Why do Sell-Side Analysts Still Prevail? Credible Optimistic Recommendation by Cheap Talk*

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May 28, 2018

Abstract

We investigate a cheap talk game between an analyst and an investor where the analyst's information about true state is imperfect and the combination of the optimistic bias and the precision is heterogeneous. Under specific conditions, there exists a Perfect Bayesian Equilibrium where the analyst's recommendation for investment decision is optimistic, and the investor who is aware of this bias still follows the recommendation.

Keywords: cheap-talk, recommendation, bias

JEL Codes:

*We appreciate the financial support from Dongguk University's new faculty settlement program. All errors are ours.

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1 Introduction

After the recent global financial crisis, analysts and rating agencies have been under heavy criticism for their overly optimistic opinion in their analyses of the assets and the companies they follow. Most of the financial analysis reports, prepared and provided by sell-side analysts, are available for investors at a low cost, or even for free because the analysts' interest lies more in the increased volume of sales or trading via the brokerage firms they work for than in the accuracy of their reports. Moreover, analysts who wish to be truthful may be denied from accessing the necessary inside information of the companies or assets they cover if the report are indeed truthful and provide negative recommendation to investors, who would then choose to sell. Finally, analysts' own incentives for career concern and reputation are not necessarily aligned with the investors' interests (e.g. Ottaviani and Sørensen, 2006c).

If the investors, however, are rational, they should take the potential bias of sell-side analysts' reports into consideration and do Bayesian update to derive their posteriors about the state of the assets they invest. If sell-side analysts provide worthless information continuously, the investors would simply disregard their reports, and, if so, the brokerage firms have no reason to maintain research department and hire analysts. Thus, we believe a more proper question should be as "If all market participants are aware of the over-optimism problem of the reports from sell-side analysts, why do they still prevail in the market?"

We investigate how a sell-side analyst, whose report is available for free but possibly optimistically biased, can still influence the investor's decision. For our analysis, we extend the cheap-talk model of Gilligan and Krehbiel (1987). Similar to their model, the state of the asset and the choice of actions are discrete. There is an optimistic bias for the informed party, or the analyst, too. In our model, however, the analyst's signal about the true state is imperfect and the combination of the optimistic bias and the precision of signal is heterogeneous: either more precise, but more biased, or less precise, but less biased.[1] Like most of cheap talk models, the analyst's report or recommendation itself does not affect the analyst's payoff nor the investor's, unlike the investment choice. Unlike Kamenica and Gentzkow (2011) and some other cheap-talk models, the true state also affects the analyst's utility in our model, which implies that he cares about his reputation as well.

The result shows that if there is heterogeneity in the type of analyst under some conditions, there exists a Perfect Bayesian Equilibrium where the analyst's recommendation for investment decision is optimistically biased, and the investor who is aware of the potential existence of the bias still follows the recommendation. On the other hand, if there is no

[1] For example, an analyst may be able to access the information from an insider of a company he follows, on the condition that the report should be more optimistic.

heterogeneity of the analyst's type, only the babbling equilibrium exists under the same condition.

The result comes from the following features in our model. First, the cardinality of action is greater than that of state, which enables the optimistic shift of report with little pooling/babbling of messages. Second, given the heterogeneity of analyst type, low and high levels in his bias and precision, the pooling of messages to the middle, or "hold," by low type is regarded credible. Then, after considering the possibility of "hold" from high type analyst, which is actually a negative message, the investor may find it still better off by following the recommendation. Without the possibility of the low type, the recommendation of "hold" can be interpreted as a negative signal, and, thus, no separation of messages in equilibrium can be achieved.

Considering a few facts that there is information asymmetry between the analyst and the investor, that the investor can usually obtain the analyst's report with little cost, and that the analyst has an optimistic bias toward "buy" for more brokerage fees, better relation with the company he covers, or both, strategic costless transfer of information, or "cheap-talk," models are proper and widely used in many previous studies.

