full-service investment banks. Finally, other studies find no evidence of changes in behavior

when analysts move from one full-service investment bank to another (see Clarke, Khorana, Patel, and Rau (2007)), consistent with their facing similar remuneration practices and incentives.

To provide evidence on the generality of our findings, we use compensation data from a second top tier investment bank for the sub-period 1988 to 1993. The findings are generally similar to those our test firm: All-Star status is a key driver of analyst total compensation in both cross-sectional and longitudinal tests; and aggregate portfolio trading volume continues to be important in the cross sectional tests. Both firms have insignificant estimates for stock recommendation performance and forecast accuracy.

Taken as a whole, our evidence is consistent with the hypothesis that analysts' compensation packages are designed to maximize value for their employer and its shareholders (Michaely and Womack (2005) and Reingold (2006)). Wall Street firms, after all, use research to generate business (Eccles and Crane (1988)). Analysts who directly contribute to business, either by following important stocks or by satisfying key clients, are rewarded handsomely. Moreover, consistent with practitioners' claim that "the real value of sell-side research comes from the service aspects, and that is routinely focused on the largest clients" (Saumya, Sinha, and Jain (2006), p. 4),[5] we find that *Institutional Investor* ratings, which reflect large clients' rankings of the quality and timeliness of analysts' services (Bradshaw (2008), Reingold (2006), and Michaely and Womack (2005)), play an important role in analyst remuneration. The fact that *Institutional Investor* ratings remain economically and statistically significant, even when forecast accuracy, stock picking profitability, and investment banking contributions are held

[5] Bradshaw (2008) summarizes information from *Institutional Investor* magazine's annual buy side polls over the period 1998 – 2005 and reaches the same conclusion. A similar argument is made by Dan Reingold, a former "star" telecom analyst, who asserts that as a sell-side telecom analyst, "Your job is to get Fidelity and Capital Research and Alliance Capital Management to call you before they decide to buy or sell telecom stocks" (Reingold (2006), p. 33).

constant, is especially noteworthy given that prior research has established associations among these variables (e.g., Stickel (1991), Leone and Wu (2007), Krigman, Shaw, and Womack (2001), and Clarke et al. (2007)).

Our findings have important implications for alternate theories of analyst remuneration. First, they indicate that analysts' pay is strongly related to *outcome-based* performance metrics (*II* rankings and investment banking outcomes) that drive value creation at investment banks. The use of these measures is therefore consistent with recent agency model predictions that optimal contracts use *outcome-based* (rather than action-based) performance measures to align managers' incentives with those of owners (e.g., Baker (2002), Prendergast (2002), Baker and Jorgensen (2003), and Raith (2007)).

Second, we find little evidence that compensation is directly related the two most widely studied performance measures within the analyst literature. Our tests cannot reject the null hypothesis that analyst compensation is unassociated with stock recommendation performance and forecast accuracy. Consistent with this finding, our interviews revealed that both banks' performance evaluation processes did not incorporate forecast accuracy (although stock picking profitability was tracked). Interestingly, our tests indicate that this lack of evidence cannot be attributed to forecast accuracy and stock picking performance being subsumed by other variables, such as *II* ranking. Neither forecast accuracy nor stock-picking profitability are related

to compensation in univariate tests.[6] However, we cannot rule out that cross-firm differences in analysts' forecast accuracy and/or stock picking performance drive firm-level compensation.[7]

Finally, our findings contribute to the literature on compensation. Most of the studies in this area, which have focused on CEO pay, find little evidence of use of relative performance evaluation. In contrast, we find strong evidence of the use of relative performance evaluation for analysts. *II* rankings rate analysts relative to peers covering the same industry and therefore insulate analysts from exogenous industry factors that could affect their performance in a given year. Moreover, unlike the few papers that have examined compensation below the top management level (e.g., Medoff and Abraham (1980, 1984), Fisher and Govindarajan (1992)), which generally document a small but statistically significant relation between compensation and performance, we find strong evidence of relations that are both statistically *and* economically significant. Also, in contrast to prior investigations of Wall Street compensation, we are able to study the actual compensation of individual decision makers. Due to data limitations, prior research has been forced to examine indirect data, such as the compensation of groups/divisions.[8]

This paper is organized as follows. Section I develops our hypotheses. Section II explains data sources, sample composition, and variables used. Empirical results are presented in Section III. Section IV concludes with a discussion of the results.

---

[6] Moreover, prior research suggests that, *within high-status investment banks*, *II* ranking is unrelated to forecast accuracy and long-window stock-picking performance (see Section III.A for a discussion of this literature). *Institutional Investor* also states that forecast accuracy and stock picking performance receive relatively little emphasis from their buy-side respondents (e.g., Bradshaw (2008)).

[7] Hong and Kubik (2003) and Mikhail, Walther, and Willis (1999), provide evidence that extremely good or bad forecast accuracy realizations can have an indirect impact on analysts' compensation via turnover.

[8] Coles, Suay, and Woodbury (2005) study the compensation of buy-side investment advisory *companies*. Kaplan and Rauh (2008) impute the compensation of investment bankers using publicly available firm- and division- level data and a variety of practitioner-verified assumptions.

I. HYPOTHESIS DEVELOPMENT

This section develops hypotheses about the drivers of sell-side analysts' compensation. Our analysis draws on field interview data from eleven investment banks, prior analyst research, and economic compensation theories.

A. Financial Analyst's Role in Value Creation at Investment Banks

A large body of research has shown that sell-side analysts create value for investment banks in two primary ways. First, they generate trading commissions for their employers (Hayes (1998) and Irvine (2001 and 2004)). Institutional investors demand analyst services both as a basis for their investment decisions and to satisfy standards of fiduciary responsibility (O'Brien and Bhushan (1990)). Although institutional investors do not directly compensate banks for the quality of analyst research and there is no explicit contract that ties institutional trading to the receipt of analysts' reports (McNichols (1990) and Michaely and Womack (1999)), our interviews with the research executives at eleven leading investment banks suggest that, as a practical matter, institutional arrangements and relational contracts ensure that research quality is a leading indicator of commission revenue. For example, large institutional investors use a formal voting mechanism to rate the value of analyst research across banks and use these aggregate ratings as an input into the allocation of brokerage commissions across banks for the next three to twelve months.

The second way that sell-side analysts create value for their employers is by helping to generate corporate finance fees (Krigman, et al. (2001) and Clarke, et al. (2007)). Issuer firms demand analyst services because analyst coverage can produce greater institutional investor awareness and liquidity (Kelly and Ljungqvist (2007) and O'Brien and Bhushan (1990)).

Although issuer firms do not directly pay for analyst coverage, they direct their corporate finance business to banks that can help them achieve their informational objectives (Krigman et al. (2001)). Prior to the Global Settlement of 2003, issuer firms also used highly-regarded analysts as advisors for mergers, acquisitions, and other strategic corporate finance transactions (Healy and Palepu (2001)). Such interactions allowed analysts' employers to obtain coveted lead underwriter positions on lucrative deals, increasing banking fees (Reingold (2006)).

In summary, financial analysts' create value for their employers by maximizing their banks' trading commissions and corporate finance fees. Given that optimal compensation contracts are designed to provide employees with an incentive to create value for their organization's owners (Jensen and Meckling (1976) and Baker (2002)), we expect that analyst compensation will be tied to leading and lagging indicators of trading commissions[9] and investment banking contributions.

B. Economic Factors Expected to Drive Analyst Compensation

Optimal performance measure choice is highly dependent on the characteristics of an agent's tasks. All else equal, if the task is straightforward, an action-based performance measure will be efficient since it imposes less risk on the agent (Holmström (1979), Banker and Datar (1989), and Baker (2002)). However, if the agent has valuable specific knowledge then an outcome-based performance measure will typically be optimal since it provides agents with better incentives to use their knowledge productively (Prendergast (2002), Baker and Jorgensen (2003), Raith (2007)). Our tests therefore examine the relation between analyst compensation

[9] According to O'Brien and Bhushan (1990, p. 59), "it is rare (and controversial) for research analysts' compensation to be *explicitly* based on commissions" [emphasis added]. Our interviews with eleven leading investment banks support this claim. However, based on these interviews and economic theory, we predict that analyst compensation will be tied to leading and lagging indicators of commissions.

and a variety of outcome- and action-based performance measures. In addition, microeconomic theory and prior empirical research suggests that analysts' compensation is likely to be related to their job and human capital characteristics.[10]

In this section, we develop each of the theoretical constructs into testable predictions about the types of compensation variables that are likely to induce financial analysts' to generate additional brokerage and investment banking business for their banks. At all the banks where we interviewed virtually all of the metrics we discuss were used for analyst evaluations. However, in no case were they aggregated into a comprehensive assessment using a formula. Overall assessments were therefore subjective aggregations of measured (and potentially unmeasured) performance metrics.

B.1. Outcome-Based Performance Measures

We consider four outcome-based performance measures for financial analysts. The first is whether the analyst is rated as an "All-Star" by *Institutional Investor (II)* magazine. *II* ratings are based on an annual survey of buy-side institutions and are widely-viewed as the most comprehensive publicly available measure of analyst performance.[11] The survey requests customers to vote for analysts who "have been the most helpful to them and their institution in researching U.S. equities over the past twelve months" (Institutional Investor (1996 and 1997)). Prior research has shown that star analysts contribute to the performance of their investment banks by generating additional trading volume (Jackson (2005)) and by attracting investment

[10] See Milgrom and Roberts (1992), Gibbons and Waldman (1999), and Prendergast (1999 and 2002) for reviews of this literature.

[11] Other ratings of analyst performance are provided by Greenwich Associates, the banks' own sales force, and by clients in quarterly votes on analysts.

banking clients (Dunbar (2000), Krigman et al. (2001), and Clarke et al (2007)).[12] The metric is therefore highly congruent with banks' objectives,[13] and is expected to have a positive association with analyst remuneration.

Our second outcome-based performance measure is the analyst's contribution to the firm's investment banking operations. Because this outcome measure is highly congruent with banks' objectives, we predict a positive association between analysts' contributions to investment banking and their compensation.

The final two outcome-based metrics, stock recommendation performance and earnings forecast accuracy, have been widely studied in prior research. Evidence suggests that (changes in) stock recommendations have investment value for bank clients (e.g., Womack (1996) and Jegadeesh et al. (2004)). Analysts with superior recommendation performance potentially create value for banks in two ways. First, they enhance the bank's reputation in public research ratings by the *Wall Street Journal*, which are based on recommendation performance.[14] Second, they are likely to generate more commission business from clients who value their research. It is therefore

[12] Dan Reingold, a former star telecom analyst at Morgan Stanley, Merrill Lynch, and CSFB, states: "To understand the *I.I.* rankings is to understand what really made a Wall Street analyst in the 1990s…How accurate our stock picks were didn't matter so much. What did matter was whom the buy-side analysts and portfolio managers voted for in the poll. And so our jobs became as much about responding to the needs of every potential voter as they were about actually doing good research and accurately picking stocks. … Getting ranked in *I.I.* they said, was good for everyone. It made it easier for the retail brokers to attract clients, helped the traders and institutional sales people generate more commissions, and lest we forget, it helped the bankers attract investment banking business from corporate executives" (Reingold (2006), pp. 87, 88, 91).

[13] We use the term "congruent" in the sense of Feltham and Xie (1994), Datar, Kulp, and Lambert (2001), and Baker (2002). Loosely speaking, a performance measure is said to be congruent if inclusion of the measure in an analyst's incentive compensation contract will induce the analyst to take actions that are closely aligned with the bank's objectives. Multitasking agency models predict that congruent performance measures will be heavily weighted in analysts' incentive compensation plans.

[14] The *Wall Street Journal* began publishing its annual "Best on the Street" report in 1993. The report lists the top five analysts within each industry based solely on recommendation performance (Emery and Li (2008)). Anecdotal evidence suggests that investment banks care about the *WSJ*'s ratings. For example, Merrill Lynch posted the names of its nine analysts who made the 2005 *WSJ* rankings on its website. Moreover, Merrill's head of Americas Equity Research commented that the bank's strong ranking "clearly showcase[s] our leadership in providing high-quality fundamental stock analysis across all sectors." (Merrill Lynch (2005)).

not surprising that many of the research directors we interviewed noted that they track analysts' recommendation performance. As a result, we predict that analysts' compensation is positively related to their stock picking performance.

Research on analysts' earnings forecasts finds that more accurate forecasting is associated with "favorable" job transitions (Hong and Kubik (2003)) and that top-tier investment banks employ significantly more accurate forecasters (e.g., Clement (1999) and Malloy (2005)). Consequently, it appears that prestigious Wall Street research houses, such as our sample firm, demand forecast accuracy. We therefore predict a positive association between the accuracy of earnings forecasts and analyst compensation.

