Expectations Management*

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Abstract

Empirical evidence suggests the existence of a market premium for firms whose earnings exceed analysts' forecasts and that firms respond by managing analysts' expectations downward. This paper provides a theoretical analysis of the driving forces behind expectations management, paying particular attention to the differing roles played by publicly-communicated and privately-communicated analyst forecast guidance. While conventional wisdom suggests that both private and public forecasts are used to guide analysts' forecasts downward, we find that only the private forecast is used for this purpose. In contrast, managers bias their public forecast *upwards*, in order to reduce investors' inference of the *downwardly*-biased guidance privately provided to the analyst. We show that the magnitudes of private and public bias increase with the precision of the information privately communicated to the analyst. This result suggests that Regulation Fair Disclosure may have played an important role in reducing managers' motivation to engage in private *as well as* public expectations management. Our findings also suggest a simple rational explanation for the observed market premium for beating analysts' expectations. We show that the quality of reported earnings is an important determinant of the magnitude of this premium, and even whether such a premium exists.

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1 Introduction

There is abundant empirical evidence in the accounting literature suggesting that firms manage earnings and analysts' earnings expectations in order to ensure that reported earnings equal or exceed the prevailing consensus analyst forecast.[1] There is also a stream of analytical research devoted to understanding the driving forces behind earnings management.[2] In contrast, little is known analytically about the dynamics behind expectations management. A salient feature of expectations management, which distinguishes it from earnings management, is that it works by way of a third party – the analyst – with whom a firm's manager can communicate both publicly (by releasing a public forecast of earnings) and privately (through private expectations guidance). In this paper we investigate how managers use these public and private channels of communication in order to guide analysts' forecasts. Conventional wisdom suggests that firms use these two channels interchangeably. We show that the forces driving expectations management are more complicated, and that managerial public and private forecasts serve very different purposes with respect to expectations management. We also demonstrate that the existence of these forces provides a simple explanation for the empirically documented "meet-or-beat" phenomenon, in which firms that beat the most recent consensus analyst forecast earn a market premium relative to those that fall short.

At first glance, it is not obvious how expectations management could benefit the firm's manager, except in the very short run. If the analyst's earnings forecast is just a noisy estimate of the firm's earnings, then it would be superfluous once earnings are announced and would not enter into the determination of the firm's stock price at that time. As a result, any short-term effect that expectations management might have on price would be

[1] See, for example, Dechow et al. (1995), Degeorge et al. (1999), Bartov et al. (2002), Kasznik and McNichols (2002), Matsumoto (2002), Skinner and Sloan (2002), Richardson et al. (2004), Burgstahler and Eames (2006), Cotter et al. (2006), and Das et al. (2011).

[2] Theoretical research on earnings management include Dye (1988), Trueman and Titman (1988), Fischer and Verrecchia (2000), Guttman et al. (2006), Bertomeu (2013), Gao (2013), and Strobl (2013). See also the references in Beyer et al. (2010).

reversed at the time of the earnings announcement. For there to be a more permanent effect, it is necessary that the analyst's earnings forecast provide information about firm value *supplementary* to the information reflected in earnings.

In this paper we present a simple, intuitive model in which analysts' forecasts exhibit this property. In our model a firm's earnings each period are a function of underlying firm quality and transitory market conditions existing during the period. Investors learn about the transitory market effect by observing the analyst's forecast revision during the period, which reflects new information that the analyst learns about the prevailing market conditions. Using their observation of the forecast revision and the period's realized earnings, investors are then able to draw inferences about the firm's underlying quality. Given reported earnings, the lower the revised forecast (that is, the worse the period's market conditions), the higher will be the inferred quality of the firm and, in turn, the higher will be the firm's stock price. This is because when market conditions are unfavorable, achieving a given level of earnings requires higher firm quality. This leads to a negative relation between the analyst's forecast revision and the post-earnings announcement price, consistent with the "meet-or-beat" phenomenon.

