Stock Recommendation of an Analyst who Trades on Own Account

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Abstract

I analyze the stock recommendation of a security analyst who can also trade on own account. In order to introduce analyst trading perhaps in the most innocuous way, I first consider a setting where the analyst’s recommendation has no impact on stock price. The implication of the analyst’s ability to trade on own account for the optimal stock recommendation is quite negative: For a general class of compensation schemes, the analyst’s recommendation is the same for every signal and it is completely independent of the true signal, the analyst preferences or the quality of the signal. This result also holds when the recommendation can potentially affect the stock price. The performance based scheme commonly used in the industry to rank analysts also belongs to the general class considered and the above result applies.

JEL Classification: G11, G14
Keywords: Security Analyst, Stock Recommendation, Private Portfolio Choice, Non-exclusive Contracts

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1 Introduction

An important function of security analysts in equity research departments of financial brokerage firms is to provide timely and unbiased information to investors. However, following the poor performance of the stock market in general and of the analysts’ recommendations for the year 2000, the credibility of stock analysts’ recommendations came under attack by the popular press. A series of corporate scandals involving some Wall Street firms did not help. Newspaper headlines such as "Shoot All the Analysts" (by Financial Times, March, 2001) and "Can We Trust Wall Street Again?" (the cover of the Fortune magazine) expressed a popular concern on analyst credibility. Alarmed by the growing media attention and discomfort, the Congress held hearings to find remedies for the potential conflict of interests analysts face when making their stock recommendations.\(^1\) The opening remarks of the Subcommittee Chairman Richard Baker during these hearings summarize this public discontent: "..the foundation of the free market system is the free flow of straightforward, unbiased information. I must say I am deeply troubled by evidence of Wall Street’s erosion of the bedrock of ethical conduct."

The debate on the credibility of the analyst’s recommendations focused on the internal pressure from the analyst’s firm particularly with respect to increasing the investment banking business. This objective calls for pleasing the underwriting clients by issuing optimistic reports. A conflict of interest arises because the brokerage clients (investors) want unbiased research but investment banking clients (issuers or underwriters) want optimistic research. Therefore, the analyst may feel pressure to boost the stock price. In the summer of 2002, the SEC approved new NASD (National Association for Security Dealers) rules which mandate separation of research and investment banking and prohibit the compensation of analysts from specific investment banking deals.\(^2\)

According to Boni and Womack (2002), another important source of conflict regarding the credibility of analyst recommendations is the analyst’s own personal investments. They note that this issue is relatively much less emphasized compared to the analyst’s ties with the investment banking branch. In an article in the April 2001 issue of Institutional Investor titled "Should Analysts Own Stock in Companies

\(^1\)The U.S. Congress held hearings, titled "Analyzing the Analysts" in the summer of 2001.
\(^2\)The new NASD Rule 2711 can be found at www.nasdr.com/pdf-text/rf02_21_final.pdf. See also Boni and Womack (2003).
"Wall Street research analysts increasingly are accused of ditching their objectivity to please underwriting clients. But largely overlooked in all of the complaints has been perhaps the most fundamental conflict of interest for all Wall Street analysts—owning the stock of companies they cover. It is not illegal; nor by Wall Street’s standards is it unethical. In fact it is a common industry practice..." (page 60).

The new NASD Rules also increased the disclosure requirements on the analyst’s trading positions. However, the issue of whether allowing the analysts to trade on their own account is still controversial. Boni and Womack (2002) point out that some practitioners are in favor of the analyst’s stock ownership, arguing that the analysts would be more careful and diligent in valuing a company’s stock when they own it. According to Schack (2001), these proponents say that by owning shares in the sectors they cover, the analysts are "putting their money where their mouth is. Why should they be prohibited from buying what they know best?" The opponents of analyst trading, on the other hand, say that the whole practice is unethical since the analysts have a clear incentive to manipulate the stock price if they have a stake of their own. For that reason their personal holdings must be made at least transparent, if not prohibited.

The theoretical literature on the credibility of analyst stock recommendations has not addressed the implications of analyst’s personal trades. In this paper, I consider the stock recommendation of an analyst who can also trade on own account using the information he/she observes. In order to introduce analyst trading perhaps in the most innocuous way, I first analyze a setting where the analyst’s recommendation has no impact on the stock price. This setting prevents any incentives to misreport merely to manipulate the stock price and helps to illustrate a somewhat overlooked aspect of analyst’s trades; the resulting ability to undo the compensation scheme. I present a model where an analyst privately observes an information signal on the stock return, makes a recommendation to clients and also optimally chooses a personal position in the stock of the company he/she covers. Both the analyst’s portfolio decision

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3 Schack (2001) quotes the research head at a major firm saying; "I like seeing stock ownership in the industries and particularly the names that the analyst recommends. If you are going to recommend it to your clients, then why on earth don’t you own it yourself?"