B.2. Action-Based Performance Measures

Based on our discussions with Wall-Street research directors and insights from prior research, we incorporate two action-based performance measures in our compensation regressions. The first is analysts' frequency of coverage, measured by the number of times analysts revise their annual EPS estimates within the performance evaluation period. This widely tracked measure was included in the performance evaluation and development documents that we received from our sample bank. Moreover, prior research suggests that it is a leading indicator of value creation. For example, Krigman et al. (2001) find that dissatisfaction with the frequency of coverage is a key determinant of firms' decision to switch underwriters.

Our second action-based performance measure is the number of initiations made by the analyst. Like revision activity, initiations were widely tracked by the banks we interviewed, appeared in our firm's performance evaluation and development materials, and have been the subject of prior academic research. For example, Ertimur, Muslu and Zhang (2007) argue that

contractual mechanisms, such as "research guarantees," provide analysts with strong initiation incentives.[15] Moreover, analysts' initiation reports are typically much longer and contain more detailed, contextual analyses than their other reports. We hypothesize that there is a positive relation between analyst compensation and both forecast revisions and initiations.

B.3. Job Characteristics

Dating back to at least Mayer (1960), economists have hypothesized that optimal organizational design requires that larger and more complex tasks be handled by more capable employees. Consistent with these predictions, empirical compensation studies show that size is a significant driver of executive remuneration (see Rosen (1992) and Murphy (1999) for a review of this literature).

For investment banks, larger and more complex analyst tasks relate to the types and number of stocks covered. Research directors we interviewed commented that it is particularly important to have strong analysts covering key stocks that have a disproportionate impact on the business. Similarly, a recent report by Sanford C. Bernstein (Hintz, Werner, and St. John (2006)) argues that analysts who cover large capitalization sectors of the equity market generate the greatest commissions and are allocated a large share of the firm's research resources. However, not all analysts have the talent to cover important stocks (e.g., Clement (1999)). Consequently, theory predicts that firms will bid aggressively for analysts who can successfully manage key stocks and that, in competitive equilibrium, small differences in talent will lead to large

[15] Research guarantees are agreements in which "Bank A" accepts payment from "Bank B" in exchange for initiating coverage of Bank B's investment banking client. For more information on research guarantees, see Ertimur et al. (2007).

differences in compensation.[16] Consequently, we predict that analysts who cover portfolios with larger aggregate trading volumes will receive higher compensation.

B.4. Human Capital Characteristics

Since Becker (1964), compensation theorists have studied how general-purpose and firm-specific human capital affect compensation.[17] One prediction of this literature is that in settings where firm-specific human capital is important, *outside* hires will command a premium over inside hires, holding performance constant.[18] Consistent with this theory, Murphy and Zabojnik (2004 and 2007) find that CEOs hired from the outside earn approximately 15% more than CEOs who were promoted internally. Since firm-specific human capital is an important determinant of analyst performance (Groysberg and Lee (2008)), we predict that "homegrown analysts" will earn less than outside hires, holding performance constant.

In addition, if analysts learn to do important tasks, such as mentoring, through experience and these benefits are not fully captured in our outcome- and action-based measures of performance, then we should find a positive association between analyst compensation and experience.

---

[16] See Gabaix and Landier (2008) for an application of this argument to CEO remuneration.

[17] General-purpose human capital is completely mobile. It is as valuable to potential employers as it is to one's current employer. Firm-specific human capital is not mobile and will only lead to improved performance at the current employer.

[18] This arises because if firm-specific human capital is valuable, outside hires must, on average, have more general human capital to compete with their peers. Since compensation is increasing in bargaining power and bargaining power is increasing in the ratio of general-to-firm specific human capital (holding performance constant), it follows that outside hires will earn more than insiders, holding performance constant. Despite this pay differential, insiders will typically not elect to switch firms because their performance, and hence compensation, would suffer due to the loss of firm-specific human capital.

II. DATA SOURCES AND SUMMARY STATISTICS

A. Data Sources

The data used in this study come from five sources: a proprietary compensation file, I/B/E/S, CRSP, SDC Platinum, and *Institutional Investor*. We begin with compensation data for all senior sell-side analysts[19] who worked for the sample bank between 1988 and 2005. For each of the 1,051 analyst-years,[20] the company provided us with information on the analyst name, hire date, annual salary and bonus awards.[21] We merged these data with fiscal-year-end forecasts from the I/B/E/S Detail EPS History File, market information from CRSP, and investment banking data from SDC. After imposing the traditional forecasting restrictions (see appendix), the primary sample comprises 609 analyst-year observations, an average of 33.8 analysts per year. Given that I/B/E/S did not begin to track stock recommendations until 1994, our analyses that include recommendations data are restricted to a sample of 401 observations (an average of 33.4 analysts per year).

Institutional Investor ratings were obtained from two sources. First, we collected data on All-American analysts (including all runners-up) from the October issue of *Institutional Investor* magazine for each sample year. Second, we used the full *Institutional Investor* research report available for the years 1996 to 2002,[22] to collect information on the number of votes for all

[19] Wall Street firms employ senior analysts and junior analysts. The forecasts and recommendations of senior analysts are recorded by analyst tracking services, such as First Call, I/B/E/S, Reuters, and Zacks. Junior analysts, who are often called "associates," provide research support to senior analysts. We are unaware of any publicly available performance measures for junior analysts.

[20] These 1,051 analyst-years include strategists, economists, and other senior employees who do not issue forecasts for individual stocks. These individuals are dropped from our sample when we merge to I/B/E/S.

[21] The bank also supplied us with various performance evaluation and development documents. We used these hard copies to ensure that our explanatory variables matched those tracked by the bank.

[22] In contrast to the publicly available rankings, which occupy roughly 50 pages of each October's edition of *Institutional Investor* magazine, these more comprehensive ratings are published annually in 350-400 page books. These books were first published in 1995. We examine the years 1996 – 2002 because of data limitations.

analysts who received one or more votes from within a given industry. While our first source of *Institutional Investor* data has been utilized in many studies,[23] we are unaware of any prior research that has utilized or discussed our more comprehensive *Institutional Investor* data.

B. Analyst Compensation Measures

Descriptive data on our key dependent variable, compensation for the sample firm's analysts in 2005 dollars, is reported in Figure 1 and Table I. Mean real total direct compensation for the sample period was $843,174, 25% coming in the form of salary and the remaining 75% in the form of a bonus.[24]

Mean real analyst compensation at the sample firm increased dramatically during the late 1990s to a peak of around $1.4 million in 2000 to 2002, and declined by 44% between 2003 and 2005. As indicated in Table I, much of the variability in compensation over the sample period arose from variation in bonus awards. For example, the dramatic growth in compensation from 1995 to 2002 was fueled by average real bonus growth rates of 45% in 1995, 21% in 1996, 33% in 1997, and 77% in 2000. When the cycle reversed, average real bonuses declined by 33% in 2003 and 26% in 2005.

Mean (median) *nominal* salaries grew modestly throughout the sample, from $146,667 ($150,000) in 1988 to $173,077 ($175,000) in 2005. There was only one instance of a nominal salary decrease within our data. However, *nominal* salary growth rates were less than rates of

[23] These studies include Stickel (1992 and 1995), Krigman et al. (2001), Leone and Wu (2007), and Clarke et al. (2007).

[24] Our total direct compensation measure comprises both salary and bonus. However, it excludes benefits, such as 401(k) contributions and healthcare coverage, and therefore understates true total compensation. Our discussions with Wall Street research directors suggest that some analysts have individual employment agreements with their firms. These agreements specify a guaranteed minimum bonus (typically for the first year of service), severance benefits, and leave provisions. Unfortunately we have no historical records of such agreements for our sample firm.

inflation, since mean (median) *real* salaries showed small but steady declines throughout much of the eighteen-year period, from $239,535 ($244,979) in 1988 to $173,077 ($175,000) in 2005.

The large increases in compensation that occurred during the late 1990s were not shared equally among the analysts employed by the firm. As shown in Figure 1, during the late 1990s, the variance and skewness of the income distribution increased substantially. At the peak of the cycle, analysts in the top decile of the compensation distribution received $3,236,484 (in 2005 dollars), more than three times the compensation of the median analyst. In contrast, in 2005, analysts in the top decile earned less than 2.2 times compensation of the median analyst at the firm.

Finally, it is worth noting that the large decline in analyst remuneration that occurred in the last 3-4 years of our sample is consistent with reports of declining research budgets at top-tier investment banks. For example, Francis et al (2004) cite a report by Sanford C. Bernstein, which estimates that the total research budgets of the eight largest investment banking firms declined 37% between 2000 and 2003, from $2.7 billion to $1.7 billion. During this period, the median analyst bonus at our sample firm dropped 33%, from $886,052 to $592,642.

C. Predictive Variables

Table II reports descriptive statistics for analysts' outcome- and action-based performance metrics, job characteristics, and human capital indicators. A concern is that providing this data for the sample firm could effectively reveal its identity. To preserve the firm's anonymity, where available we report descriptive statistics for analysts at all top-twenty banks. Our sample firm is consistently rated among the leading twenty investment banks during

the sample period, and its analyst metrics are comparable to those for other top twenty firms. As a benchmark, we also present data for all analysts on the I/B/E/S database.

C.1. Outcome-Based Performance Measures

We examine four outcome metrics: All-Star ranking by *II*, investment banking business, earnings forecast accuracy, and stock recommendation performance. For each of these metrics we align analyst performance for the year with the firm's compensation evaluation period, December 1 to November 30 of each year. Data on *II* All-Star ratings for the sample firm's analysts, published in mid-October, are used to construct a dummy variable that takes the value one if an analyst at the sample firm is named by *II* as one of the top three analysts or a runner-up in his/her sector, and zero otherwise. To preserve the test firm's anonymity we do not present descriptive statistics for its All-Star rankings. However, in 1996 and 1997 (the midpoint of our sample), *II* representation at comparable high status, full-service investment banks ranged from 30% to 70% (*Institutional Investor* (1996 and 1997)). In contrast, Leone and Wu (2007) report that only 7% of I/B/E/S analysts achieved *II* recognition during the 1991-2000 period.

Investment banking business is the number of investment banking transactions (IPO, secondary offers, and M&A transactions) undertaken by companies the analyst covers for the compensation year, where the sample firm is a member of the banking syndicate. Data used to generate this index are from the Securities Data Corporation (SDC) and I/B/E/S databases. To preserve the anonymity of the sample firm, we do not report descriptive statistics for this variable. Further, the bank prohibited us from examining the impact of the Global Settlement on analysts' bonus compensation. Our tests therefore examine the average compensation effect of investment banking throughout the sample period.

We estimated earnings forecast accuracy (controlling for industry and horizon) using a variant of Clement's (1999) relative forecast accuracy index (see appendix for calculation).[25] To be included in this analysis, forecasts must be made between 90 and 360 days before the earnings announcement and the earnings announcement must occur within the compensation evaluation period.[26] As shown in Table II, the median top twenty analyst makes earnings forecasts that have 14% lower absolute errors than the consensus, versus 8% for the I/B/E/S population.[27] This is consistent with Clement's (1999) claim that analysts at high-status banks have better resources and, as a result, are able to make more accurate forecasts.[28] It is also consistent with Hong and Kubik's (2003) finding that analysts with top (bottom) decile forecasting performance are more likely to move from low (high) status banks to high (low) status banks.

Stock recommendation performance is measured using mean annualized raw returns to strong buy and buy recommendations, the approach used by the sample firm to measure recommendation performance.[29] This performance measure is constructed by scaling the recommended holding period of each "buy" and "strong buy" by the number of recommended holding days relative to the number of days in the year. For example, if returns for a recommended 60-day holding period are 7%, the annualized return is 43% (7%*365/60) (see the

[25] We also used undeflated absolute forecast errors, price-deflated absolute forecast errors, and the standard-deviation deflated measure reported in Groysberg, Healy, and Chapman (2008). None of these measures was associated with analyst compensation.

[26] We also examined the relation between average forecast accuracy over the past two and three years and current period compensation. Neither strengthened the relation between forecast accuracy and compensation. We report our results using single period forecast accuracy, as this maximizes our sample size.

[27] Our -0.08 median I/B/E/S forecast accuracy estimate is identical to that of Clement (1999, Table 2 Panel B) and indicates that the distribution for this variable is skewed.

[28] For similar evidence, see Malloy (2005).

[29] Although the firm did not use risk-adjusted returns to evaluate analyst performance, we also estimated the pay-for-performance relation using several risk-adjusted stock picking indices (see appendix). None of these stock return metrics was related to analyst compensation. Similarly, we examined short window returns and trading volume around recommendation changes. Neither was included in the performance evaluation materials that we received from the investment bank and neither was related to analyst compensation.

appendix for more details on the calculation). Although this stock picking performance index may seem crude relative to many of the regression-based approaches used by academics (e.g., Barber, Lehavy, and Trueman (2007)), analysts indicated that it is highly intuitive and has good "line of sight." Consequently, this simple measure may result in more efficient contracting (Bonner and Sprinkle (2002)). On the other hand, linking large monetary rewards to this measure would likely induce a "disposition effect" (Barber and Odean (1999)) since analysts would have an incentive to lock-in short-term gains (that are annualized) and spread-out losses. Table II shows that the median annualized buy recommendation return for top twenty firm analysts during the period 1994 to 2005 was 13.5%. This was remarkably similar to the 13.9% return for the I/B/E/S population.