In our model the firm's manager receives private information about the firm's earnings. After observing the information, the manager publicly issues a (possibly biased) forecast of earnings and privately communicates an additional (possibly biased) forecast to the analyst prior to the analyst revising her initial forecast. In determining the biases in his public and private forecasts, the manager's goal is to maximize the firm's post-earnings announcement stock price, less any cost of biasing. We show that the manager engages in public expectations management *only* because he provides a privately-communicated forecast to the analyst. This suggests that public expectations management serves a supplementary role to private expectations management, rather than playing a primary role. The public forecast is used by investors to learn about the manager's private communication with the analyst. Consequently, when the manager privately guides the analyst's forecast downward (in order to take advantage of the inverse relation between her forecast and price), he also biases his public forecast *upward*. The positive public bias lowers investors' inference of the *downwardly*-biased guidance provided to the analyst.

When the costs of expectations management via the public and private channels are set equal to each other, we find that the manager engages in a greater level of private bias than of public bias. This is because private expectations management more effectively influences the post-earnings announcement stock price than does public expectations management. This is a result of the manager's public forecast being an imprecise indicator to investors of the guidance privately provided to the analyst. We also find that the magnitudes of public and private bias are increasing in the precision of the information that the manager privately communicates to the analyst. This suggests that Regulation Fair Disclosure (Reg FD), which restricted private communication between managers and analysts, may have served to limit the level of private *as well as* public expectations management.

If we allow the manager to choose the precision of the information communicated privately to the analyst, then the manager will set precision at its maximum possible level, as long as the cost of public expectations management is sufficiently low. In so doing, the manager maximizes the weight that the analyst places on the manager's downwardly-biased private guidance and minimizes the weight she places on the upwardly-biased public forecast. This leads to the highest level of expectations management activity. However, if the cost of public expectations management is sufficiently high, then the manager will set precision at its lowest possible level, minimizing the amount of information privately communicated. In this case, the manager will have no incentive to engage in expectations management. These results illustrate the important role that the cost of public expectations management plays in determining the extent to which the manager chooses to communicate private information to the analyst and guide her expectations.

We also demonstrate that if the manager is allowed to choose whether to release a public forecast, he will opt against providing one. The choice not to make a public disclosure serves as a commitment device, as it ensures that the manager also does not communicate privately with the analyst and does not engage in expectations management. While there are many other reasons why a manager might choose to issue a public forecast, our analysis highlights a cost of that decision – that it may induce the manager to engage in costly expectations management.

Finally, we show that the quality of reported earnings is an important determinant of the magnitude, and even existence, of a market premium for firms whose earnings exceed analysts' forecasts. In particular, we demonstrate that when reported earnings become sufficiently noisy, the market premium for beating expectations actually turns negative. The reason for this is that when the level of noise is high, the primary role of the analyst's forecast is to provide information about the firm's underlying real earnings, rather than about current market conditions only. The post-announcement stock price then becomes an increasing (rather than decreasing) function of the analyst's disclosed forecast.

The plan of this paper is as follows. In Section 2 we present our basic model and show that a market premium for firms whose earnings exceed analysts' expectations arises naturally in this setting. In Section 3 we introduce expectations management. In Section 4 we define and characterize the resulting equilibrium. Equilibrium analyses are presented in Section 5. We briefly extend our model in Section 6 to allow for more general information structures and show that a necessary condition for public expectations management to arise in equilibrium is that the manager and analyst share some private information. We summarize in Section 7. Proofs to all propositions appear in the appendix.

2 The basic setting

Consider a two period economy in which shares of a risky firm and a riskless asset are available for trading. All investors in the market are assumed to be risk neutral and symmetrically informed, and the risk-free rate of return is set equal to zero, without loss of generality. The firm generates real earnings of e_1 and e_2 in periods 1 and 2, respectively. The total of these earnings equals the firm's total net cash inflow over the two periods, which is paid out as a liquidating dividend to shareholders at the end of the second period. There is one analyst who covers the firm, and whose role it is to forecast the period's earnings. In this section we assume that the firm's manager does not provide his own forecast of earnings. In the next section we allow the manager to issue an earnings forecast as well as to engage in both expectations management and earnings management.

Real earnings in period t, $t = 1, 2$, are comprised of two components, m_t and i_t, where:

$$e_t = m_t + i_t. \tag{1}$$

The components m_t and i_t are independent, normally distributed random variables, with prior means (as of the beginning of period 1) of zero and variances of V_m and V_i, respectively. Unless otherwise stated, all variances in our model are strictly positive and bounded. We assume that the analyst provides an initial forecast of first-period earnings at the beginning of the first period (before observing any private information). Given that each period's real earnings have a prior mean of zero, this initial forecast is equal to zero. The price of the firm, which equals investors' expectation of the sum of real earnings over the two periods, is also equal to zero at the beginning of the first period.