4 Another example is quoted in Boni and Womack (2002): In November 2001, the newly appointed SEC chairman Harvey Pitt said "I don’t think there is any inherent need for a prohibition against an analyst owning stock."
and the reporting strategy take the stock price as given. I consider a general class of compensation schemes with the only restriction that the part of the analyst’s compensation that depends on the report corresponds to a portfolio traded in the market. I characterize the optimal reporting and portfolio strategy for this general class. I then analyze a performance-based compensation scheme which has also been considered by Morgan and Stocken (2003) and Bhattacharya and Pfleiderer (1985) in settings with no analyst trading.5

The implications of the analyst’s ability to trade on own account for the stock recommendation are quite negative: (1) For the general class of compensation schemes considered, I show that the analyst makes the same report for every signal independent from the true signal, his/her preferences or the quality of the signal. (2) The equilibrium reporting and portfolio strategy I describe continues to hold in an extension where analyst recommendation can potentially affect the stock price. (3) The performance based scheme, which induces truthfulness in the absence of analyst’s personal trades, is a special case in the general class considered and the above result applies.

The underlying mechanism that drives the results is as follows: If the part of the analyst’s compensation that depends on the report corresponds to a portfolio traded in the market, the analyst can undo the effect of any report on the compensation scheme by the subsequent choice of a private portfolio. Due to this ability, the optimal stock recommendation becomes the same for every information signal: given the security prices, for every signal the analyst chooses the report that maximizes the market value of the part of the compensation scheme that depends on the report. The subsequent personal portfolio sells the portfolio implicitly created by this report and uses the sales price plus any initial wealth to buy an optimal portfolio conditional on the true signal.

Since the analysis does not rely on any price impact by the analyst’s recommendation, I do not address stock price manipulation by false recommendations.6 The paper rather illustrates a relatively less emphasized but clearly important problem with the analysts’ personal trades: the analyst’s resulting ability to undo the compensation scheme, so that the optimal reporting strategy is the same for every signal.

5Michealy and Womack (1999) present evidence to justify this performance-based scheme, which we discuss in Section 3.2.
6See Benabou and Laroque (1992) and Morgan and Stocken (2003) for models which consider incentives to manipulate prices in a cheap-talk framework.
Therefore, the contribution of this paper is not to formalize the argument that the analyst would issue an optimistic report to boost the price if he/she owns the stock in a private portfolio. Instead, our approach is motivated by the recent work on non-exclusive agency contracts, where an agent can engage in side contracts and undo any risk exposure induced by the compensation scheme. The class of compensation schemes that our result holds is precisely the one where the analyst can unilaterally alter the consequences of the report by trading in the asset market. Interestingly, a special case in this class of contracts is a performance based scheme which induces a truthful recommendation in the absence of any analyst trading. In that sense, this paper contributes to a growing literature on nonexclusive contracts by analyzing a practically relevant application in financial markets.

2 Related Literature

The common modeling approach in the agency literature that analyzes the relationship between investors and agents providing financial services has been to disregard the possibility that the agent can also trade on own account. This common approach is not unique to applications in finance, but it also applies to most models in a principal-agent framework. In some sense, it has been almost axiomatic to assume that contracts are exclusive and the agent cannot engage in side contracts with third parties. The analyst’s trades on own account is similar to the idea that the agent can engage in side contracts unobservable to the market and hence can alter the intended effects of the compensation scheme. This similarity links the paper to a recent literature that studies the effect of non-exclusivity in agency contexts (for recent examples of agency models with non-exclusive contracting, see, e.g., Bisin and Guaitoli (2004), Kahn and Mookherjee (1998), Bizer and DeMarzo (1999)). I discuss in further detail the relation between this paper and non-exclusive contracting literature in Section 3.1.7

In the context of financial services firms providing information to investors (equity analysts) or making informed decisions on behalf of investors (mutual fund managers), the only paper that allows the agent to trade on own account is Biais and Germain.

7The analyst’s ability to trade on own account in our setting is also similar to a corporate executive’s ability to trade in financial markets to hedge her compensation scheme. Bebchuck et al. (2003) argue that the CEO’s access to hedging the compensation scheme renders incentive contracting ineffective. Bisin et. al. (2004) develop a model of imperfect corporate governance where shareholders can monitor if CEO hedges away her compensation scheme.
Their setting, however, corresponds to the problem of a mutual fund manager who uses the information to select a portfolio on behalf of the investors. Since the manager does not disclose any information, they do not address the credibility of analyst recommendations. Instead they focus on whether the manager will create a mutual fund portfolio that maximizes investor welfare.