C.2. Action-Based Performance Measures

Two action-based performance measures are included in our regression models: the frequency of coverage and the frequency of initiations. To construct our frequency of coverage measure, we keep only those forecasts from the I/B/E/S EPS detail forecast file that are between 360 and 90 days of the company's EPS announcement and then sum the number of EPS forecasts by analyst-evaluation-year (this is broadly similar to the approach used in Hong et al. (2000)). Our frequency of initiation measure is also similar to prior research (e.g., Ertimur et al. (2007), Irvine (2003), and McNichols and O'Brien (1997)) in that we focus on "new" (as opposed to "original") coverage. The descriptive statistics in Table II indicate that the median analyst at a top twenty bank makes 25 forecast revisions per year and initiates coverage on one new stock, similar to values for all I/B/E/S analysts.

C.3. Job Characteristics

We expect analyst compensation to vary positively with the scale of analysts' portfolios. We use the natural logarithm of the *lagged* aggregate number of shares traded for all firms covered by the analyst during the annual performance evaluation period as our scale metric.[30] The coefficient on *lagged* trading volume can be interpreted as a reward for covering important stocks, and not as a measure of pay for current period performance.[31] Compensation for increasing aggregate trading volume in the current period is likely to be reflected in other coefficients, such as II ranking and the 'number of initiations' coefficients.

As reported in Table II, the aggregate trading volume of stocks covered by the median analyst at a top twenty firm is 928 million shares, 45% higher than that of the median analyst in the full I/B/E/S sample (641 million shares).

C.4. Human Capital Characteristics

Two human-capital metrics are used in our tests: homegrown versus externally hired status and analyst experience. The effect of being homegrown versus hired externally is estimated using a dummy variable that takes the value one if the analyst was initially hired by the sample bank and was promoted internally, and zero if the analyst was hired directly at the senior

[30] To test the robustness or our results, we also estimated all of our regressions using lagged market capitalization in place of lagged trading volume. Our results are qualitatively and quantitatively similar to those reported. We also examined the robustness of our results to choice of lagged versus non-lagged trading volumes. Our results are insensitive to this design choice. Consequently, we opted for the lagged variable, as it does not confound portfolio scale (the desired economic construct) with the effect of analysts' current period actions.

[31] Thus, we use the more generic term "compensation response coefficient" when referring to our model's parameters. We use this term to refer to pay-for-performance sensitivities (the coefficients on the action- and outcome- based measures) and the coefficients on effort-insensitive variables (job characteristics and human capital variables).

analyst level (often from a competitor bank). For the sample firm, 14% of its analysts are homegrown.[32]

Analyst experience is defined as the natural logarithm of the number of years that the analyst has been employed as a senior analyst.[33] As shown in Table II, median experience for analysts at the leading twenty banks is five years, comparable to that for the I/B/E/S population.

In summary, analyst characteristics for the sample firm are similar to those for other top twenty banks. They are also remarkably similar to the population of I/B/E/S analysts in terms of experience, number of firms covered, forecast revisions, stock initiations, and buy recommendation returns. However, analysts at the sample firm (and other top twenty firms) cover larger firms, are more likely to be *II* ranked, and make more accurate earnings forecasts than the typical analyst in the I/B/E/S database.

III. EMPIRICAL EVIDENCE

A. Univariate Results

Table III presents Pearson and Spearman correlations for compensation and the key performance metrics. Column 1 indicates that total direct compensation is positively correlated with *II* All-Star status, the number of investment banking deals in which the bank participates and where the analyst covers the stock, the number of forecast revisions during the year, the lagged aggregate trading volume of stocks covered, and analyst experience. There is no

[32] We report this estimate for the sample firm since it is based on private information and cannot be used to identify the sample firm. Comparable estimates are not available for other top-twenty firms or for the I/B/E/S population.

[33] As noted by Clement, Koonce, and Lopez (2007), experience is a broad concept and different types of experience can lead to different types of human capital. Our definition of experience is similar to Clement (1999) and captures analysts' experience with the profession (as opposed to experience with specific stocks, events, or transactions).

association between total compensation and either earnings forecast accuracy or stock recommendation performance.

Correlations between bonus compensation and the performance metrics are remarkably similar to those for total compensation. However, for salary, three differences are worth emphasizing. First, the correlation with investment banking transactions declines markedly and becomes insignificant. Second, the correlation with analyst experience increases. Third, the correlation with the homegrown analyst dummy is negative, implying that senior analysts who entered the firm at the junior analyst level received lower salaries than peers who joined the firm at the more senior port of entry.

The correlation matrix also indicates that All-Star status is positively correlated with the number of forecast revisions and analyst experience, and negatively correlated with the homegrown dummy, implying that the firm targets ranked analysts for external hires. All-Star status is unrelated to earnings forecast accuracy, consistent with prior evidence for top-tier banks (Fang and Yasuda (2005a), Tables IV and VI).[34] There is also no correlation between II status and long-window stock recommendation performance, consistent with Stickel (1995, Table 6 and Figure 3) and Emery and Li (2008).[35] Finally, there is no significant association between forecast accuracy and stock picking performance, consistent with prior research (e.g., Mikhail et al. (1999)).[36]

[34] Stickel (1992) and Leone and Wu (2007) document a positive association between forecast accuracy and *II* status, but use a sample that comprises both top- and lower-ranked firms.

[35] In contrast, Cohen, Frazzini, and Malloy (2008, fn. 22) find no evidence that II All-Star analysts outperform other analysts on their buy/sell recommendations. Stickel (1995, Table 6 and Figure 3), Fang and Yasuda (2005b), and Leone and Wu (2007) document a positive association between II status and *short-window* stock returns.

[36] Evidence in Bradshaw (2004) suggests that analysts' stock recommendations are primarily determined by their long-term growth forecasts, not their short-term EPS forecasts.

B. Cross-Sectional Regression Results

Following prior research,[37] we use logarithmic OLS regressions to estimate the implicit weights placed on various performance measures for the sample firm's compensation system. Compensation response coefficients are estimated using total direct compensation, as well as salary and bonus components for the full period 1988 to 2005 and for the sub-period 1994 to 2005 (when recommendation returns are available). We include year fixed effects to control for changes in industry and firm performance over time.[38] To evaluate the proportion of variance in compensation attributable to each of the explanatory variables, we follow Ittner, Larcker, and Meyer (2003) and report the incremental explanatory power of each variable.[39] Reported standard errors use the Froot-Rogers estimator and are robust to both heteroskedasticity and analyst-level autocorrelation (Froot (1989) and Rogers (1993)).

B.1. Total Compensation Models

[37] See Bushman and Smith (2001) for a review of this literature.

[38] In unreported tests we drop the year effects and include changes in the financial sector stock index as an explanatory variable. Although the adjusted R^2 of the model declines by just over 5%, the industry return is both economically and statistically significant. However, it is unclear whether this variable reflects the performance of the financial services sector, or the firm itself. Distinguishing between these two forces is necessary in order to interpret the coefficient as either retention incentives (e.g., Oyer (2004)) or incentives for effort and teamwork (e.g., Bushman, Smith and Indjejikian (1995)). To distinguish between these alternate hypotheses, we attempted to collect data on the financial performance of the sample investment bank using the bank's X-17A-5 SEC Filings. However, income statement data were not available, as the firm chose to withhold the income statement portion of the X-17A-5 under the SEC's confidential treatment provision. For more information on the X-17A-5 filings, see Agrawal and Chen (2008).

[39] We measure incremental explanatory power using a partial R^2 statistic. The partial R^2 is the proportion of the effect plus error variance that is attributable to an effect and is calculated as: $R^2 = SS_{Effect}/(SS_{Effect} + SS_{Error})$. Alternatively, this statistic can be calculated as follows: (1) regress the dependent variable on all explanatory variables, except the effect of interest (2) regress the effect of interest on all other explanatory variables (3) take the square of the Pearson correlation of the residuals from (1) and (2). It is worth noting that the t-ratio partial R^2 estimator shown in Greene (2000, pp. 234, equation 6-29) is not appropriate in our context, as it assumes IID disturbances.

Table IV presents results for our cross-sectional total compensation model. The model's explanatory power is remarkably strong with an adjusted R^2 of 58%. For the 1988 to 2005 sample, the coefficients indicate that three variables are significantly related to compensation: All-Star status, investment banking transactions, and the lagged aggregate trading volume of covered stocks. The estimated coefficient for All-Star analysts is 0.476, which implies that on average total compensation for star analysts' was 61% higher than for lower-rated or unrated analysts.[40] The relative importance of All-Star status for compensation purposes is underscored by the high partial R^2 of 0.17.

The investment banking estimate of 0.081 implies that an analyst who follows a company that is an investment banking client in a given year earned 8% higher total compensation than analysts with no investment banking clients. The partial R^2 for this variable is 7%, considerably lower than for *II* ranking or aggregate trading volume (see below).

The estimate on the logarithm of the lagged aggregate trading volume of covered stocks is 0.179. This estimate implies that an analyst whose aggregate trading of stocks covered is at the third quartile earned 48% higher total compensation than a peer who covers stocks with a trading volume at the first quartile.[41] The incremental R^2 of this variable is roughly 14%, implying that it packs considerable explanatory punch. Finally, the coefficients on mean relative forecast error,

[40] A one-unit change in the explanatory variable X is associated with a $100 \cdot (e^b - 1)$% change in compensation, where b denotes the estimated coefficient on variable X.

[41] Since we regress the natural logarithm of compensation on the natural logarithm of aggregate trading volume, increasing trading volume the first quartile (Q_1) to the third quartile (Q_3) will result in a $100 \cdot \left(\left(e^{\ln(Q_3)-\ln(Q_1)} \right)^b - 1 \right)$% change in expected compensation, where *b* denotes the estimated coefficient on the natural logarithm of aggregate trading volume.

annualized stock recommendation performance, homegrown status, number of forecast revisions, number of stock initiations, and analyst experience are insignificant.[42]

Table IV also shows the results for the 1994 to 2005 subsample, when we have access to stock recommendation performance. The results are generally similar to those for the full sample period. Total compensation is related to All-Star status (with a coefficient of 0.525), the number of stocks the analyst covered that were also investment banking clients that year (with a coefficient of 0.079), and the lagged aggregate trading volume of stocks covered (with an estimated coefficient of 0.207). The stock performance variable is insignificant.[43]

Finally, we re-estimated the model for the seven-year period (1996-2002) for which we have detailed *II* analyst ratings. These additional ratings allow us to partition analysts who do not appear within the October edition of *Institutional Investor* magazine (i.e., analysts who did not receive at least a runner-up rank) into: (i) analysts who received at least five votes, but not enough votes to appear within the magazine (ii) analysts who received between one and four votes (termed "honorable mentions"), and (iii) analysts who received no votes. The total compensation estimates, reported in Table IV, are 0.91 for All-Star analysts named in *II* magazine, 0.43 for analysts who received at least 5 votes but were not rated as All-Stars, and 0.16 for analysts with between 1 and 4 votes (inclusive). These imply that relative to analysts who receive no *II* votes, the average total compensation premium was 149% for All-Star analysts, 54% for non-All-Stars who receive more than five votes, and 17% for analysts who

[42] In unreported tests, we also examine whether analysts are rewarded for making optimistic forecasts for the companies they cover or for banking clients. We find no evidence that the sample bank rewards its analysts for providing optimistic earnings forecasts.

[43] The forecast accuracy and stock picking insignificance results cannot be attributed to a lack of variation in these variables. Consistent with prior literature (e.g., Mikhail et al. (1999) and Hong and Kubik (2003)), Table II shows that, although analysts at top-tier banks are more accurate forecasters than analysts at lower-tier banks, there is still considerable variation in forecast accuracy and stock picking performance among analysts employed by top 20 banks.

receive 1 to 4 votes. Thus, it appears that the compensation allocation process is designed to reward not only the top rated analysts, but also to distinguish between analysts with medium and low ratings from institutional clients.