The firm's real earnings are assumed to be intertemporally correlated. Specifically, $cov\,(m_1, m_2) = p_m V_m$ and $cov\,(i_1, i_2) = p_i V_i$, where $p_m, p_i \in [0, 1]$. The parameter p_m (p_i) represents the persistence of component m (i) between the two periods. We assume that component m is more persistent than component i ($p_m > p_i$). Accordingly, we sometimes refer to m as the persistent component of earnings and i as the transitory component. We think of the persistent component as representing underlying firm quality and the transitory component as reflecting the specific market conditions during the period. For simplicity, we assume for the remainder of our analysis that $p_i = 0$. Relaxing this assumption does not have any qualitative effect on our results.

The firm's reported earnings for period t, e_{tr}, are equal to real earnings, e_t, plus noise introduced by the accounting system, ε_{et}. The noise term, ε_{et}, is normally distributed with a mean of zero and a variance of $V_{\varepsilon e}$, and is independent of all other variables in the model. We sometimes refer to the variance, $V_{\varepsilon e}$, as the noise in the accounting reporting system.

Sometime during the first period the firm's analyst receives a noisy signal of i_1, denoted by z_i, where:

$$z_i = i_1 + \varepsilon_i, \tag{2}$$

and $\varepsilon_i \sim N(0, V_{\varepsilon i})$, independent of all other variables. More generally, the analyst could also be provided with a noisy signal of the persistent component, m_1, as long as the precision of this signal was not too high relative to that of the information she observes about the transitory component, i_1. This assumption reflects the notion that in each period the analyst learns more about the impact of current market conditions on firm performance that period than she does about the impact of the firm's unobservable underlying quality.[3] For simplicity, and without any qualitative effect on our results, we assume below that $V_{\varepsilon i} = 0$, so that the analyst learns the value of the transitory earnings component, i_1, perfectly during the period. After observing i_1, the analyst publicly releases a revised forecast, AF, of current-period reported earnings, where:

$$AF = E\left[e_{1r}|i_1\right]. \tag{3}$$

Since the prior expectation of m_1 is zero, $AF = i_1$.

Using the publicly observable information, (AF, e_{1r}), investors set the end-of-period 1 price, P_1, equal to their expectation of the sum of real earnings over the two periods:

$$P_1(AF, e_{1r}) = E(e_1 + e_2|AF, e_{1r}). \tag{4}$$

[3]This is consistent with Hutton et al. (2012), who find that in forecasting current-period earnings, analysts' information advantage lies at the macroeconomic level.

Using Bayes' rule, along with the assumptions that $\text{cov}(m_1, m_2) = p_m V_m$ and $\text{cov}(i_1, i_2) = p_i V_i$, yields:

$$P_1(AF, e_{1r}) = \beta_{AF} AF + \beta_e e_{1r}, \tag{5}$$

where:

$$\beta_{AF} = \frac{-V_m p_m + V_{\varepsilon e}}{V_m + V_{\varepsilon e}}, \tag{6}$$

and:

$$\beta_e = \frac{V_m}{V_m + V_{\varepsilon e}} \left(1 + p_m\right). \tag{7}$$

From expression (6) we see that whether the post-announcement price varies directly or inversely with the analyst's forecast depends on the amount of noise in the accounting system. To understand why this is so, note that the analyst's forecast provides two types of information to investors. The first is information about the persistent component of earnings, m_1, and the second is information about the period's total real earnings, e_1. At one extreme, when there is no noise in the accounting system ($V_{\varepsilon e} = 0$), the firm's reported earnings perfectly reveal its real earnings, and so the analyst's forecast is used by investors solely as a source of information about m_1. In fact, in conjunction with reported earnings, it provides perfect information about that component ($m_1 = e_{1r} - AF$). For a given level of reported earnings, the lower is AF, the higher is the inferred value of the persistent component, m_1, and the higher is investors' expectation of the second period's real earnings. This means that the post-earnings announcement price will vary inversely with AF. At the other extreme, when there is an infinite level of noise in the accounting system ($V_{\varepsilon e} = \infty$), reported earnings are not informative at all about real earnings and the analyst's forecast is used by investors solely as a source of information about those earnings, in total ($E\left[e_1\right] = AF$). The forecast does not provide any additional information about the individual component, m_1. Consequently, the higher is AF, the higher is investors' assessment of the period's real earnings, and the higher is the post-earnings announcement price. From (6) we see that there is a threshold level of $V_{\varepsilon e}$, denoted by $\hat{V}_{\varepsilon e} \equiv p_m V_m$, below which β_{AF} is negative and above which it is positive. When reporting quality is high ($V_{\varepsilon e} < \hat{V}_{\varepsilon e}$), the information that AF provides about m_1 dominates the information provided about e_1, and the post-announcement price decreases in AF. When reporting quality is low ($V_{\varepsilon e} > \hat{V}_{\varepsilon e}$), the information provided about e_1 dominates the information provided about m_1 and price increases in AF.