A related paper is Trueman (1994) who also studies security analyst reports in a setting where analysts are not concerned with the price impact of their reports. The analysts in Trueman (1994) have different forecasting abilities unobservable to the market. Each analyst discloses a report with the objective of maximizing the clients’ posterior probability that the analyst has high forecasting ability. In other words, the analysts try to convince investors of their forecasting expertise. They are not allowed to trade on own account by assumption. Trueman shows that high quality analysts truthfully reveal their information, whereas low quality analysts mimic the high types. In contrast, I describe an equilibrium where the analyst makes the same report for every signal and for every forecasting ability (precision of the signal).

The closest paper to this one is Morgan and Stocken (2003). They consider the credibility of the analyst’s recommendations in a setting where investors are uncertain about the pressure that the analyst faces to boost the stock price. Their analyst may have incentives to issue an optimistic report to win business for the investment banking branch of his/her company. In that sense, they address precisely the misalignment of the analyst’s incentives due to ties with the investment banking business. In order to focus on the information that analysts communicate via stock reports and the responsiveness of stock prices to analyst recommendations, they purposely rule out the possibility that the analyst may trade on own account. Instead, I focus on the implications of the analyst’s personal trades for the reporting strategy in a setting where the stock price does not depend on the analyst’s recommendation in equilibrium. Therefore, the analysis in this paper complements theirs by addressing the somewhat overlooked potential source of conflict identified by Boni and Womack (2002) and Schack (2001), namely the analyst’s personal trades. I further discuss how my setting differs from Morgan and Stocken (2003) in Section 3.2.

Although there is little theoretical modeling of analyst recommendations, there is a large body of empirical work on how analyst incentives affect reporting behavior (see, e.g., Lin and McNichols (1998), Michaely and Womack (1999), Womack (1996)). Barber et al. (2001) study stock price responses to analyst recommendations. Hong et al. (2000) find empirical evidence that supports the career concern motivated herding theories, in the context of the market for security analysts. Golec (1992) tests the principal-agent model of investor-portfolio manager relationship.
3 The Model

The model considers a financial market with one risky and one safe security. There is a security analyst who follows the risky security and issues a recommendation to clients. The details of the set-up are explained below.

The Security Market: Consider a financial market where investors can trade two securities at date 1: a safe security (I normalize its price to one) and a risky security. A portfolio is described by a pair \((x, y) \in \mathbb{R}^2\) where \(x\) is the shares of the safe security and \(y\) is the shares of the risky security. Portfolios are traded at date 1 and liquidated at date 2. The liquidation value of a portfolio \((x, y)\) is given by

\[ x + \theta y, \]

where \(\theta\) is the stochastic final value of the risky security to be realized at date 2.

Information, Reporting and Private Portfolio: Before trading takes place, the security analyst observes a private signal \(s\) which is correlated with \(\theta\). I do not impose any restrictions on the quality (precision) of the signal, but I assume that the information is not publicly observable or verifiable. Therefore, the analyst is not constrained in any way to make a truthful report. Given the signal realization \(s\), the analyst makes a report \(m\) to the clients. The analyst also chooses a private portfolio \((F, d)\) on own account at date 1 which is also unobservable to all the market participants. The assumption that the analyst’s personal trades are unobservable captures the potential conflict of interest that undermines the credibility of the analyst’s recommendations. Even with increased disclosure requirements, full transparency of analyst trades is hard to implement. Schack (2001) notes that it is difficult to know how widespread is the practice of personal trades, but the analyst’s own investments

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9 The framework with only one risky security can be extended to multiple risky securities. In practice, a security analyst is responsible from covering a few stocks in a certain industry. Therefore, a single risky security framework does not seem to be too restrictive.

10 Admati and Pfeiderer (1986, 1990) study the problem of an information seller in a noisy rational expectations framework. To focus on how the information revealed from the stock price affects the seller’s problem, they assume that the seller truthfully provides information if sold directly and makes the promised investment if information is sold indirectly.

11 The new NASD Rule 2711 mandated by SEC in 2002 aims to increase the transparency of the analysts’ trading positions. Following the negative media coverage, some financial firms also adopted new disclosure rules and restrictions of their own. Prudential Securities announced that they would implement a new policy requiring their senior analysts to disclose if they own $10,000 or more of securities covered in their research reports. Early during the debate, Merrill Lynch imposed a rule that prohibits analysts from buying shares in companies (see Gasparino and Opdyke (2001) and Opdyke (2001)).
in companies they cover can be huge.\textsuperscript{12}

The Analyst’s Compensation: The analyst’s compensation depends on the report \( m \) and the realized final value \( \theta \) of the risky security. I denote this compensation by

\[
h(m, \theta) + g(\theta)
\]

where \( h(m, \theta) \) is the part of the compensation that depends on the analyst report. I also include the part \( g(\theta) \) independent of \( m \) for generality although setting \( g(\theta) \equiv 0 \) is inconsequential. For the moment, I do not impose any specific functional form on the compensation scheme.