B.2. Salary and Bonus Models

Table V shows model estimates for salary (Panel A) and bonus (Panel B) compensation components. Both salary models have an adjusted R^2 of 49%. Five variables exhibit a significant association with analysts' salaries: All-Star status, the number of stock initiations, the lagged aggregate trading volume of covered stocks, experience, and whether the analyst is homegrown. For the full sample period, the All-Star estimate of 0.145 indicates that star analysts earned 16% higher salaries than lower rated or unrated analysts. The lagged aggregate trading volume estimate (0.062) implies that an analyst whose aggregate trading volume of covered stocks is at the third quartile earned 15% higher salary than an analyst with an aggregate trading volume of covered stocks at the first quartile. The estimated experience coefficient of 0.073 indicates that a 10% increase in experience was accompanied by a 0.7% increase in salary. The estimate for the homegrown dummy (-0.115) implies that homegrown analysts earned 11% lower salaries than their peers who were hired from outside firms. The negative estimate for forecast initiations is modest (-0.009) and counter-intuitive; it implies that analysts covering a new stock received 0.9% lower compensation. One possible explanation for this counterintuitive result is that analysts who are struggling with their existing portfolio of stocks may search out new firms to cover. Finally, forecast accuracy and buy recommendation performance are unrelated to salary awards.

The bonus compensation models have adjusted R^2s of 52% and 56%.[44] Three variables are systematically related to bonus awards: All-Star status, investment banking contributions, and the lagged aggregate trading volume of covered stocks. For the full sample, the estimate for All-Star status (0.694) implies that star analysts received bonus awards that were 100% higher than those who were not among the top three or runner-up. The investment banking estimate of 0.113 implies that an analyst who covers one banking client earned a 12% higher bonus than peers who covered no banking clients. And the lagged aggregate trading volume coefficient (0.224) indicates that analysts whose covered stocks had an aggregate trading volume at the third quartile had 64% higher bonus awards than analysts whose trading volume of stocks covered was at the first quartile. Consistent with findings for total and salary compensation, forecast accuracy and buy recommendation performance were unrelated to variation in realized analyst-year bonuses.

B.3. Model Stability

The primary results discussed above indicate the average drivers of analyst compensation during the twelve and eighteen year sample periods. To examine whether there have been changes in the model estimates over time, we re-estimate the models for three six-year sub-periods (1988-93, 1994-1999, and 2000-05), and for two nine-year sub-periods (1988-1996 and 1997-2005). The results are similar to those reported for the full sample period. Total compensation is significantly positively related to the top *II* ranking, investment banking and lagged trading volume of stocks covered for each of the sub-periods. We find no evidence that

[44] Although bonuses in many industries are censored at 0, left censored bonuses are not a problem at our sample firm. The minimum bonus in our data is $2,500 and there is no evidence of bunching around this number. Consequently, we present OLS (as opposed to Tobit) regressions.

total or bonus compensation models assign higher weights to *II* rankings for top rated analysts or on trading volume of stocks covered during any of the sample sub-periods. Finally, estimates for earnings forecast accuracy and stock recommendation returns are insignificant in each of the sub-period models.

Although statistically insignificant (*P-Value* = 0.11), the strongest evidence of direct forecasting incentives occurred in the 1988 – 1993 period.[45] During this period, a 10% decrease relative forecast error was associated with a 1.3% increase in total compensation. Interestingly, Hong and Kubik (2003) find that relative forecast accuracy mattered less for analysts' career concerns in the late 1990s than in the late 1980s and early 1990s. Thus, there is weak evidence that analysts' implicit and explicit forecasting incentives moved in tandem during the 1990s.

B.4. Does II Suppress The Effects of Forecast Accuracy and Stock Picking

To test whether forecast accuracy and stock recommendation performance effects are subsumed by the II ranking variable, which aggregates a variety of dimensions of analyst performance, we re-estimate the model for each of the sub-period and for the entire sample excluding II ranking. The estimates for forecast accuracy and stock recommendation performance are insignificant in the entire sample and each of the sub-periods.

C. Longitudinal Regression Results

Prior research has raised questions regarding the validity of cross-sectional pay-for-performance regressions (e.g., Murphy (1985)). A primary concern is that the independent variables in compensation models are correlated with omitted variables (such as talent/ability),

[45] These subsample results are virtually identical to those reported in Table VII for Company 1.

which are the real drivers of compensation. One common approach to dealing with this concern is through the use of a fixed-effects model. Including an analyst fixed-effect in the compensation model can mitigate many of the omitted variable problems that undercut cross-sectional designs. A fixed-effect specification will provide consistent estimates of the parameters if assignment is a function of the unobservable fixed effects (e.g., Wooldridge (2002)).[46] The results indicate whether time-series changes in the independent variables (e.g. *II* ranking, investment banking relations) are related to compensation changes, and as a result control for time-invariant cross-sectional differences in analyst ability.[47]

The results for total compensation, salary, and bonus are reported in Table VI. Two variables are associated with both total compensation and bonus awards: All-Star status and investment banking transactions by covered firms. The All-Star coefficients reflect the compensation effect of gaining (or losing) All-Star status. The estimates of 0.229 for total compensation and 0.381 for bonuses imply that total compensation increased by 26% and bonus awards by 46% when analysts became ranked. In comparison, cross-sectional estimates reported in Table IV and V imply that the compensation effects for star analysts were substantially higher (61% using total compensation and 100% using bonuses). There are two potential explanations for this scale difference. First, since All-Star status and analyst ability are likely to be highly correlated, some of the All-Star effect will be subsumed by the fixed analyst effect in

[46] As noted earlier, Hong and Kubik (2003) document an association between analysts' three-year record of forecast accuracy and optimism and job separations. They find that optimistic and accurate analysts are more likely to secure employment at top tier investment banks, such as our sample firm. Since our analysis of analyst remuneration is conditioned on bank status, one could argue that selection on *unobservables* (e.g., Heckman (1979)) threatens the validity of our cross-sectional inferences. However, to the extent that the unobservable forecasting and stock-picking styles are sticky over time, which seems likely (e.g., Jacob et al. 1999; Mikhail, Walther, and Willis (2004)), our fixed-effects specifications will partially control for such concerns.

[47] In estimating analyst fixed effect models using our data, there is no within-analyst variation in "homegrown status." Similarly, the within-analyst variation in experience is absorbed by the year and analyst effects. We therefore exclude these human capital variables from the analysis.

longitudinal models; cross-sectional estimates do not control for (unobservable) analyst abilities. A second explanation is that there is a compensation premium for star analysts who are ranked highly year after year. This premium is reflected in cross-sectional estimates, but not in the longitudinal estimates since it is highly unusual for an analyst who has been ranked for a number of years to lose his or her ranking.

The longitudinal estimates for investment banking are 0.059 for total compensation and 0.083 for bonuses. They indicate that analysts who covered an investment banking client in a given year received 6% higher total compensation and 9% higher bonus awards that year than peers who covered no banking clients (versus 8% and 12% for cross-sectional models). Since coverage of investment banking clients is likely to vary widely across analysts and years, it is not surprising that the longitudinal estimates are comparable in magnitude to the cross-sectional coefficients.

In contrast to results reported in Tables IV and V, the estimates on lagged aggregate trading volume of covered stocks are insignificant, suggesting that this variable is captured in the fixed analyst effect. This discrepancy between cross-sectional and longitudinal results is consistent with the predictions of the job characteristics literature cited in Section I.B (e.g., Mayer (1960) and Rosen (1982)). This literature predicts that (a) highly talented analysts will be sought to cover economically important industries/portfolios of stocks (b) their high pay will reflect a scarcity rent, and (c) an analyst cannot increase his or her compensation simply by increasing the scale of his or her portfolio. According to the theory, compensation and portfolio scale are jointly determined by (unobservable) abilities. As before, the estimates for forecast revisions, stock initiations, and forecast accuracy are insignificant.

Using data for the 1994-2005 period we continue to find that total/bonus compensation are positively related to both All-Star status and investment banking business. There is little reliable evidence that analysts' total or bonus compensation is affected by changes in the stock performance of buy recommendations or earnings forecast accuracy.

Table VI also reports salary estimates for the longitudinal model. Two variables are significant: All-Star status and the lagged aggregate trading volume of stocks covered. The All-Star estimate of 0.04 implies that a star analyst received 4% higher salary compensation than non-star analysts. The trading volume estimate (0.047) indicates that a 10% change in portfolio scale is associated with a 0.5% increase in salary. In contrast to results reported in Table V, stock initiations are unrelated to salary awards. Like the earlier findings, salary estimates for forecast revisions, forecast accuracy and buy-recommendation performance (for the 1994-2005 period) are insignificant.

D. Generalizability

Due to data limitations, our sample is made up entirely of analysts from one firm. This restriction has both an advantage and a disadvantage. On the positive side, the likelihood that our results are due to a spurious correlation caused by unobserved heterogeneity is reduced. On the negative side, one obvious question is whether the findings can be generalized to other top-tier firms. As noted earlier, our interviews with research directors indicated a remarkable consistency in the performance metrics used for determining analyst bonus awards. Moreover, according to the research directors that we interviewed, two mechanisms ensure that compensation practices remain similar across top-tier firms. First there is considerable inter-firm job hopping by analysts and research directors. Such job hopping should facilitate the transfer of

performance evaluation and remuneration practices across firms (Frederickson, Peffer, and Pratt (1999)). Second, compensation benchmarking is widespread on Wall Street.[48]

Nevertheless, to provide additional evidence on the robustness of our findings, we re-estimate our regression equation using data from a different top-20 investment bank. The second firm provided us with annual total compensation for 254 analyst-year observations in years 1988 to 1993. Over this period, the mean (median) real compensation (in 2005 dollars) for analysts at the second firm was $530,862 ($505,848). This is very similar to the mean (median) real compensation for analysts at our primary firm, which was $545,177.40 ($525,386.24) over this period

Results of the relation between compensation, and these independent variables for the primary and secondary firms are reported in Table VII using both cross-sectional and longitudinal models.[49] The findings are generally quite similar, and increase our confidence that the sample firm findings are not purely idiosyncratic.

For the cross-sectional models, both firms appear to reward analysts who are All-Stars and cover higher aggregate trading volume stocks. The All-Star estimates are 0.393 for the primary firm and 0.543 for the secondary firm. The market cap estimates are 0.207 for the primary sample firm and 0.087 for the secondary firm.

---

[48] For much of our sample period one firm – McLagan Partners – provided most of the benchmarking data and consulting services for financial services and securities firms.

[49] The homegrown variable that has been reported thus far is based on proprietary data from Company 1. We do not have these data for Company 2. Consequently, for the comparisons in Table VII, we use a homegrown proxy constructed from I/B/E/S. This variable is one if an analyst's first EPS forecast on I/B/E/S was issued at Company 1 (Company 2), and zero if the analyst's first EPS forecast was issued while the analyst was employed by another bank. If an analyst enters Company 1 (Company 2) at the senior analyst level immediately after leaving a buy-side or industry career, then our original homegrown variable will equal zero while the I/B/E/S-based variable will equal one. The results in Table VII are unchanged if we use the proprietary homegrown variable for Company 1 and the I/B/E/S-based variable for Company 2, with one exception. The homegrown estimate for Company 1 becomes negative and statistically different from both zero and the estimate for Company 2.

Several interesting differences between the two firms' compensation practices emerge from the cross-sectional estimates. For example, the primary firm pays higher compensation to analysts who cover investment banking clients and to, to a lesser extent, analysts who cover stocks with larger trading volumes. Moreover, although the forecast accuracy estimates for both firms are statistically indistinguishable from zero, they are statistically different from one another. Interestingly, forecast accuracy appears to be *more important* at our *primary* sample firm.

For the longitudinal models, both firms appear to value All-Star analysts. The estimates indicate that the two firms pay 19-26% higher compensation to newly ranked analysts. Once again, the investment banking estimates imply that the primary firm rewards its analysts for covering banking clients, whereas the secondary firm does not. Finally, neither firm appears to provide direct incentives for improved stock performance or forecast accuracy

IV. CONCLUSIONS

Equity research is an important economic activity. Most top-tier investment banks spend over a hundred million dollars on equity research each year.[50] Moreover, within the U.S., millions of individuals rely on equity research when allocating their savings.[51] A Citigroup/Smith Barney survey of retail investors (Madan, Sobhani, and Bhatia (2003)) reported that, "of those surveyed, 87% rate the strength of a research department as very/somewhat important when selecting a brokerage firm, and 50% of high-net-worth investors have read a

[50] For example, in 1995 (which approximates the mid-point of our sample), Goldman Sachs spent $120 million on equity research (Goldman Sachs (1995)). The Sanford C. Bernstein estimates cited by Francis et al. (2004) imply that annual research budgets at the top 8 investment banks averaged between $200 and $300 million during the 2000 – 2003 period of our sample.

[51] Such reliance may be either direct (i.e., retail investors) or indirect, through institutionally-managed holdings.

research report over the past 12 months (70% of clients with $1 million investable assets)." However, recent research suggests that retail investors do not understand analysts' incentives and, more importantly, that this naivety may be responsible for suboptimal investment decisions and an inefficient allocation of capital (Malmendier and Shanthikumar (2007)).

We use data for a single top-tier investment bank to examine factors that drive its analyst compensation. Interviews with research directors at eleven leading banks, including the sample bank, indicate that factors considered in setting analyst compensation include outcome-based performance measures, action-based performance measures, characteristics of the job, and human capital indicators.