These results provide a theoretical explanation for the empirically documented market premium for firms whose earnings exceed analysts' expectations. (See Bartov et al., 2002, and Kasznik and McNichols, 2002.) Holding fixed the period's earnings surprise (realized earnings minus the beginning-of-period earnings forecast), these studies find that firms whose earnings beat the most recent analyst consensus earnings forecast have a higher return over the period than do those firms whose earnings fall short. In our setting, the beginning-of-period analyst forecast is zero, as is the beginning-of-period market price. Consequently, the earnings surprise over the period is equal to the reported earnings, e_{1r}, while the return over the period is equal to the end-of-period price, P_1. In this context, then, a market premium exists if, holding e_{1r} fixed, the lower is AF, the greater is P_1. Our theory predicts that this will be the case, as long as the noise in the accounting system is not too high. Bartov et al. (2002) and Kasznik and McNichols (2002) also show that the future earnings of firms that exceed expectations are, on average, higher than those of firms that miss. Our analysis yields the same prediction. In our model the market premium arises precisely because a less favorable analyst forecast causes investors to increase their estimate of the persistent earnings component and, in turn, their expectation of future earnings.

3 Introducing expectations management

Having established that the firm's post-earnings announcement stock price is a function of the analyst's forecast, we now introduce the manager and allow him to exploit this relation by engaging in expectations management. In our model, expectations management is defined as the introduction of a bias into the earnings forecast publicly released by the manager and/or privately communicated to the analyst, designed to influence the inferences investors draw from the analyst's forecast about her private information. In this setting, we also allow the manager to engage in earnings management. Our analysis below focuses on the manager's first-period actions. This is because the post-earnings announcement price at the end of the second period is equal to the firm's liquidating dividend and so is unaffected by either expectations or earnings management.

There are three dates in period 1. At date 1 the manager observes a noisy signal of the period's real earnings. Denoted by z_e, it is given by:

$$z_e = e_1 + \varepsilon_z, \tag{8}$$

where $\varepsilon_z \sim N(0, V_{\varepsilon z})$. The variable ε_z captures the noise in the manager's private information and is assumed to be independent of all other variables. After observing z_e, the manager publicly releases a forecast of earnings, *MF*, given by:

$$MF = z_e + b_{MF}, \tag{9}$$

where b_{MF} is the amount of bias that the manager introduces into his public forecast. Additionally, he provides the analyst with a private forecast of earnings. Denoted by *MP*, this forecast is given by:

$$MP = z_e + b_{MP}, \tag{10}$$

where b_{MP} is the level of bias introduced by the manager into his private forecast.[4] We choose to express each of the manager's forecasts as his *signal* plus bias, rather than as his expectation of reported earnings plus bias. This is solely for ease of exposition. Since, in

[4] As shown below, the equilibrium levels of bias, b_{MF} and b_{MP}, are functions of the information privately observed by the manager. For expositional simplicity we suppress the functional notation.

equilibrium, his expectation for reported earnings is a known linear function of his signal, this alternative presentation is without loss of generality.

Given the information structure in (8), the manager's forecast, by itself, provides no information to investors about the value of the firm once the period's earnings are released. Modeling the manager's information in this way ensures that the sole purpose of biasing the public and private forecasts is to influence investors' inferences about the analyst's private information.