Prior Beliefs and Market Prices: I first consider the case where the group of investors who employ the analyst and receive the report are atomic. This assumption implies that the analyst’s recommendation is observable only to a small group of investors and hence it has no price impact. It is true that the common concern for the analysts’ own trades is the possibility of making biased recommendations to inflate the price of the stocks they own. My purpose is not to overrule this relatively better understood possibility.\textsuperscript{13} This assumption, which I relax shortly, introduces analyst trading perhaps in the most innocuous way. It helps to illustrate that the analyst’s personal trades has undesirable consequences for the recommendation even without any incentives to misreport merely to manipulate the security price. I relax this assumption in Section 3.3 and allow the whole market to revise their beliefs on \( \theta \) conditional on the analyst’s report.

The common prior beliefs of the market on \( \theta \) is such that \( E[\theta] = p_0 \). I assume that the market for the risky security is efficient and investors are risk neutral. Since the analyst recommendation or personal trades have no price impact, the price of the risky security, which I denote by \( p \), is then given by \( p = p_0 \).

\textsuperscript{12} Furthermore, Shack (2001) convincingly points out that full disclosure of analyst’s stock ownership poses its own problems: "If an analyst recommends ten stocks but owns only seven of them himself, the reaction from the companies and investors when disclosure is made is likely to be heated. Nonownership in that context would speak almost as loudly as a sell recommendation." (Schack (2001, page 67). For a discussion of the effectiveness of new disclosure rules, see also Boni and Womack (2003).

\textsuperscript{13} A study by the SEC’s Office of Investor Education and Assistance emphasizes the power that the analysts can have on stock prices: "....analysts exert considerable influence in today’s marketplace. Analyst recommendations or reports can influence the price of a company’s stock....The mere mention of a company by a popular analyst can temporarily cause its stock to rise or fall—even when nothing about the company’s prospects recently has changed." (cited in Boni and Womack (2002, page 7). Womack (1996) finds that on the day that an analyst at a major brokerage firm issues a new buy recommendation, the stock price increases by 3 percent and its trading volume is twice normal, on average.
3.1 A General Result

Given \( p = p_0 \), the signal \( s \) and some initial wealth \( w_0 \), the analyst’s problem is to choose a report \( m \) and a private portfolio \((F, d)\) to maximize the expected utility \( E[u(h(m, \theta) + g(\theta) + F + d\theta)|s] \) subject to \( F + p_0d \leq w_0 \) where \( u(.) \) is the analyst’s monotone increasing utility function. Substituting for \( F \) from the budget constraint, an equivalent problem is choose a report \( m \) and a position \( d \) in the risky security to maximize \( E[u(w(m, d))|s] \) where

\[
 w(m, d) = h(m, \theta) + g(\theta) + d(\theta - p_0) + w_0. \tag{3}
\]

I denote this problem by (P1). I now introduce the following assumption on the part of the compensation scheme \( h(m, \theta) \) that depends on the report.

**Assumption 1:** \( h(m, \theta) \equiv \alpha(m) + \beta(m)\theta \) where \( \alpha(m), \beta(m) \) are real valued functions of \( m \).

A practically relevant scheme that satisfies this assumption, and also similar to the one used by Morgan and Stocken (2003), Stoughton (1993) and Bhattacharya and Pfleiderer (1985), is a performance based scheme of the form \(-(m - \theta)^2\). To see this, note that one can rewrite this scheme as

\[
 -(m - \theta)^2 = \underbrace{\frac{2m\theta - m^2 - (\theta)^2}{h(m, \theta)}}_{\text{h(m, \theta)}} \underbrace{g(\theta)}_{\text{g(\theta)}} \tag{4}
\]

This performance based scheme is known to illicit truthful disclosure of the signal in the absence of any analyst trades (see Bhattacharya and Pfleiderer (1985)). I analyze this scheme in Section 3.2 where I provide further motivation from industry practice. The key implication of Assumption 1 is that for every report \( m \), the part \( h(m, \theta) \) of the analyst’s compensation that depends on the report corresponds to a portfolio \((\alpha(m), \beta(m))\) traded in the market.

In order to characterize the optimal solution to (P1), I also need the following technical assumption on \( h(m, \theta) \) which ensures a solution. A performance based scheme of the form \(-(m - \theta)^2\) satisfies this technical assumption as well.