Our cross-sectional tests indicate that three variables have an economically and statistically significant relation to total compensation: being ranked as one of the top analysts in an industry by institutional investors, covering a firm that becomes an investment banking client that year, and the lagged aggregate trading volume of stocks the analyst covers. Analysts rated among the top in an industry receive 61% higher compensation than unrated analysts. Analysts who covered an investment banking client in a given year earned 8% higher total compensation than analysts with no investment banking clients. And analysts who covered stocks with aggregate trading volume at the third quartile earned 48% higher compensation than peers at the first quartile. These same factors also drive bonus compensation. This should not be too surprising, since bonus awards makes up on average 75% of total compensation.

Salary compensation is also driven by *II* rankings and the lagged aggregate trading volume of covered stocks. But two additional factors are also important: experience and whether the analyst is homegrown or hired from a competitor. A 10% increase in experience is

accompanied by a 0.7% increase in salary. Homegrown analysts earn 11% lower salaries than analysts hired from competing firms.

In longitudinal tests that control for differences in analyst quality, the fixed effects estimates explain much of the variation in analyst pay. However, two variables continue to be associated with both total compensation and bonus awards: *II* ranking, and investment banking transactions by covered firms. Not surprisingly, the *II* ranking estimates are smaller than for the cross-sectional models; on average, analysts earn 26% higher total compensation when they gain *II* status. For the salary regressions, two variables are important, *II* rank and the lagged aggregate trading volume of covered stocks.

We find no evidence in either univariate or multivariate tests that analyst compensation is related to the stock performance of their buy recommendations or to their earnings forecast accuracy. Action-based measures (i.e., forecast revisions and stock initiations) are also generally insignificant.

Our findings are generally consistent with several agency theory predictions on compensation contracting. The most important single performance metric, *II* ratings, provides a comprehensive assessment of analyst performance that insulates analysts from market- and industry-wide factors, and is congruent with the revenue and profit goals of the investment bank. Further, since the metric is an aggregation of responses of hundreds of buy-side professional and is constructed by a third party, it is verifiable and less likely to be prone to centrality or leniency biases.

The results complement prior research on analysts' incentives. Based on evidence that All-Star analysts (who are expected to be better-compensated) make more accurate and informative earnings forecasts, Stickel (1992) infers that analysts are rewarded for superior

forecast accuracy. Our results support his conjecture that II rankings are important drivers of analyst compensation. But they indicate that the key components of II rankings that are rewarded are not forecast accuracy and recommendation performance.

Hong and Kubik (2003) find that analysts who consistently make extremely inaccurate forecasts have a higher likelihood of being fired from a high status bank such as our sample firm. Combined with our findings, this suggests that analysts' forecasting incentives resemble a *Mirrlees contract*. Under a normal range of forecast outcomes, there is no relation between forecast performance and compensation within banks. However, extremely negative forecasting outcomes are associated with an increased probability of dismissal. Analyst forecast accuracy is therefore likely to differ across firms, with high status banks employing more accurate forecasters and providing higher compensation than lower ranked firms. In contrast, our results, when combined with those of Mikhail et al. (1999), suggest that analysts face neither explicit nor implicit stock picking incentives.

APPENDIX

This appendix provides a more detailed description of the forecast accuracy and stock picking profitability indices used in our study.

A. Forecast Accuracy Index

Given that the sample banks did not track forecast accuracy, we rely on prior literature to guide our choice of forecast accuracy index. In the spirit of Clement (1999), Jacob, et al. (1999), Malloy (2005), and Clement et al. (2007), we measure analyst *i*'s forecasting performance by comparing analyst *i*'s absolute forecast error to the average absolute forecast error of other analysts following the same stocks during the same time period.[52] First, we calculate the proportional mean absolute forecast error (PMAFE) for each of the *J* stocks followed by analyst *i* within year *t*. Second, we average the PMAFEs across the *J* companies followed by analyst *i* in year *t*.[53]

$$Ave\ Relative\ Forecast\ Error_{it} = \frac{1}{J}\sum_{j=1}^{J}\left(\frac{\left|Forecast_{ijt} - Actual_{jt}\right|}{\frac{1}{I}\sum_{i=1}^{I}\left|Forecast_{ijt} - Actual_{jt}\right|}\right)$$

To ensure comparability with prior research on analyst incentives (e.g., Hong and Kubik (2003), Fang and Yasuda (2005a), Leone and Wu (2007)), we focus on annual (rather than quarterly) forecasting accuracy. Following prior research,[54] we examine the last forecast issued in the forecasting period. In our study, the forecasting period is between twelve and three

[52] Consistent with economic theory (e.g., Holmström (1982)), prior research, (e.g., Hong and Kubik (2003) and Mikhail et al (1999)) suggests that analysts are evaluated based on relative (as opposed to absolute) forecast accuracy.

[53] As noted by Francis, Chen, Willis, and Philbrick (2004), deflated accuracy indices, such as Clement's PMAFE, remove scale effects in the data and permit meaningful aggregation of stocks that vary in size.

[54] E.g., O'Brien (1990), Mikhail et al. (1997), Clement (1999), Jacob et al., (1999), and Hong and Kubik (2003).

months prior to the annual earnings release (see Figure A1). By taking the last forecast within the forecast window we avoid penalizing analysts who make early forecasts, which prior research suggests are less accurate than later forecasts (e.g., O'Brien 1988).

Finally, since relative forecast accuracy is only a meaningful performance metric when there are multiple analysts covering a company, we estimate relative performance only for firms that are covered by at least three analysts (Jacob et al. (1999)).

B. Stock Picking Performance Indices

The stock picking performance index reported in this paper is the average annualized holding period return, the method used by the sample firm. To illustrate this method, consider the following hypothetical example. Assume that an analyst opened the 2002 evaluation year with a buy recommendation on companies X and Y Corp. The analyst did not alter his recommendation for company X Corp. during the 2002 year. At year-end the stock had appreciated from $10 to $12, a 20% increase. In contrast, after three months, the analyst downgrades company Y to a hold. The stock was priced at $20 at the beginning of the evaluation year, and was priced at $18 when it was downgraded, a 10% decline. This holding loss is equivalent to a 40% loss on an annualized basis (-10%*12/3). If there were no other recommendations made by the analyst for the year, the mean recommendation return would be -10% ((20%-40%)/2).

A better understanding of this method, including the timing of various events, can be gleaned from Table AI. This table resembles the stock picking evaluation form used by the research director at our sample firm; however, several extra columns have been added to clarify calculations. For pedagogical purposes, we have deliberately chosen extreme values.

We also tested the robustness of our results using a second estimation procedure, which is based on Barber, Lehavy, and Trueman (2007). To implement their approach we create a

portfolio of Buy/Strong Buy recommendations and estimate daily returns to this portfolio using the daily rebalancing technique described in Barber et al. We then estimate analyst *i*'s abnormal stock picking performance for year *t* as the intercept, α^{it}, from the following daily time-series OLS regressions:

$$(1) \qquad r_d^{it} - r_{fd}^t = \alpha^{it} + \varepsilon_d^{it}$$

$$(2) \qquad r_d^{it} - r_{fd}^t = \alpha^{it} + \beta^{it}\left(r_{md}^t - r_{fd}^t\right) + \varepsilon_d^{it}$$

$$(3) \qquad r_d^{it} - r_{fd}^t = \alpha^{it} + \beta^{it}\left(r_{md}^t - r_{fd}^t\right) + s^{it} SMB_d^t + h^{it} HML_d^t + w^{it} WML_d^t + \varepsilon_d^{it}$$

where r_d^{it} is the portfolio return on day *d* for analyst *i* in year *t*; r_{fd}^t is the CRSP daily risk-free return on day *d* in year *t*; r_{md}^t is the daily return on the CRSP value-weighted market index; SMB_d^t is the return on day *d* in year *t* of a value-weighted portfolio of small stocks minus the return on day *d* in year *t* of a value-weighted portfolio of big stocks; HML_d^t is the return on day *d* of year *t* of a value-weighted portfolio of high book-to-market stocks minus the return on day *d* of year *t* on a value-weighted portfolio of low book-to-market stocks; WML_d^t is the return on day *d* of year *t* on a value-weighted portfolio of stocks with high recent returns minus the return on day *d* of year *t* on a value-weighted portfolio of stocks with low recent returns.[55]

[55] We thank Ken French for providing us with daily factor returns.

Figure A1. Example of the EPS forecast window for an analyst who follows General Motors during the 2004 evaluation year. The evaluation year begins on 12/1/2003 and ends on 11/30/2004.

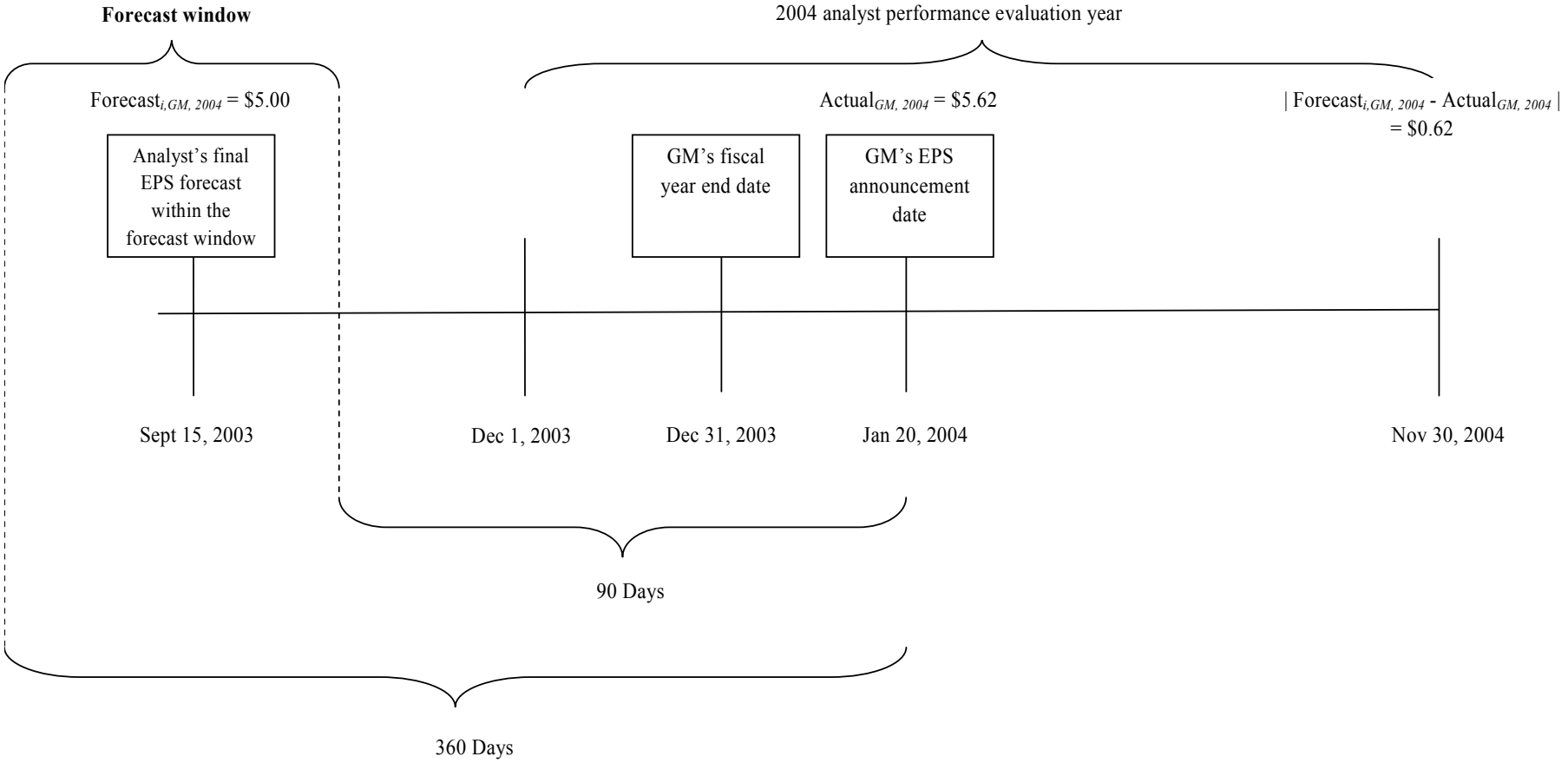

Table AI. Example of stock picking performance calculation for an individual analyst for evaluation year 2002.
The evaluation year begins on 12/1/2001 and ends on 11/30/2002.