At date 2 of the first period the firm's analyst observes her signal, i_1. Conditional on MF, MP, and i_1, the analyst publicly releases a revised forecast, AF, of current-period reported earnings, e_{1r}:

$$AF = E\left[e_{1r}\,|MF, MP, i_1\right]. \tag{11}$$

At the end of the period, date 3, the manager observes the period's earnings, $e_1 + \varepsilon_{e1}$, and releases an earnings report of

$$e_{1r} = e_1 + \varepsilon_{e1} + b_e, \tag{12}$$

where b_e is the bias that the manager introduces into his report. Using the publicly observable information, (MF, AF, e_{1r}), investors set the end-of-period 1 price, P_1, equal to their expectation of the sum of the real earnings over the two periods:

$$P_1(MF, AF, e_{1r}) = E\left[e_1 + e_2|MF, AF, e_{1r}\right]. \tag{13}$$

A timeline of the events in the two periods is presented in Figure 1.

In choosing b_{MF}, b_{MP}, and b_e, the manager's goal is to maximize his expected utility:

$$E(U) = E[P_1(MF, AF, e_{1r})|I_M] - \frac{c_{MF}}{2}(b_{MF} - \varepsilon_{MF})^2 - \frac{c_{MP}}{2}(b_{MP} - \varepsilon_{MP})^2 - \frac{c_e}{2}{b_e}^2, \tag{14}$$

where I_M denotes the manager's information set. Allowing the manager's utility to also be a function of the price at the end of the second period would not change our analysis since the manager cannot affect this price through his actions (it is equal to the liquidating dividend).

The second, third, and fourth terms on the right-hand side of expression (14) are the costs to the manager of engaging in public expectations management, private expectations management, and earnings management, respectively. The cost parameters, c_{MF}, c_{MP}, and c_e, are all positive and bounded. The variables ε_{MF} and ε_{MP} reflect market uncertainty over the cost of biasing the public and private forecast, respectively.[5] These variables are assumed to be normally distributed with means of zero and variances of $V_{\varepsilon MF}$ and $V_{\varepsilon MP}$, respectively, and to be independent of each other and of all other variables in the model. The manager learns the values of ε_{MF} and ε_{MP} at date 1; however, they remain unknown to investors and the analyst.

4 Definition and characterization of equilibrium

Equilibrium in our model is formally defined as follows:

Definition (Equilibrium). An equilibrium consists of (i) a public forecasting rule for the manager, $MF(.)$, (ii) a private forecasting rule for the manager, $MP(.)$, (iii) a first-period earnings reporting rule, $e_{1r}(.)$, (iv) a forecasting rule for the analyst, $AF(.)$, and (v) an end-of-period 1 pricing rule, $P_1(.)$, such that:

a. given $AF(.)$ and $P_1(.)$, the manager's public forecast is equal to $MF = z_e + b_{MF}$; the manager's private forecast is equal to $MP = z_e + b_{MP}$; and reported earnings are equal to $e_{1r} = e_1 + \varepsilon_{e1} + b_e$, where the biases, b_j, $j = MF, MP, e$, satisfy:

$$b_j = \arg\max_{b_j}\{E[P_1(MF, AF, e_{1r})|I_M] - \frac{c_{MF}}{2}(b_{MF} - \varepsilon_{MF})^2 - \frac{c_{MP}}{2}(b_{MP} - \varepsilon_{MP})^2 - \frac{c_e}{2}{b_e}^2\};$$

[5] Dye and Sridhar (2004) and Beyer (2009) use this formulation in order to introduce uncertainty into the cost functions of an owner/manager.

b. given $MF(\cdot)$, $MP(\cdot)$, and $e_{1r}(\cdot)$, the analyst's forecast is equal to $AF = E\left[e_{1r}\left|MF, MP, i_1\right.\right]$; and

c. given $MF(\cdot)$, $MP(\cdot)$, $AF(\cdot)$, and $e_{1r}(\cdot)$, the end-of-period 1 price is equal to $P_1(MF, AF, e_{1r}) = E(e_1 + e_2|MF, AF, e_{1r})$.

In equilibrium the manager determines the optimal levels of public forecast bias, private forecast bias, and earnings management in order to maximize his expected utility, taking as given the linear pricing rule and the analyst's forecasting rule. The analyst takes the manager's public and private forecasting rules, as well as the earnings reporting rule, as given, and releases a forecast equal to her expectation of the firm's period 1 reported earnings. Investors set the post-earnings announcement stock price equal to their expectation of the sum of the firm's real earnings over the two periods, taking as given the manager's public and private forecasting and earnings management rules, as well as the analyst's forecasting rule.