Since Crawford and Sobel (1982), wide variety of cheap-talk models are proposed in different settings and contexts.

- Informed receiver: Lai (2014), Ishida and Shimizu (2016)
- Multiple senders: Battaglini (2002)
- Multiple receivers: Board and Dragu (2008), Yeung et al. (2014)
- Very biased sender with multi-dimensional signal: Chakraborty and Harbaugh (2010)
- Bayesian persuasion: Kamenica and Gentzkow (2011)

Previous literature that studies the forecasting bias of analysts' report more directly mainly focuses on the effect of the career concern and compensation (e.g. Hong and Kubik, 2003; Jackson, 2005; Ljungqvist et al., 2006) on reporting. It is only Ottaviani and Sørensen (2006a,b,c) that provides theoretical analyses based on the cheap-talk approach. However, their studies do not address the optimistic bias in the analyst's reports.

Our contribution may be two-fold. From the perspectives of theoretical model, we propose a cheap-talk game where the sender's private information is partially revealed, and the receiver follows the sender's message, which is optimistic but credible in the sense that following the recommendation is better for the receiver. From the perspectives of applications, our result somehow explains the rationale behind the prevalence of sell-side analysts, even after recurring financial crises.

The rest of the paper is constructed as follows. Chapter 2 provides an analysis of the benchmark model with homogeneous type of analysts. Chapter 3 extends the benchmark model and provides the conditions that lead to a PBE with credible optimistic reports from analysts. Chapter 4 concludes and discusses the result.

2 Model

There are two players; an investor and an analyst. The analyst has imperfect information about the true state of a change in asset price he follows, $\theta \in \{-w, w\}$ where w reflects the degree of change after observing a noisy private signal $s \in \{L(ow), H(igh)\}$ with precision P such that $0.5 < P \leq 1$. The analyst is supposed to report the value of his signal to the investor, $r \in \{L, H\}$, which bears no cost for falsification (i.e. cheap-talk). The investor receives the report r for free and chooses her investment decision $a \in \{-w, 0, w\}$, which can be considered as "S(ell)", "H(old)", and "B(uy)", respectively.

The investor's utility is quadratic, or, $u_1 = -1/2(\theta - a)^2$ and, the analyst's utility is $u_2 = -1/2(\theta + b - a)^2$ where b reflects the analyst's bias toward "Buy." We assume the following relationship between the precision and bias so that the bias is large enough for the analyst not to truthfully report, but not large enough for the investor to elicit any informative recommendation from the analyst.

Assumption 1 $(2P-1)w < b < w$ *unless specified.*

2.1 Benchmark

When $s = H$, if the analyst truthfully reports "buy" and the investor's expected utility, believing it to be actually so, is

$$\begin{aligned} u_1(a = w|r = B) &= -P(w - w)^2/2 - (1 - P)(-w - w)^2/2 \\ &= -2(1 - P)w^2 \end{aligned}$$

and the analyst's expected utility is

$$\begin{aligned} u_2(r = B|s = H) &= -P(w + b - w)^2/2 - (1 - P)(-w + b - w)^2/2 \\ &= -b^2/2 - 2(1 - P)(w^2 - bw) \end{aligned}$$

It is obvious that there is no incentive for the analyst to report falsely if $s = H$, and also no incentive for the investor not to choose "buy" in this case.

When $s = L$, if the analyst truthfully reports "sell," and the investor believes it to be true, her utility is

$$u_1(a = -w|r = L, s = L) = -P(-w + w)^2/2 - (1 - P)(w + w)^2/2 = -2(1 - P)w^2$$

and the analyst's utility is

$$\begin{aligned} u_2(r = L|a = -w, s = L) &= -P(-w + b + w)^2/2 - (1 - P)(w + b + w)^2/2 \\ &= -b^2/2 - 2(1 - P)(w^2 + bw). \end{aligned}$$