**Assumption 2** \( h(m, \theta) \equiv \alpha(m) + \beta(m)\theta \) is such that there is a unique report \( m^* \) that maximizes \( V(m) \equiv \alpha(m) + \beta(m)p_0 \).
The following observation illustrated in Figure 1 is key in characterizing the solution to (P1). By Assumptions 1 and 2, for every report \( m \), the part \( h(m, \theta) \) of the compensation scheme that depends on \( m \) corresponds to a portfolio schedule denoted by \( PT \) in the figure. Note that \( h(m, \theta) \) plus the private portfolio \((F, d)\) yields the analyst a wealth distribution

\[
h(m, \theta) + F + d\theta.
\]

Given \( h(m, \theta) \equiv \alpha(m) + \beta(m)\theta \), this distribution becomes

\[
F + \alpha(m) + (\beta(m) + d)\theta
\]

which corresponds to a total position \( F + \alpha(m) \) in the safe security and \( \beta(m) + d \) in the risky security. Therefore, the private portfolio \((F, d)\) can be used to undo \( h(m, \theta) \). Any risk undertaken from reporting \( m \) can be undone by a private portfolio. An optimal reporting strategy for every signal \( s \), is then to choose a report \( m \) that maximizes the market value of \( h(m, \theta) \) or equivalently the market value of the corresponding portfolio \((\alpha(m), \beta(m))\). Hence, optimal report must be \( m = m^* \in \arg \max V(m) \equiv \alpha(m) + \beta(m)p_0 \) which is denoted by point A in the figure. The subsequent private portfolio choice sells the portfolio \((\alpha(m^*), \beta(m^*))\) implicitly created by the report \( m^* \) and uses the sales price \( V(m^*) \) plus any other initial wealth to buy an optimal portfolio given the signal. This is denoted by point B in the figure.

![Figure 1: Analyst’s optimal reporting and private portfolio strategy](image)
I now formalize this observation and characterize the solution to (P1). I first show that the optimal report \( m \) must be such that \( m = m^* \in \arg \max V(m) \equiv \alpha(m) + \beta(m)p_0 \) for all \( s \). Suppose \((\bar{m}, \bar{d})\) is a solution to (P1) and for contradiction suppose \( \bar{m} \notin \arg \max V(m) \). By Assumption 2, there is a report \( m^* \in \arg \max V(m) \) such that

\[
V(m^*) - V(\bar{m}) \equiv [\beta(m^*) - \beta(\bar{m})]p_0 + \alpha(m^*) - \alpha(\bar{m}) \equiv \delta > 0
\]  

(7)

For convenience, let \( \Delta_1 \equiv \beta(m^*) - \beta(\bar{m}) \). I now show that \((m^*, \bar{d} - \Delta_1)\) is a strictly better strategy than \((\bar{m}, \bar{d})\). To prove this, one can use the definition of final wealth \( w(m, d) \) in (3) and Assumption 1 to obtain

\[
w(m^*, \bar{d} - \Delta_1) = h(m^*, \theta) + (\bar{d} - \Delta_1)(\theta - p_0) + g(\theta) + w_0
\]

\[
= \alpha(m^*) + \beta(m^*)\theta + \bar{d}(\theta - p_0) - \Delta_1(\theta - p_0) + g(\theta) + w_0
\]

\[
= V(m^*) - V(\bar{m}) + w(\bar{m}, \bar{d})
\]

\[
= \delta + w(\bar{m}, \bar{d})
\]

which proves that \( E[u(w(m^*, \bar{d} - \Delta_1))|s] > E[u(w(\bar{m}, \bar{d}))|s] \) and contradicts the initial assumption that \((\bar{m}, \bar{d})\) is optimal. Therefore, the optimal report must be such that \( m = m^* \in \arg \max V(m) \).

Given the optimal reporting choice \( m^* \in \arg \max V(m) \), the analyst’s problem now reduces to choosing a personal portfolio \((F, d)\) to maximize \( E[u(h(m^*, \theta) + g(\theta) + F + d\theta)|s] \) subject to \( F + p_0d \leq w_0 \). Let \( d \equiv \tau - \beta(m^*) \) and \( F \equiv K - \alpha(m^*) \). Using Assumption 1, then the problem becomes choosing a personal portfolio \((K, \tau)\) to maximize \( E[u(K + \tau\theta + g(\theta))|s] \) subject to \( K + p_0\tau \leq w_0 + V(m^*) \). Therefore, the following result is established.