Company	Date buy* rec. first issued (or 12/1/2001 if issued in prior years)	Stock price at buy* rec. issue date (or price at 12/1/2001 if issued in prior years)	Date buy* rec. downgraded or coverage dropped	Stock price at 11/30/2002 or downgrade/ drop coverage date	Return (formula)	Return (%)	Annualizing multiplier	Annualized return
A Corp.	12/1/2001	4	N/A	8	(8-4)/4	100%	1	100%
B Inc.	4/1/2002	3	5/1/2002	2	(2-3)/3	-33%	12	-400%
C Corp.	12/1/2001	10	12/15/2001	11	(11-10)/10	10%	26	260%
C Corp.	11/1/2002	11	N/A	11	(11-11)/11	0%	12	0%
						Average annualized return		***-10%***

*Buy and strong buy recommendations are grouped together under name "buy recommendations."

Figure 1
Sell-side analysts' total compensation (in 2005 dollars)

This figure plots total real compensation for sell-side analysts at the sample firm over the period 1988-2005. This figure is based on a total of 609 analyst-year observations. The number of analysts within each year ranges from 26 to 42 (see Table I for more details). Total compensation equals salary plus bonus. Compensation data were inflation-adjusted using CPI data from the Federal Reserve Economic Database (FRED).

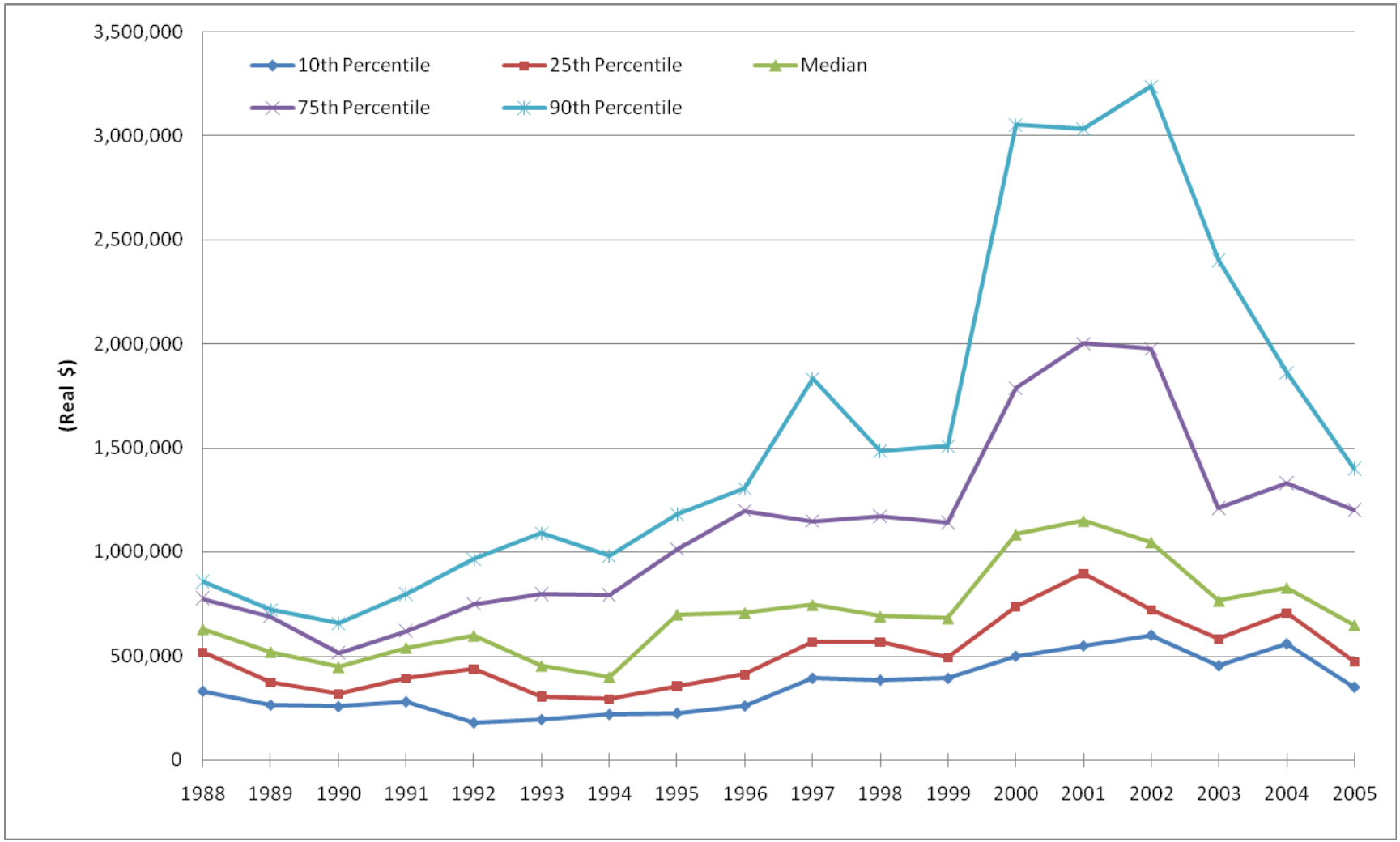

Table I
Summary statistics for sell-side analyst compensation (in 2005 dollars)

The sample consists of all I/B/E/S-listed, U.S sell-side analysts from a major financial institution for the years 1988-2005. Total compensation equals salary plus bonus. Compensation data were inflation-adjusted using CPI data from the Federal Reserve Economic Database (FRED).

		Total Compensation			Total Bonus			Salary		
Year	N	Median	Mean	% change in mean	Median	Mean	% change in mean	Median	Mean	% change in mean
1988	30	$628,780	$621,295		$412,382	$381,759		$244,979	$239,535	
1989	32	$518,921	$512,435	-17.5%	$284,822	$279,213	-26.9%	$249,707	$233,222	-2.6%
1990	30	$446,036	$437,588	-14.6%	$184,960	$199,555	-28.5%	$253,722	$238,033	2.1%
1991	30	$538,738	$544,435	24.4%	$303,263	$307,057	53.9%	$253,314	$237,378	-0.3%
1992	33	$596,364	$587,937	8.0%	$332,854	$363,597	18.4%	$249,641	$224,340	-5.5%
1993	37	$452,181	$561,478	-4.5%	$242,963	$351,603	-3.3%	$229,465	$209,875	-6.4%
1994	42	$397,675	$532,785	-5.1%	$177,475	$322,350	-8.3%	$210,341	$210,435	0.3%
1995	40	$698,544	$691,448	29.8%	$453,986	$467,403	45.0%	$256,417	$224,044	6.5%
1996	31	$707,289	$786,587	13.8%	$483,934	$567,035	21.3%	$248,172	$219,552	-2.0%
1997	32	$745,016	$967,936	23.1%	$513,199	$756,708	33.4%	$231,816	$211,228	-3.8%
1998	38	$689,370	$892,411	-7.8%	$517,215	$689,156	-8.9%	$216,132	$203,256	-3.8%
1999	41	$680,235	$903,092	1.2%	$467,736	$705,944	2.4%	$210,481	$197,148	-3.0%
2000	33	$1,083,983	$1,444,028	59.9%	$886,052	$1,249,095	76.9%	$197,931	$194,932	-1.1%
2001	30	$1,148,835	$1,452,376	0.6%	$940,007	$1,263,410	1.1%	$194,907	$188,967	-3.1%
2002	36	$1,046,826	$1,430,818	-1.5%	$883,642	$1,245,876	-1.4%	$190,381	$184,942	-2.1%
2003	36	$764,829	$1,011,027	-29.3%	$592,642	$832,137	-33.2%	$186,869	$178,890	-3.3%
2004	32	$826,937	$1,019,897	0.9%	$648,545	$841,634	1.1%	$180,977	$178,263	-0.4%
2005	26	$647,500	$796,923	-21.9%	$450,000	$623,846	-25.9%	$175,000	$173,077	-2.9%
Total	609	$681,428	$843,174		$450,388	$635,199		$213,515	$207,974	

Table II
Descriptive statistics for the period 1988 to 2005[a]

This table reports descriptive statistics by analyst-year for the principal explanatory variables. Panel A reports the characteristics of analysts who are employed by high status firms, such as the sample bank. High-status firms were identified using the prestige ranking published by *Institutional Investor (II)*. Panel B reports statistics for all analysts reported on I/B/E/S. As is discussed in Section I.B, the variables are grouped into four categories. Action- and outcome-based variables are measured at the *end* of the sample firm's evaluation year (November 30) and differ based on their relative vulnerability to *ex-post* environmental uncertainty. Human capital and job characteristics variables are measured at the *beginning* of the sample firm's evaluation year (December 1). The variables are defined as follows. Mean relative earnings forecast error is the ratio of an analyst's absolute forecast error for a given company/year/horizon relative to the consensus absolute forecast error for the same company/year/horizon (minus 1), averaged across all firms covered by the analyst within the given performance evaluation period. To be included in this analysis, forecasts must be made between 90 and 360 days before the earnings announcement date and the earnings announcement must occur within the performance evaluation period. Buy recommendation mean annualized return is the annualized raw return from buying stocks that are recommended as buy or strong buy and selling when the recommendation is downgraded to hold or lower. Forecast revisions are the number of distinct annual earnings forecasts reported on I/B/E/S for a given analyst. Stock initiations are the number of companies for which an analyst issues a first earnings forecast during the year. Aggregate trading volume of firms covered is the sum of the annual trading volume for all stocks covered by the analyst. Analyst experience is the number of years since the analyst first issued an annual earnings forecast on I/B/E/S.

	Panel A: Analysts at "top-20" firms (N = 21, 570)			**Panel B: Analysts in I/B/E/S population (N = 55, 263)**		
	Q1	**Median**	**Q3**	**Q1**	**Median**	**Q3**
Outcome-Based Performance Variables						
Mean relative eps forecast error	-0.31	-0.14	0.10	-0.28	-0.08	0.19
Buy recommendation mean annualized return[a]	-15.7%	13.5%	42.8%	-17.1%	13.9%	45.5%
Action-Based Performance Variables						
Forecast revisions	9	25	45	8	22	41
Stock initiations	0	1	3	0	2	4
Job Characteristic Variables						
Aggregate trading volume of covered firms (millions of shares)	273	928	2,465	160	641	1,995
Human Capital Variables						
Experience (years)	2	5	9	2	4	8

[a] Data on buy recommendations are available for the 1994-2005 time period. Returns are estimated using 12,641 analyst years for "top-20" firms and 29,629 analyst-years for the I/B/E/S population.

Table III

Pearson (below diagonal) and Spearman (above diagonal) correlations

This table reports correlation coefficients based on a sample of analysts who were employed by a high-status investment bank. All correlations are based on 609 observations from the years 1988-2005, except those involving stock picking performance, which are based on 401 observations from the years 1994-2005. Total compensation equals salary plus bonus. All-Star takes the value one for analysts who are ranked by *Institutional Investor* magazine as "First Team," "Second Team," "Third Team," or "Runner Up" in a given year, and zero otherwise. Investment banking transactions are the number of investment banking transactions (IPO, M&A, and secondary offers) undertaken by companies the analyst covers where the analyst firm is a member of the banking syndicate. Mean relative earnings forecast error is the ratio of an analyst's absolute forecast error for a given company/year/horizon relative to the consensus absolute forecast error for the same company/year/horizon, averaged across all firms covered by the analyst within the given performance evaluation period. To be included in this analysis, forecasts must be made between 90 and 360 days before the earnings announcement date and the earnings announcement must occur within the performance evaluation period. Buy recommendation mean annualized return is the annualized raw return from buying stocks that are recommended as buy or strong buy and selling when the recommendation is downgraded to hold or lower. Forecast revisions are the number of distinct annual earnings forecasts reported on I/B/E/S for a given analyst. Stock initiations are the number of companies for which an analyst issues a first earnings forecast during the year. Aggregate trading volume of firms covered is the sum of the annual trading volume for all stocks covered by the analyst. Analyst experience is the number of years since the analyst first issued an annual earnings forecast on I/B/E/S. Homegrown analyst is a dummy variable that takes the value one if the analyst was initially hired by the sample bank and was promoted internally, and zero if the analyst was hired directly at the senior analyst level (often from a competitor bank).