If he falsifies and reports $r = Low$, and the investor believes it to be true, her utility is

$$u_1(a = w|r = H, s = L) = -(1 - P)(w - w)^2/2 - P(-w - w)^2/2 = -2Pw^2$$

and the analyst's utility is

$$\begin{aligned} u_2(r = H|a = w, s = L) &= -(1 - P)(w + b - w)^2/2 - P(-w + b - w)^2/2 \\ &= -b^2/2 - 2P(w^2 - bw) \end{aligned}$$

Thus, for the analyst to report truthfully, the following inequality

$$-(1 - P)(w^2 + bw) > -P(w^2 - bw)$$

needs to be satisfied, which leads to the following condition between b and P as

$$(2P - 1)w > b.$$

It, however, violates the Assumption 1.

Proposition 1 *Given the Assumption 1, the analyst does not report truthfully and only babbling equilibrium exists.*

In a babbling equilibrium where the analyst always reports $r = High$ regardless of s, and the investor's posterior about $s = L$ for the off-equilibrium report $r = Low$ is one, the investor always chooses $a = 0$ and her expected utility is

$$u_1(a = 0) = -w^2/2 > -w^2 = u_1(a = w) = u_1(a = -w).$$

For the analyst, when $s = L$, his expected utility is

$$u_2(r = H|a = 0, s = L) = -w^2/2 - b^2/2 + (2P - 1)wb > u_2(r = L|a = -w, s = L).$$

2.2 Possibility of Compensation

To make the analyst report truthfully when $s = L$, the investor now considers a way of compensating the analyst so that the amount of compensation that will be given to him, c, for the negative report[2] (i.e. $r = L$) satisfies the following incentive compatibility condition

$$\begin{aligned} u_2(r = L, a = -w|s = L) &= -b^2/2 - 2(1 - P)(w^2 + bw) + c \\ &\geq u_2(r = H, a = 0|s = L) = -w^2/2 - b^2/2 + (2P - 1)wb, \end{aligned}$$

which leads to

$$c \geq bw - (2P - 3/2)w^2 > w^2/2.$$

If she does not compensate him, she instead chooses $a = 0$, which leads to $u_1(a = 0) = -w^2/2$. Thus, she will compensate the analyst if and only if

$$-2(1 - P)w^2 - c \geq -w^2/2,$$

which leads to

$$2(P - 3/4)w^2 \geq c \geq bw - (2P - 3/2)w^2 > w^2/2.$$

which leads to the following proposition. Note that $P > 3/4$ is a necessary condition for her to check the necessity of compensation to him.

Proposition 2 *The investor has no incentive to compensate the analyst for truthful negative report, or $r = L$ for $s = L$.*

Proof. Given Assumption 1, or $b > (2P-1)w$, the investor's cost of compensation is greater than the utility from $a = 0$. Because the maximum possible utility from truthful report is zero, which is achievable only if $P = 1$, she cannot be strictly better off. Finally, if the bias is smaller than $(2P - 1)w$, she does not need to compensate the analyst anyway to get a truthful report. ■

This result is not unexpected considering that the analyst's outside option is not zero as in conventional settings, and the functional structure of utility is the same for both the analyst and the investor, which implies that she has little room for compensating him.

[2] Or the analyst can be compensated for the correctness. In that case, his expected compensations are Pc and $(1 - P)c$ for truthful and untruthful reports, respectively. The qualitative implications are not different.

3 More Choice of Actions and Heterogenous Types

Suppose now that the investor has three options for investment decision, $a \in \{-w, 0, w\}$ and the analyst's report r delivers one of these options, $r \in \{S(ell), H(old), B(uy)\}$, while his signal about the state of the world, $s \in \{L, H\}$, as well as the state itself, $\theta \in \{-w, w\}$ are still binary. In other words, now the analyst recommends the investor's decision for investment rather than reports his information about the state of world.