The following proposition describes the nature of the equilibrium in our setting.

Proposition 1. *A unique linear equilibrium exists in which the manager engages in public and private expectations management and earnings management. In this equilibrium,*

a. the analyst's forecast is given by $AF\left(MF, MP, i_1\right) = \gamma_0 + \gamma_{MF}MF + \gamma_{MP}MP + \gamma_i i_1$, *where:*

$\gamma_{MF} = \frac{(V_m + V_{\varepsilon e})V_{\varepsilon MP}}{D} > 0$;

$\gamma_{MP} = \frac{(V_m + V_{\varepsilon e})V_{\varepsilon MF}}{D} > 0$;

$\gamma_i = \frac{V_{\varepsilon MP}V_{\varepsilon z} + V_{\varepsilon MF}(V_{\varepsilon MP} + V_{\varepsilon z})}{D} > 0$; *and*

$D \equiv V_{\varepsilon MF}V_{\varepsilon MP} + \left(V_{\varepsilon MF} + V_{\varepsilon MP}\right)\left(V_m + V_{\varepsilon e} + V_{\varepsilon z}\right)$;

b. the end-of-period price is $P_1\left(MF, AF, e_{1r}\right) = \beta_0 + \beta_{MF}MF + \beta_{AF}AF + \beta_e e_{1r}$, *where:*

$\beta_{MF} = -\left(V_{\varepsilon e} - \hat{V}_{\varepsilon e}\right)\frac{V_i(V_{\varepsilon MP}V_{\varepsilon z} + V_{\varepsilon MF}(V_{\varepsilon MP} + V_{\varepsilon z}))}{E}$;

$\beta_{AF} = \left(V_{\varepsilon e} - \hat{V}_{\varepsilon e}\right) \frac{V_i(V_{\varepsilon MF}+V_{\varepsilon z})(V_{\varepsilon MF}V_{\varepsilon MP}+(V_m+V_{\varepsilon e}+V_{\varepsilon z})(V_{\varepsilon MF}+V_{\varepsilon MP}))}{(V_m+V_{\varepsilon e})E}$;

$\beta_e = \frac{(1+p_m)V_m}{V_m+V_{\varepsilon e}} > 0$; *and*

$E \equiv (V_m + V_{\varepsilon e})^2 V_{\varepsilon MF}^2 + V_i \left(V_m V_{\varepsilon MF}^2 + V_{\varepsilon e} V_{\varepsilon MF}^2 + (V_{\varepsilon MF} + V_{\varepsilon z})(V_{\varepsilon MP} V_{\varepsilon z} + V_{\varepsilon MF}(V_{\varepsilon MP} + V_{\varepsilon z}))\right)$;

c. *the biases introduced by the manager are:*

$b_{MF} = \frac{\beta_{MF}+\beta_{AF}\gamma_{MF}}{c_{MF}} + \varepsilon_{MF}$;

$b_{MP} = \frac{\beta_{AF}\gamma_{MP}}{c_{MP}} + \varepsilon_{MP}$; *and*

$b_e = \frac{\beta_e}{c_e} > 0$.

In equilibrium the analyst attaches a positive weight to each of the pieces of information she observes - *MF*, *MP*, and i_1 - when forming her forecast. At first glance it might seem surprising that the analyst uses the manager's public forecast at all, given that she also receives private guidance from him. She does so because the manager's private communication is biased and the public forecast is valuable in partially extracting that bias.