**Proposition 1**  
(i) For every signal \( s \) the analyst reports

\[
m^* \in \arg \max V(m) \equiv \alpha(m) + \beta(m)p_0
\]  

(9)

(ii) The analyst selects a personal portfolio \((K, \tau)\) that maximizes

\[
E[u(K + \tau\theta + g(\theta))|s]
\]  

subject to \( K + p_0\tau \leq w_0 + V(m^*) \).
Corollary 2 For the class of compensation schemes satisfying Assumptions (1) and (2), the analyst’s optimal report is the same for every signal and it is completely independent from the precision of the signal and the risk preferences of the analyst.

Thus, for the class of compensation schemes considered, allowing the analyst to trade on own account has a severe effect on the recommendation. The optimal recommendation is the same for every information signal. The intuition follows from the observation made in the preceding paragraph. If the analyst’s compensation $h(m, \theta)$ corresponds to a portfolio traded in the market for every report $m$, then for every $s$ the analyst makes the same report that maximizes the market value of this implicit portfolio. The analyst’s optimal private portfolio choice then sells this portfolio implicitly created by the report and uses the sales price to buy an optimal portfolio given the signal. In a way, the analyst reports according to the market’s prior beliefs maximizing the value of the report and invests according to own preferences and information.

Relation to Literature on Nonexclusive Contracts: A common theme in the literature on non-exclusive agency contracts is the agent’s ability to engage in side contracts and unilaterally change the intended incentive effects of the compensation scheme. In the current setting, the agent (analyst) can replicate and hence unilaterally alter the part of the compensation that depends on the action (in this case the report). Since the investors do not observe the private portfolio $(F, d)$, nobody except the analyst knows the analyst’s final wealth distribution (or the analyst’s eventual bet on the stock return) after making a report $m$. This is similar to the agency settings with non-exclusive contracts in Arnott and Stiglitz (1991), Garvey (1993), Kahn and Mookherjee (1998), Cole and Kocherlakota (2001), Bisin and Guaitoli (2004) and Bisin and Rampini (2004) where the principal does not observe the final wealth distribution that the agent obtains by side trades before choosing costly and unobservable effort. The analysis in this paper combines adverse selection ($s$ is private information) and moral hazard ($(F, d)$ is a private action). The private action $(F, d)$ is chosen using the true signal and undoes any risk undertaken from reporting $m^*$.

The above result can also be interpreted as an application of the Fisher’s Separation Theorem in the context of a financial services firm providing recommendations to customers. Irving Fisher’s original analysis is concerned with the investment and consumption decision of an agent in a two-period setting: given some initial endow-
ment and an investment opportunity, the agent makes an optimal investment decision and chooses an optimal consumption sequence.\textsuperscript{14} Fisher shows that when the agent can borrow and lend, the optimal investment decision is independent of the agent’s preferences: it is solely determined by the available technology or what Fisher calls a productive opportunity. The optimal investment choice maximizes the market value of the productive opportunity. In the current setting, this optimal strategy corresponds to maximizing the market value of the compensation scheme that the report generates. Once this market value is maximized, the agent then chooses an optimal consumption (portfolio) according to own preferences and information. In that sense, Assumption 2 is not much different than assuming a concave production function so that the firm’s production problem has a solution.

3.2 A Performance-Based Contract

In order to illustrate the above result, I now lay out a commonly used CARA-normal framework and employ a performance-based compensation scheme. I make the following additional assumptions.

Information: The analyst’s private signal $s$ is specified as $s = \theta + \varepsilon$ where the noise term $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ and it is independent from $\theta$. In this formulation, the posterior distribution of $\theta$ conditional on $s$ is given by $(\theta | s) \sim N(\mu(s), H^{-1})$ where

$$
\mu(s) = Ts + (1 - T)p_0 \quad \text{with} \quad T \equiv \sigma_\varepsilon^2 / (\sigma_\theta^2 + \sigma_\varepsilon^2) \quad \text{and} \quad H^{-1} \equiv (\sigma_\theta^2 \sigma_\varepsilon^2) / (\sigma_\theta^2 + \sigma_\varepsilon^2).
$$

Analyst Preferences: The security analyst has CARA preferences described by the utility function $u(w) \equiv -\exp(-aw)$ where $a$ is the coefficient of absolute risk aversion and $w$ is analyst’s final wealth. The general result on the optimal reporting strategy does not depend on any specific form for the analyst’s preferences. I assume CARA preferences only to be able to explicitly solve the analyst’s private portfolio choice.