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
I	Ln total compensation		0.99**	0.32**	0.21**	0.13**	-0.06	-0.02	0.26**	-0.04	0.53**	0.14*	-0.06
II	Ln bonus	0.96**		0.20**	0.15**	0.13**	-0.06	-0.01	0.22**	-0.03	0.55*	0.11**	-0.02
III	Ln salary	0.40**	0.29**		0.50**	0.09*	0.03	-0.01	0.42**	-0.11**	-0.02	0.34**	-0.36**
IV	All-Star	0.24**	0.19**	0.47**		-0.03	0.05	0.03	0.38**	-0.06	0.05	0.21**	-0.20**
V	No. of investment banking transactions	0.20**	0.19**	0.05	-0.04		-0.05	0.07	-0.01	0.09*	-0.08	0.03	-0.01
VI	Ln relative eps forecast error	-0.01	-0.02	0.02	0.05	-0.01		0.09	-0.05	0.07	-0.04	0.05	-0.09
VII	Buy recommendation performance	-0.05	-0.04	-0.06	-0.01	0.10*	0.04		-0.09	0.03	-0.06	-0.09	0.02
VIII	No. of forecast revisions	0.25**	0.22**	0.39**	0.39**	0.02	-0.07	-0.04		0.05	0.37**	0.42**	-0.20**
IX	No. of stock initiations	-0.05	-0.03	-0.08**	-0.07	0.09*	0.07	0.04	0.03		-0.02	-0.03	-0.03
X	Ln lagged aggregate trading volume of stocks covered	0.56**	0.55**	0.13**	0.01	-0.14**	-0.07	-0.01	0.38**	-0.06		0.17**	0.02
XI	Ln analyst experience	0.19**	0.13**	0.39**	0.18**	0.04	0.05	-0.03	0.41**	-0.10*	0.18**		-0.36**
XII	Homegrown analyst	-0.07	-0.02	-0.38**	-0.20**	-0.01	-0.09*	-0.02	-0.20**	0.00	0.05	-0.36**	

* and ** indicate significance at the 5% and 1% levels, respectively (based on a two-tailed t-test).

Table IV
Cross-sectional determinants of analysts' total compensation

This table reports cross-sectional compensation response coefficients for analysts employed by a high-status investment bank during three time periods. The three sample periods were chosen based on data availability. Compensation data are available for the years 1988-2005. Stock recommendations are available for the years 1994-2005 and detailed *Institutional Investor* data are available for the years 1996-2002. The response coefficients were estimated using ordinary least squares regressions. Year indicator variables (not reported) were included to control for period-specific changes in the firm's bonus pool. Significance levels are based upon standard errors clustered at the analyst level and pertain to the null hypothesis that the respective coefficient is zero. The dependent variable is the natural log of total compensation (salary + bonus). All-Star takes the value one for analysts who are ranked by *Institutional Investor* magazine as "First Team," "Second Team," "Third Team," or "Runner Up" in a given year, and zero otherwise. Non-All Star with at least 5 votes (1 to 4 votes) takes the value 1 for analysts not included in II magazine but who received at least 5 votes (1 to 4 votes), and zero otherwise. Analysts who received no votes are accounted for with the model's intercept. All other explanatory variables are described in Table III.

	1988 – 2005		**1994 – 2005**		**1996 – 2002**	
	Est. Coef.	**Partial R^2**	**Est. Coef.**	**Partial R^2**	**Est. Coef.**	**Partial R^2**
Outcome-Based Performance Variables						
All-Star	0.476**	0.17	0.525**	0.18	0.911**	0.18
Non-All-Star						
At least 5 votes					0.433**	0.06
1 to 4 votes (inclusive)					0.155	0.01
Num. investment banking transactions	0.081**	0.07	0.079**	0.08	0.076**	0.10
Ln relative eps forecast error	-0.056	0.00	0.031	0.00	0.096	0.01
Buy recommendation performance[a]			-0.017	0.00	-0.048	0.01
Action-Based Performance Variables						
Forecast revisions	0.000	0.00	0.000	0.00	0.000	0.00
Stock initiations	-0.008	0.00	-0.007	0.00	0.013	0.00
Job Characteristic Variables						
Ln lagged aggregate trading volume of stocks covered	0.179**	0.14	0.207**	0.18	0.135**	0.07
Human Capital Variables						
Ln analyst experience	0.072	0.01	0.067	0.01	0.054	0.01
Homegrown analyst	-0.099	0.01	-0.066	0.00	-0.057	0.00
Year controls	Yes		Yes		Yes	
Adjusted R-square	0.58		0.54		0.51	
Number of Observations	609		401		230	

* and ** indicate significance at the 5% and 1% levels, respectively (based on a two-tailed t-test).

Table V
Cross-sectional determinants of analysts' salary and bonus compensation

Panel A (B) reports cross-sectional salary (bonus) response coefficients for analysts employed by a high-status investment bank during two time periods. The two sample periods were chosen based on data availability. Compensation data are available for the years 1988-2005. Stock recommendations are available for the years 1994-2005. The response coefficients were estimated using ordinary least squares regressions. Year indicator variables (not reported) were included to control for period-specific changes in the firm's bonus pool. Significance levels are based upon standard errors clustered at the analyst level and pertain to the null hypothesis that the respective coefficient is zero. The explanatory variables are described in Table III.

	Sample Period: 1988-2005		**Sample Period: 1994-2005**	
	Est. Coef.	**Partial R^2**	**Est. Coef.**	**Partial R^2**
Panel A: Dependent variable = Ln (salary)				
Outcome-Based Performance Variables				
All-Star	0.145**	0.09	0.110**	0.07
Number of investment banking transactions	0.008	0.00	0.005	0.00
Ln relative eps forecast error	0.015	0.00	0.009	0.00
Buy recommendation performance[a]			0.001	0.00
Action-Based Performance Variables				
Forecast revisions	0.000	0.00	0.001	0.01
Stock initiations	-0.009**	0.02	-0.008*	0.02
Job Characteristic Variables				
Ln lagged aggregate trading volume of stocks covered	0.062**	0.10	0.046**	0.07
Human Capital Variables				
Ln analyst experience	0.073**	0.06	0.066**	0.06
Homegrown analyst	-0.115**	0.04	-0.112**	0.05
Year controls	Yes		Yes	
Adjusted R-square	0.49		0.49	
Number of Observations	609		401	

* and ** indicate significance at the 5% and 1% levels, respectively (based on a two-tailed t-test).

Table V – *Continued*

	Sample Period: 1988-2005		Sample Period: 1994-2005	
	Est. Coef.	**Partial R^2**	**Est. Coef.**	**Partial R^2**
Panel B: Dependent variable = Ln (bonus)				
Outcome-Based Performance Variables				
All-Star	0.694**	0.15	0.679**	0.16
Number of investment banking transactions	0.113**	0.06	0.105**	0.07
Ln relative eps forecast error	-0.106	0.00	0.042	0.00
Buy recommendation performance[a]			-0.009	0.00
Action-Based Performance Variables				
Forecast revisions	0.001	0.00	0.001	0.00
Stock initiations	-0.005	0.00	-0.009	0.00
Job Characteristic Variables				
Ln lagged aggregate trading volume of stocks covered	0.224**	0.10	0.266**	0.15
Human Capital Variables				
Ln analyst experience	0.044	0.00	0.072	0.01
Homegrown analyst	-0.107	0.00	-0.044	0.00
Year controls	Yes		Yes	
Adjusted R-square	0.56		0.52	
Number of Observations	609		401	

* and ** indicate significance at the 5% and 1% levels, respectively (based on a two-tailed t-test).

Table VI
Longitudinal determinants of analysts' total, salary, and bonus compensation

This table reports "within analyst" compensation response coefficients for analysts employed by a high-status investment bank during two time periods. The two sample periods were chosen based on data availability. Compensation data are available for the years 1988-2005. Stock recommendations are available for the years 1994-2005. The response coefficients were estimated using ordinary least squares regressions. Analyst-fixed effects (not reported) were included to control for differences in innate abilities. Year indicator variables (not reported) were included to control for period-specific changes in the firm's bonus pool. Human capital variables are not reported because they are subsumed by the fixed analyst and year effects. Significance levels are based upon standard errors clustered at the analyst level and pertain to the null hypothesis that the respective coefficient is zero. The explanatory variables are described in Table III.

	Total compensation		**Salary**		**Bonus**	
	Sample Period: 1988-2005	**Sample Period: 1994-2005**	**Sample Period: 1988-2005**	**Sample Period: 1994-2005**	**Sample Period: 1988-2005**	**Sample Period: 1994-2005**
Outcome-Based Performance Variables						
All-Star	0.229**	0.123**	0.040*	0.018	0.381**	0.135**
Number of investment banking transactions	0.059**	0.065**	0.008	0.006	0.083**	0.087**
Buy recommendation performance[a]		-0.027		0.001		-0.035
Ln relative eps forecast error	0.038	0.085	0.007	0.005	0.012	0.096
Action-Based Performance Variables						
Forecast revisions	0.002	0.001	0.000	0.001	0.003	0.001
Stock initiations	0.004	0.006	-0.003	-0.003	0.008	0.012
Job Characteristic Variables						
Ln lagged aggregate trading volume of stocks covered	0.060	0.092	0.047**	0.024	0.046	0.142*
Year controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	568	374	568	374	567	374
Adjusted R-square	0.84	0.86	0.90	0.92	0.80	0.85

* and ** indicate significance at the 5% and 1% levels, respectively (based on a two-tailed t-test).

Table VII
Generalizability of results

This table compares the compensation practices of our primary sample firm (Firm 1) to those of another top-tier investment bank (Firm 2) over the years 1988-1993. This period was chosen based on the availability of data for Firm 2. The dependent variable is the natural log of total compensation (salary + bonus). Separate salary and bonus data are not available for Firm 2. With the exception of the homegrown analyst variable, which is based on proprietary data from Firm 1, the explanatory variables in this table are identical to those reported in Tables III – VI. See Table III for a description of these variables. For the purposes of this table, 'homegrown analyst (I/B/E/S-based)' is a dummy variable that takes the value one if the analyst's first EPS forecast on I/B/E/S was issued at the sample bank, and zero if the analyst's first EPS forecast was issued while the analyst was employed by another bank. Standard errors are robust to heteroskedasticity and have been cluster-corrected by analyst code. For comparison with Tables I –VI, all variables are expressed in real (2005-equivalent) terms.

	Cross-sectional model			**Longitudinal model**		
	Firm 1	**Firm 2**	**Difference**	**Firm 1**	**Firm 2**	**Difference**
Outcome-Based Performance Variables						
All-Star	0.393**	0.543**	-0.150	0.172*	0.228**	-0.056
Num. of investment banking transactions	0.057**	0.023	0.034	0.028*	0.013	0.015
Ln relative eps forecast error	-0.133	0.140	-0.273*	-0.058	-0.038	-0.020
Action-Based Performance Variables						
Forecast revisions	0.001	0.000	0.001	0.001	-0.003	0.004
Stock initiations	-0.006	-0.008	0.002	-0.004	0.000	-0.004
Job Characteristic Variables						
Ln lagged aggregate trading volume of stocks covered	0.207**	0.087	0.120	0.109	0.064	0.045
Human Capital Variables						
Ln analyst experience	0.030	0.176*	-0.146			
Homegrown analyst (I/B/E/S-based)	0.006	-0.037	0.043			
Year controls	Yes	Yes		Yes	Yes	
Number of observations	192	254		173	246	
Adjusted R-square	0.53	0.54		0.84	0.84	

* and ** indicate significance at the 5% and 1% levels, respectively (based on a two-tailed t-test).

REFERENCES

Agrawal, Anup and Mark Chen, 2008, Do analysts conflicts matter? Evidence from stock recommendations, *Journal of Law & Economics,* forthcoming.

Barber, Brad M., and Terrance Odean, 1999, The courage of misguided convictions, *Financial Analysts Journal* 55, 41-55.

Barber, Brad, Reuven Lehavy and Brett Trueman, 2007, Comparing the stock recommendation performance of investment banks and independent research firms, *Journal of Financial Economics* 85, 490-517.

Baker, George, 1987, Discussion of an analysis of the use of accounting and market measures of performance in executive compensation contracts, *Journal of Accounting Research* 25, 126-129.

Baker, George, 2002, Distortion and risk in optimal incentive contracts, *The Journal of Human Resources* 37, 728-751.

Baker, George and Bjorn Jorgensen, 2003, Volatility, noise and incentives, Working paper, Harvard Business School.

Banker, Rajiv, and Srikant Datar, 1989, Sensitivity, precision and linear aggregation of signals for performance evaluation, *Journal of Accounting Research* 27, 21-39.

Beaver, William, 2002, Perspectives on recent capital market research, *The Accounting Review 77*, 453-474.

Becker, Gary, 1964, *Human Capital: A theoretical analysis with special reference to education* (Columbia University Press for NBER, New York).

Bonner, Sarah and Geoffrey Sprinkle, 2002, The effects of monetary incentives on effort and task performance: Theories, evidence, and a framework for research, *Accounting, Organizations and Society* 27, 303-345

Bradshaw, Mark, 2004, How do analysts use their earnings forecasts in generating stock recommendations?, *The Accounting Review* 79, 25-50.

Bradshaw, Mark, 2008, Analysts' forecasts: What do we know after decades of work? Working paper, Harvard Business School.

Bushman, Robert, Raffi Indjejikian, and Abbie Smith, 1995, Aggregate performance measures in business unit manager compensation: The role of intrafirm interdependencies, *Journal of Accounting Research* 33, 101-128.

Bushman, Robert, and Abbie Smith, 2001, Financial accounting information and corporate governance, *Journal of Accounting & Economics* 32, 237-333.

Carter, Richard, Frederick Dark, and Ajai Singh, 1998, Underwriter reputation, initial returns, and the long-run performance of IPO stocks, *The Journal of Finance* 53, 285-311.