The end-of-period price in equilibrium is increasing in reported earnings ($\beta_e > 0$). This is because (a) the first period's reported earnings are a noisy signal of that period's real earnings and (b) the two periods' real earnings are positively correlated. Since $\beta_e > 0$, the manager has an incentive to bias reported earnings upward ($b_e > 0$). However, since the bias is a constant in our model, investors can perfectly infer the firm's unmanaged earnings from its reported earnings. Allowing the bias to be a random variable, though, would not have any effect on our analysis. In contrast to the unambiguously positive effect of reported earnings on price, the directional impact of the manager's and of the analyst's publicly disclosed forecasts on price depend on the sign of $V_{\varepsilon e} - \hat{V}_{\varepsilon e}$. As discussed earlier, when the noise is sufficiently low, the analyst's forecast is used mainly to provide information about the persistent earnings component, m_1, and so the relation between AF and price is negative. When the noise in the accounting reporting system,$V_{\varepsilon e}$, is high enough, the analyst's forecast is mainly used to provide information about the first period's total real earnings and the relation between AF and price is positive. Consequently, the mean level of bias in the manager's publicly disclosed forecast, $\bar{b}_{MF} = \frac{\beta_{MF}+\beta_{AF}\gamma_{MF}}{c_{MF}}$, and in his privately communicated forecast, $\bar{b}_{MP} = \frac{\beta_{AF}\gamma_{MP}}{c_{MP}}$, also depend on the sign of $V_{\varepsilon e} - \hat{V}_{\varepsilon e}$.

5 Equilibrium analysis

5.1 Basic results

Since the information provided by the analyst's forecast about the persistent earnings component is at the heart of our model and drives our theoretical prediction of a market premium when earnings exceed analysts' expectations, we initially focus on this source of investor uncertainty. To do so, we abstract from uncertainty over the level of total real earnings by setting $V_{\varepsilon e} = 0$. (We examine the case of $V_{\varepsilon e} > 0$ later in the section.) When $V_{\varepsilon e} = 0$, there is no noise in the accounting reporting system and investors can perfectly infer real earnings from their knowledge of reported earnings and the equilibrium level of earnings management. The next set of results follow immediately from Proposition 1:

Corollary 1. *When $V_{\varepsilon e} = 0$, equilibrium is characterized by:*

$\beta_{AF} < 0$;

$\beta_{MF} > 0$;

$\bar{b}_{MF} = \frac{\beta_{MF}+\beta_{AF}\gamma_{MF}}{c_{MF}} > 0$; *and*

$\bar{b}_{MP} = \frac{\beta_{AF}\gamma_{MP}}{c_{MP}} < 0$.

Since the analyst puts positive weight on the manager's privately communicated forecast ($\gamma_{MP} > 0$) and because the price is decreasing in the analyst's forecast ($\beta_{AF} < 0$) when $V_{\varepsilon e} = 0$, the manager has an incentive to privately guide the analyst's forecast downward. The numerator of $\bar{b}_{MP}$, $\beta_{AF}\gamma_{MP}$, captures the effect of private forecast bias – it is the amount by which price increases per unit decrease in *MP*. Note that the private forecast affects price in this setting because (a) the analyst discloses a forecast of earnings rather than her signal directly and (b) investors do not observe *MP*. With *MP* unknown, investors are unable to use the analyst's forecast (which incorporates MP) to completely infer her private information, i_1. By biasing MP downward and influencing the analyst to reduce AF, the manager leads investors to infer a lower value for the analyst's private information, i_1, and a higher value for the persistent earnings component, m_1. Given the level of reported earnings, this results in a higher post-earnings announcement price.

Similar reasoning would seem to suggest that the manager should bias his public forecast downward as well, given that the analyst gives it positive weight, too, in determining her own forecast ($\gamma_{MF} > 0$). There is a difference here, however, in that investors publicly observe MF and can completely undo its effect on the analyst's forecast. In this case the manager's incentive to bias his public forecast does not stem from its direct effect on the analyst's forecast. Rather, the incentive arises from the relation that exists between it and the manager's private forecast to the analyst. These two forecasts are positively correlated because they both include the noise term in the manager's signal, ε_z. Consequently, investors use their observation of the manager's public forecast to make inferences about the information that the manager privately communicated to the analyst.

Holding fixed the analyst's forecast and reported earnings, an increase in the manager's public forecast increases investors' estimate of the manager's private disclosure to the analyst. This, in turn, lowers investors' inferred value for the analyst's private information, i_1, and leads to a higher end-of-period price. This is what gives the manager an incentive to bias his public forecast upward ($\bar{b}_{MF} > 0$) at the same time as he privately guides the analyst's forecast downward. Contrary to conventional wisdom, expectations management is not necessarily characterized by downward *public* guidance of analysts' forecasts.