Compensation: The compensation scheme of the analyst is given by

$$
f(m, \theta) \equiv -(\theta - m)^2. \quad (11)
$$

The above scheme compensates the analyst based on the forecasting performance and it is of interest for several reasons. As discussed in Michaely and Womack (1999), the Institutional Investor All-American Research Team poll, based on a survey of

\textsuperscript{14} Irving Fisher, \textit{The Theory of Interest} (New York: MacMillan Co, 1930) is the most widely known reference for the Separation Theorem.
money managers and institutions, ranks analysts on their earnings-forecasting ability. This poll is a commonly accepted measure of analyst’s standing in the industry and securities firms take the analyst’s standing in this poll into consideration when setting analyst compensation. Morgan and Stocken (2003) also consider a variant of this scheme as I discuss shortly. This compensation scheme is also of interest because Bhattacharya and Pfleiderer (1985) have shown that it elicits truthful disclosure of information for any risk averse agent. Stoughton (1993) shows that this scheme also motivates the agent to acquire precise information if the agent’s costly effort determines the precision of the signal. None of these papers, however, allows the analyst to trade on own account.

Formally, given some initial wealth $w_0$ and the signal $s$ and security price $p_0$, the analyst’s problem is to choose shares of the risky security $d$ and a report $m$ to maximize $E[-\exp(-a[(d(\theta-p_0)-(\theta-m)^2)])|s]$. If the analyst cannot hold a portfolio on own account (when $d = 0$ by assumption), the compensation scheme $-(\theta - m)^2$ induces $m(s) = \mu(s)$ for every signal $s$ and precision $H$, i.e., the analyst always reports the true conditional mean given the signal (see Bhattacharya and Pfleiderer (1985)). In the absence of any private trades by the analyst, the performance based scheme gives incentives to minimize the forecast error and it yields the desired outcome of truthfulness for every signal.

However, if the analyst can trade on own account, this incentive scheme can be undone and the reporting strategy changes drastically. To illustrate that Proposition 1 applies, recall that the performance based compensation scheme can be written as $f(m, \theta) = (2m)\theta - m^2 - \theta^2$. The part of the compensation scheme that depends on the analyst’s report (given by $h(m, \theta) \equiv 2m\theta - m^2$) corresponds to a portfolio which contains $2m$ shares of the risky security and that borrows $m^2$ at a gross rate $r = 0$. Therefore, Assumption 1 is satisfied. Assumption 2 holds as well: The market value of this portfolio is given by $2mp_0 - m^2$ which has a unique maxima at $m^{**} = p_0$. Therefore, Proposition 1 applies.

**Proposition 3** Suppose the analyst’s compensation is given by $f(m, \theta) \equiv -(\theta - m)^2$ and the analyst can trade on own account. Then for every signal $s$, the analyst reports $m^{**} = p_0$ and takes a position in the risky security given by $d(s) = H(\mu(s) - p_0)/a$.

Proof: The above result follows from Proposition 1. I also provide a direct solution in the Appendix.
**Discussion:** It is illustrative to relate the analysis to Morgan and Stocken (2003). They analyze a similar environment where investors are uncertain about the analyst’s precise incentives in making a recommendation. The analyst’s payoff is specified as

\[ \pi(p(m), \theta) = 2bp(m) - (\theta - p(m))^2 \]  

(12)

where \( b \) is a parameter completely exogenous to the analyst and it describes the incentives to inflate the price.\(^{15} \) They interpret these incentives as the result of a pressure felt by the analyst to boost the stock price and win business for the investment banking branch of the securities firm he/she works for. If no such pressure exists, then the analyst has purely performance-based concerns and incentives are aligned with the investors. They do not allow for the analyst to trade on own account and their analysis is different than this paper as I explain below.

(i) In their setting, the report \( m \) affects analyst’s payoff only if it has an effect on the stock price \( p \). Without any effect on the stock price, any report is optimal, whereas in my setting \( m^{**} = p_0 \) is optimal for every \( s \).

(ii) The analyst in Morgan and Stocken (2003) cannot affect \( b \). Hence, he/she cannot undo any performance based incentives by private trades. In the current setting, the analyst’s payoff is given by

\[ w(m, d) = d(\theta - p) - (\theta - m)^2 \]  

(13)

with the private position \( d \) in the risky security chosen endogenously by the analyst and the report \( m \) does not affect \( p \) in equilibrium. In other words, in their setting the analyst takes \( b \) as given and by the report influences the stock price \( p \), whereas here the analyst takes \( p \) as given but he/she does choose a position \( d \) undoing the compensation scheme. As I show in the next section, if one assumes that the analyst can potentially affect \( p \) by \( m \), the equilibrium I describe continues to hold. Therefore, the key consideration in this paper that determines the optimal reporting strategy is not the ability to affect the stock price, but the ability to trade on own account to undo the compensation scheme.