Clarke, Jonathan, Ajay Khorana, Ajay Patel, and P. Raghavendra Rau, 2007, The impact of all-star analyst job changes on their coverage choices and investment banking deal flow, *Journal of Financial Economics* 84, 713-737.

Clement, Michael B, 1999, Analyst forecast acccuracy: Do ability, resources, and portfolio complexity matter? *Journal of Accounting & Economics* 27, 285-303.

Clement, Michael, Lisa Koonce, and Thomas Lopez, 2007, The roles of task-specific forecasting experience and innate ability in understanding analyst forecasting performance, *Journal of Accounting & Economics* 44, 378-398.

Coles, Jeffrey, Jose Suay, and Denise Woodbury, 2000, Fund advisor compensation in closed-end funds, *The Journal of Finance* 55, 1385-1414.

Cowen, Amanda, Boris Groysberg, and Paul Healy, 2006, Which types of analyst firms are more optimistic? *Journal of Accounting & Economics* 41, 119-146

Cowen, Lauren, Andrea Frazzini, and Christopher Malloy, 2008, Sell side school ties, Working paper, Harvard Business School.

Datar, Srikant, Susan Kulp and Richard Lambert, 2001, Balancing performance measures, *Journal of Accounting Research* 39, 75-93.

Dunbar, Craig, 2000, Factors affecting investment bank initial public offering market share, *Journal of Financial Economics* 55, 3-41.

Eccles, Robert and Dwight Crane, 1988, *Doing Deals: Investment Banks at Work* (Harvard Business School Press, Boston, MA)

Emery, Douglas and Xi Li, 2008, Are the Wall Street analyst rankings popularity contests?, *Journal of Financial and Quantitative Analysis,* forthcoming.

Ertimur, Yonca, Volkan Muslu, and Frank Zhang, 2007, The long-run performance of analyst coverage initiations, Working paper, Duke University.

Fang , Lilly, and Ayako Yasuda, 2005a, Analyst reputation, conflict of interest, and forecast accuracy, Working paper, University of Pennsylvania.

Fang , Lilly, and Ayako Yasuda, 2005b, Are stars' opinions worth more? The relation between analyst reputation and recommendation values, Working paper, University of Pennsylvania.

Feltham, Gerald and Jim Xie, 1994, Performance measure congruity and diversity in multi-task principal/agent relations, *The Accounting Review* 69, 429-453.

Fisher, Joseph and Vijay Govindarajan, 1992, Profit center manager compensation: An examination of market, political and human capital factors, *Strategic Management Journal* 13, 205 -217.

Francis, Jennifer, Qi Chen, Richard Willis, and Donna Philbrick, 2004, *Security Analyst Independence* (The Research Foundation of CFA Institute, Charlottesville, VA).

Frederickson, James, Sean Peffer, and Jamie Pratt, 1999, Performance evaluation judgments: Effects of prior experience under different performance evaluation schemes and feedback frequencies, *Journal of Accounting Research* 37, 151-165.

Froot, Kenneth, 1989, Consistent covariance matrix estimation with cross-sectional dependence and heteroskedasticity in financial data, *Journal of Financial and Quantitative Analysis* 24, 333-355

Gabaix Xavier and Augustin Landier, 2008, Why has CEO pay increased so much? *Quarterly Journal of Economics* 123, 49 – 100.

Gibbons, Robert and Michael Waldman, 1999, Careers in organizations: Theory and evidence, in Orley Ashenfelter and David Card, ed.: *Handbook of Labor Economics vol. 3* (North-Holland).

Goldman Sachs Trust, 1995, *SEC Form 497*, Filed August 15, 1995.

Greene, William, 2000, Econometric Analysis Fourth Edition (Prentice Hall, Upper Saddle River, NJ)

Groysberg, Boris, and Linda-Eling Lee, 2008, The effects of colleague quality on top performance: The case of security analysts, *Journal of Organizational Behavior*, forthcoming.

Groysberg, Boris, Paul Healy, and Craig Chapman, 2008, Do buy-side analysts out-perform the sell-side? *Financial Analyst's Journal,* forthcoming.

Hayes, Rachel, 1998, The impact of trading commission incentives on analysts' stock coverage decisions and earnings forecasts, *Journal of Accounting Research* 36, 299-320.

Healy, Paul and Krishna Palepu, 2001, Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature, *Journal of Accounting & Economics* 31, 405- 440.

Heckman, James, 1979, Sample selection bias as a specification error, *Econometrica* 47, 153-161.

Hintz, Brad, Michael Werner, and Bryan St. John, 2006, U.S. securities industry: Institutional equities – Searching for a new business model, *Bernstein Research*, May 25.

Holmström, Bengt, 1979, Moral hazard and observability, *The Bell Journal of Economics* 10, 74-91.

Holmström, Bengt, 1982, Moral hazard in teams, *The Bell Journal of Economics* 13, 324-340.

Hong, Harrison, Jeffrey Kubik, and Amit Solomon, 2000, Security analysts' career concerns and herding of earnings forecasts, *The RAND Journal of Economics* 31, 121-144.

Hong, Harrison and Jeffrey Kubik, 2003, Analyzing the analysts: Career concerns and biased earnings forecasts, *The Journal of Finance* 58, 313-351.

Institutional Investor, 1996, The best analysts of the year, October.

Institutional Investor, 1997, The 1997 All-America research team, October.

Irvine, Paul, 2001, Do analysts generate trade for their firms? Evidence from the Toronto Stock Exchange, *Journal of Accounting Research* 30, 209-226.

Irvine, Paul, 2003, The incremental impact of analyst initiation of coverage, *Journal of Corporate Finance* 9, 431-451.

Irvine, Paul, 2004, Analysts' forecasts and brokerage-firm trading, *The Accounting Review* 79, 125-149.

Ittner, Christopher, David Larcker, and Marshall Meyer, 2003, Subjectivity and the weighting of performance measures: Evidence from a Balanced Scorecard, *The Accounting Review* 78, 725-758.

Jackson, Andrew, 2005, Trade generation, reputation, and sell-side analysts, *Journal of Finance* 60, 673-717.

Jacob, John, Thomas Lys, and Margaret Neale, 1999, Expertise in forecasting performance of security analysts, *Journal of Accounting & Economics* 28, 51-82.

Jegadeesh, Narasimhan, Joonghyuk Kim, Susan Krische, and Charles Lee, 2004, Analyzing the analysts: When do recommendations add value?, *The Journal of Finance* 59, 1083-1124.

Jensen, Michael and William Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 3, 305-360.

Kelly, Bryan and Alexander Ljungqvist, 2007, The value of research, Working paper, New York University.

Kothari, S.P., 2001, Capital markets research in accounting, *Journal of Accounting & Economics* 31, 105-231.

Krigman, Laurie, Wayne Shaw, and Kent Womack, 2001, Why do firms switch underwriters? *Journal of Financial Economics* 60, 245-284.

Leone, Andrew and Joanna Wu, 2007, What does it take to become a superstar? Evidence from Institutional Investor rankings of financial analysts, Working Paper, University of Rochester.

Lin, Hsiou-wei and Maureen McNichols, 1998, Underwriting relationships, analysts' earnings forecasts, and investment recommendations, *Journal of Accounting & Economics* 25, 101-127.

Madan, Ruchi, Robert Sobhani, and Prashant Bhatia, 2003, Brokers & asset managers: Initiating coverage – Higher lows were nice, but lower highs will be the price, *Citigroup/Smith Barney*, August 1.

Malloy, Christopher, 2005, The geography of equity analysts, *The Journal of Finance* 60, 719-755.

Malmendier, Ulrike and Devin Shanthikumar, 2007, Are small investors naïve about incentives?, *Journal of Financial Economics* 85, 457-489.

Mayer, Thomas, 1960, The Distribution of ability and earnings, *The Review of Economics and Statistics* 42, 189-195.

McNichols, Maureen, 1990, Discussion of analyst following and institutional ownership, *Journal of Accounting Research* 28, 77-82.

McNichols, Maureen, and Patricia O'Brien, 1997, Self-selection and analyst coverage, *Journal of Accounting Research* 35, 167-199.

Medoff, James and Katherine Abraham, 1980, Experience, Performance and Earnings, *The Quarterly Journal of Economics* 95, 703 – 736.

Medoff, James and Katherine Abraham, 1984, Are those Paid More Really More Productive? The Case of Experience, The Journal of Human Resources 16, 186-216.

Merrill Lynch, 2005, Research tops Journal's "Best on the Street" survey again, May. http://www.ml.com/?id=7695_8134_8296_6018_46162_48002_48005

Michaely, Roni and Kent Womack, 1999, Conflicts of interest and the credibility of underwriter analyst recommendations, *The Review of Financial Studies* 12, 653-686.

Michaely, Roni and Kent Womack, 2005. Brokerage recommendations: Stylized characteristics, market responses, and biases, in: Richard Thaler, ed.: *Advances in Behavioral Finance II* (Princeton University Press, Princeton, NJ).

Mikhail, Michael B., Beverly R. Walther, and Richard H. Willis, 1997, Do security analysts improve their performance with experience? *Journal of Accounting Research* 35, 131-157.

Mikhail, Michael B., Beverly R. Walther, and Richard H. Willis, 1999, Does forecast accuracy matter to security analysts? *The Accounting Review* 74, 185-200.

Mikhail, Michael B., Beverly R. Walther, and Richard H. Willis, 2004, Do security analysts exhibit persistent differences in stock picking ability? *Journal of Financial Economics* 74, 67-91.

Milgrom, Paul and John Roberts, 1992, *Economics, Organization, and Management* (Prentice-Hall, Englewood Cliffs, NJ).

Murphy, Kevin, 1985, Corporate performance and managerial remuneration: An empirical analysis, *Journal of Accounting & Economics* 7, 1-32.

Murphy, Kevin, 1999, Executive compensation, in Orley Ashenfelter and David Card, ed.: *Handbook of Labor Economics vol. 3* (North-Holland).

Murphy, Kevin and Jan Zabojnik, 2004, CEO pay and appointments: A market-based explanation for recent trends, *The American Economic Review* 94, 192-196

Murphy, Kevin and Jan Zabojnik, 2007, Managerial Capital and the Market for CEOs, Working paper, University of Southern California.

O'Brien, Patricia, 1988, Analysts' forecasts as earnings expectations, *Journal of Accounting & Economics* 10, 53-83.

O'Brien, Patricia, 1990, Forecast accuracy of individual analysts in nine industries, *Journal of Accounting Research* 28, 286-304

O'Brien, Patricia and Ravi Bhushan, 1990, Analyst following and institutional ownership, *Journal of Accounting Research* 28, 55-76.

Oyer, Paul, 2004, Why do firms use incentives that have no incentive effect*?, The Journal of Finance* 59, 1619-1650.

Prendergast, Canice, 1999, The provision of incentives in firms, *Journal of Economic Literature* 37, 7-64.

Prendergast, Canice, 2002, The tenuous trade-off between risk and incentives, *The Journal of Political Economy* 110, 1071-1102.

Raith, Michael, 2007, Specific knowledge and performance measurement, Working paper, University of Rochester.

Ramnath, Sundaresh, Steve Rock, and Philip Shane, 2008, The financial analyst forecasting literature: A taxonomy with suggestions for further research, *International Journal of Forecasting* 24, 34-75.

Rauh, Joshua and Steven Kaplan, 2007, Wall Street and Main Street: What contributes to the rise in the highest incomes?, Working paper, The University of Chicago.

Reingold, Dan and Jennifer Reingold, 2006, *Confessions of a Wall Street analyst: A true story of inside information and corruption in the stock market* (HarperCollins, New York, NY).

Rogers, W. H., 1993, Regression standard errors in clustered sample*, Stata Technical Bulletin* 13, 19-23.

Rosen, Sherwin, 1982, Authority, control, and the distribution of earnings, *The Bell Journal of Economics* 13, 311-323.

Rosen, Sherwin, 1992, Contracts and the Market for Executives, in Lars Werin and Hans Wijkander, ed.: *Contract Economics* (Blackwell, Cambridge, MA).

Saumya, Shubh, Jai Sinha, and Sudhir Jain, 2006, Saving Sell-Side Research, *Booz-Allen-Hamilton.*

Stickel, Scott, 1992, Reputation and performance among security analysts, *The Journal of Finance* 47, 1811-1836.

Stickel, Scott, 1995, The anatomy of the performance of buy and sell recommendations, *Financial Analysts Journal* 51, 25-39

van Lent, Laurence, 2007, Endogeneity in management accounting research: A comment, *European Accounting Review* 16,197–205.

Womack, Kent, 1996, Do brokerage analysts' recommendations have investment value? *The Journal of Finance* 51, 137-167.

Wooldridge, Jeffrey, 2002, *Econometric Analysis of Cross Section and Panel Data* (The MIT Press, Cambridge, MA).