When $s = L$, if the analyst's report is $r = Hold$ and the investor follows it, his expected payoff is

$$
\begin{aligned}
u_2(r = H|s = L) &= -P(-w + b)^2/2 - (1 - P)(w + b)^2/2 \\
&= -b^2/2 - w^2/2 + (2P - 1)wb
\end{aligned}
$$

If the bias b is sufficiently large, or $(2P - 3/2)w \leq b$, $u_2(r = Hold|s = L)$ would be better than the expected payoff from truthful report of negative signal, $u_2(r = Sell|s = L) = -b^2/2 - 2(1 - P)(w^2 + bw)$, on the condition that the investor follows the recommendation.

Assumption 1, $(2P-1)w < b$, satisfies the condition above, and the analyst would choose $r = Hold$ instead of $r = Sell$ if $s = L$. However, the investor would then deviate and choose $a = -w$ because she can conjecture that the analyst's signal is actually $s = L$ when $r = Hold$. Thus, the babbling equilibrium occurs again.

We now check whether and when the analyst has an incentive to recommend $r = Hold$ when $s = High$, which is necessary for the investor to choose $a = 0$ for $r = Hold$. His expected utility from truthful report when $s = High$, given the investor believes it to be true, is $u_2(r = Buy|a = w, s = H) = -b^2/2 - 2(1 - P)(w^2 - bw)$. Then, he reports $r = Hold$ if his expected utility

$$
\begin{aligned}
u_2(r = Hold|s = H) &= -P(w + b)^2/2 - (1 - P)(-w + b)^2 \\
&= -b^2/2 - w^2/2 - (2P - 1)bw
\end{aligned}
$$

is greater than $u_2(r = Buy|s = H)$, which means the satisfaction of the following inequality

$$
-b^2/2 - w^2/2 - (2P - 1)bw \geq -b^2/2 - 2(1 - P)(w^2 - bw),
$$

which leads to

$$
3/2 - b/w \geq 2P,
$$

Given Assumption 1, or $2P < b/w + 1$, the bias, or the precision, needs to be sufficiently small to have a pooling equilibrium of recommending "Hold." The following proposition summarizes our findings so far.

Proposition 3 *If the precision P and the bias b are single values, respectively, there exist only babbling (or pooling) equilibria.*

Now we investigate the case in which there are two types of analyst, denoted by $t \in \{l, h\}$, with precision P_l and P_h where $P_l < P_h$, and bias b_l and b_h where $b_l < b_h$. We further assume that $1/2 < P_l < 3/4 - b_l/(2w)$ and $3/4 < P_h < 1/2 + b_h/(2w)$ so that if there is only one type of precision, the high type ($t = h$) analyst has no incentive for truthful (or separating) report of $s = L$ while the low type ($t = l$) analyst does pool on "Hold."

We propose a Perfect Bayesian Equilibrium (PBE) with the following properties:

- Given the inequalities above, the analyst of type h will choose $r = Hold$ for $s = L$, and $r = Buy$ for $s = H$. If his type is l, he will then choose $r = Hold$ for both $s = L$ and H. Thus, if $r = Buy$, the investor can be confident that the signal $s = H$ comes from the analyst of type h whose precision is P_h.

- If $r = Hold$, the investor's expected payoff from $a = 0$ is

$$\begin{aligned}&\Pr(t = l|r = H)\left(\Pr(\theta = -w)u_1(a = 0) + \Pr(\theta = w)u_1(a = 0)\right)\\&+ \Pr(t = h|r = H)\left(\Pr(\theta = -w|s = L, t = h)u_1(a = 0) + \Pr(\theta = w|s = L, t = h)u_1(a = 0)\right),\end{aligned}$$

  which should be greater than both Equations (1) and (2) (note: we use l(or h) instead of $t = l$(or $t = h$) here)

$$\begin{aligned}&\Pr(l|r = H)\left(\Pr(\theta = -w)u_1(a = -w) + \Pr(\theta = w)u_1(a = -w)\right)\\&+ \Pr(h|r = H)\left(\Pr(\theta = -w|s = L, h)u_1(a = -w) + \Pr(\theta = w|s = L, h)u_1(a = -w)\right),\end{aligned} \tag{1}$$

  and

$$\begin{aligned}&\Pr(l|r = H)\left(\Pr(\theta = -w)u_1(a = w) + \Pr(\theta = w)u_1(a = w)\right)\\&+ \Pr(h|r = H)\left(\Pr(\theta = -w|s = L, h)u_1(a = w) + \Pr(\theta = w|s = L, h)u_1(a = w)\right).\end{aligned} \tag{2}$$