\(^{15}\) They show that investor uncertainty over \( b \) makes full revelation of information impossible whereas when investors are certain about \( b \) full revelation occurs.
3.3 Extension: Recommendation May Affect Stock Price

I now show that the above result extends to the case when the analyst’s recommendation may have an impact on stock price. Suppose now that all investors observe the analyst’s report and revise their beliefs on $\theta$. I again assume that the market for the risky security is efficient and all investors are risk neutral. The date 1 price of the risky security denoted by $p$ will be equal to $E[\theta]$ conditional on all publicly available information at date 1, including the analyst’s report $m$. Hence, $p(m) = E[\theta|m]$, i.e., the security price is set according to the market’s Bayesian inference given the equilibrium reporting strategy of the analyst.

All aspects of the game are common knowledge except the analyst’s privately observed signal $s$ and private portfolio $(F, d)$. I employ Perfect Bayesian Equilibrium as the equilibrium concept which requires

(i) the market price of the risky security is determined by investors beliefs which are formed by Bayes rule whenever possible and

(ii) given the market price $p(m)$ induced by the report and the true signal $s$, the analyst chooses a report $m$ and personal portfolio $(F, d)$ to maximize

$$E[u(h(m, \theta) + g(\theta) + F + d\theta)|s]$$

subject to $F + p(m)d \leq w_0$.

The following proposition shows that the equilibrium described in the previous section continues to hold. Since the analyst’s report is the same for every signal, there is a PBE where the market does not update and the report has no effect on stock price in equilibrium.

**Proposition 4** If the analyst can trade on own account, then the reporting and portfolio strategy described in Proposition 1 is a PBE with $p(m) = p_0$ for every $m$.

**Proof:** Fix the investors beliefs such that $p(m) = p_0$ for every report $m$. Given these beliefs, reporting $m = m^* \in \arg \max V(m) \equiv \alpha(m) + \beta(m)p_0$ for all $s$ is optimal by Proposition 1 and the subsequent optimal private portfolio choice is as described in Proposition 1. Hence, $m(s) = m^*$ for all $s$ is optimal given beliefs. Bayes rule implies that the beliefs on the equilibrium path is such that $p(m^*) = E[\theta] = p_0$ and for reports $m \neq m^*$, the off-equilibrium beliefs can be arbitrarily set as $p(m) = p_0$. Therefore, this is a Perfect Bayesian Equilibrium.
4 Conclusion

In this paper, I analyze the optimal signal reporting strategy of a security analyst when the analyst can trade on own account. I show that if the part of the analyst’s compensation that depends on the report corresponds to a portfolio traded in the market, then the optimal report is the same for every signal and it is independent of the true signal, precision of the signal or analyst’s preferences. The optimal report maximizes the market value of the compensation scheme that depends on the report. The subsequent private portfolio choice implicitly sells the corresponding portfolio and uses the sales price and any other initial wealth to buy an optimal portfolio, given the true signal and risk preferences. As an application of this general result, I consider a performance based scheme and show that the result applies to this scheme as well. The paper’s main contribution is delivering a general negative result on the implications of analyst’s personal trades on the optimal reporting strategy. This approach highlights a somewhat less emphasized (compared to stock price manipulation) adverse effect of the analyst’s personal trades: the resulting ability to undo the compensation scheme by trading in the market and make the signal reporting problem independent of the true signal. In that sense, this paper contributes to a growing literature on nonexclusive contracts by analyzing a practically relevant application in financial markets.
Appendix (Direct Proof of Proposition 3).

Given $p_0$ and signal $s$, the analyst’s problem is choosing $m$ and $d$ to maximize $E[-\exp(-aw(m,d))|s]$ where $w(m,d) = -(\theta - m)^2 + d(\theta - p_0)$. After algebraic manipulations, one can rewrite $w(m,d)$ as

$$w(m,d) = d(m - p_0) + (d^2/4) - (z)^2$$

with $z \equiv \theta - m - (d/2)$. Note that $(z|s) \sim N(\mu(s) - m - (d/2), H^{-1})$. It follows, then, $H(z|s)^2$ has a non-central chi-square distribution. Using the moment generating function of the noncentral chi-square, one can evaluate the conditional expectation as

$$E[-\exp(-aw(m,d))|s] = -\exp\left\{-a\left[d(m - p_0) + d^2/4 - \frac{H}{H - 2a}[\mu(s) - m - (d/2)]^2\right]\right\}$$

Maximizing this expression with respect to $d$ and $m$, one obtains

$$d - \frac{H}{a}(\mu(s) - p_0) + 2(m - p_0) = 0$$

$$\frac{H}{H - 2a}(\mu(s) - m) - \frac{ad}{H - 2a} = 0$$

Solving for $d$ and $m$ yields $m^{**} = p_0$ and $d = H(\mu(s) - p_0)/a$. 

18
References