- Thus, in equilibrium, the analyst of type $t = l$ always chooses $r = Hold$, and the analyst of type $t = h$ chooses $r = Hold$ if $s = L$ and $r = Buy$ if $s = H$. The investor always chooses $a = 0$ if $r = Hold$, $a = -w$ if $r = Sell$, and $a = w$ if $r = Buy$.

Let the proportion, or probability, of type h be denoted as $\Pr(t = h) = \alpha$. Note that $\Pr(r = H|t = l) = 1$ and $\Pr(r = H|t = h) = 1/2$, given that the investor would follow the recommendation. Then $\Pr(t = l|r = H) = (1 - \alpha)/(1 - \alpha + \alpha/2)$ and $\Pr(t = h|r = H) = (\alpha/2)/(1 - \alpha + \alpha/2)$.

Now, we only need to check whether the investor has an incentive to deviate to $a = -w$ instead of $a = 0$ if $r = Hold$. The investor's expected payoff from $a = 0$ is

$$(1-\alpha)/(1-\alpha/2)\left(-w^2/2\right) + (\alpha/2)/(1-\alpha/2)\left(P_H(-w^2/2) + (1-P_H)(-w^2/2)\right), \qquad (3)$$

which is simply $-w^2/2$, and her expected payoff from $a = -w$ if $r = Hold$ is

$$(1-\alpha)/(1-\alpha/2)\left(-2w^2\right) + (\alpha/2)/(1-\alpha/2)\left(P_H \cdot 0 + (1-P_H)(-4w^2)\right). \qquad (4)$$

From Equation (3) and (4), we can derive the following proposition.

Proposition 4 *The Bayes Nash Equilibrium described above exists if the following condition*

$$1 - \alpha/2 > 4(1 - \alpha P_H)$$

is satisfied.

This result shows that we can achieve a BNE where the investor follows the analyst's recommendation if the type of analyst is heterogeneous in combination of precision and bias. For example, if $P_H = 0.96$ and $\alpha = 0.88$, this kind of BNE appears. Note that the result does not occur under the same conditions if the analyst's type is homogeneous.

4 Conclusion and Discussion

We investigate a cheap talk game between an analyst and an investor where the analyst's information about true state is imperfect and the combination of bias and precision, or type, is heterogeneous. Under specific conditions, there is a Perfect Bayesian Equilibrium where the analyst's recommendation for investment decision is optimistic, and the investor who is aware of this bias still follows the recommendation.

This result comes from two modifications to conventional cheap talk models. First, while the true state is binary, the action is tri-nary, which means that the cardinality of action is greater than that of state, and opens the possibility of the optimistic bias without pooling/babbling of messages. Second, given the heterogeneity of analyst's type, low and high in his bias and precision pair, the pooling of messages to the middle, or "hold," by low type is truthful and regarded as credible. Then, after considering the possibility of "hold" from high type analyst, which is actually a negative message, the investor may find it still better off to follow the recommendation. Without the possibility of the existence of low type analyst, the report of "hold" can be interpreted as a negative signal, and, thus, no separation of message in equilibrium can be achieved.

There are some caveats. First, in the real world, the analyst reports disproportionately recommend "buy," above 80% for example,[3] which is far more biased than our result. Second, we assume that the cardinality of action is greater than that of state. Unfortunately, it does not resemble the actual investment decision making nor frequently assumed in the literature other than Gilligan and Krehbiel (1987), which focuses on modeling legislative organizations and decision makings.

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[3]See http://www.ebn.co.kr/news/view/829163 (in Korean) for more detail.

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