The next set of results pertains to the magnitude of the mean public and private biases in equilibrium. We have:

Corollary 2. *In equilibrium:*

a. *both* $\left|\bar{b}_{MF}\right|$ *and* $\left|\bar{b}_{MP}\right|$ *are decreasing in the noise of the private forecast bias,* $V_{\varepsilon MP}$*; and*

b. *when the cost parameters for public and private expectations management,* c_{MF} *and* c_{MP}*, respectively, are equal,* $|\bar{b}_{MF}| < |\bar{b}_{MP}|$.

The greater the noise in the manager's private guidance, the less useful will guidance be to the analyst and the less effective will it be in influencing the analyst's earnings forecast. Consequently, the manager will scale back on its use in both the public and private domains. Setting the cost parameters, c_{MF} and c_{MP}, equal to each other, and fixing $V_{\varepsilon MP}$, we can directly compare the effectiveness of public and private expectations guidance. As stated in part (b) of the corollary, the magnitude of the mean downward private bias exceeds the magnitude of the mean upward public bias in equilibrium. The reason is that public guidance is less effective than private guidance. The latter directly affects the analyst's reported forecast, while the former works indirectly, through its effect on investors' assessment of the level of the manager's private guidance.

5.2 Necessary and sufficient conditions for expectations management

Throughout our analysis we have assumed that the variance of the error in the manager's information, $V_{\varepsilon z}$, and the variance of the noise in private and public expectations management, $V_{\varepsilon MP}$ and $V_{\varepsilon MF}$, respectively, are all positive and bounded. We have also assumed that the variance of the noise in the reporting system, $V_{\varepsilon e}$, is bounded. We now relax these assumptions in order to derive the necessary and sufficient conditions for $|\bar{b}_{MP}|$ and $|\bar{b}_{MF}|$ to be strictly positive in equilibrium. We have the following result:

Corollary 3. *The manager engages in a non-zero level of private expectations management in equilibrium if and only if:*

a. *his private information is informative about the period's reported earnings* ($V_{\varepsilon z} < \infty$)*;*

b. *his public forecast does not perfectly reveal his private information* ($V_{\varepsilon MF} > 0$)*;*

c. *his privately disclosed forecast is informative about his private information* ($V_{\varepsilon MP} < \infty$)*; and*

d. *reported earnings are informative about the period's real earnings* ($V_{\varepsilon e} < \infty$)*.*

The manager engages in public expectations management if and only if, in addition to the above four conditions,

e. *his private information does not perfectly reveal the period's real earnings* ($V_{\varepsilon z} > 0$)*; and*

f. *his public forecast is informative about his private information* ($V_{\varepsilon MF} < \infty$)*.*

The manager biases his private communication to the analyst if and only if conditions (a) - (d) hold. They ensure that there is meaningful private communication of relevant information from the manager to the analyst. If $V_{\varepsilon z}$ were infinite, the manager would not have private information to share, and so the analyst would ignore any private communication between them. If $V_{\varepsilon MF}$ were equal to zero, the manager's public forecast would reveal all of his information, and so there would not be any private information to share with the analyst. If $V_{\varepsilon MP}$ were infinite, the manager's private forecast would be devoid of any information content. Finally, if $V_{\varepsilon e}$ were infinite, the analyst's private information, i_1, would not be of any value in forecasting the period's earnings. It would not be incorporated into her forecast and her forecast would not have any value to investors after earnings are announced.

Conditions (a) - (d) are also necessary to ensure that the public communication from the manager to the market is biased. This implies that public expectations management can only occur if the manager communicates private information to the analyst. This is consistent with the notion, discussed previously, that the public forecast is only useful because the manager also provides a private forecast to the analyst. In Section 6 we generalize this result by showing that, for arbitrary information structures, a necessary condition for public expectations management to arise in equilibrium is that the manager and analyst share some private information.

In addition to conditions (a) - (d), conditions (e) and (f) are necessary and sufficient to ensure that the public communication from the manager to the market is also biased. These two conditions ensure that the public forecast is informative about the manager's private guidance to the analyst. If $V_{\varepsilon MF} = \infty$, the public forecast would have no value to investors and there would not be any incentive for the manager to manage that forecast. If $V_{\varepsilon z} = 0$, the manager's public forecast would not be informative about his private communication with the analyst, conditional on the announced earnings, and would not be of any use to investors in determining the end-of-period price.

5.3 Endogenous precision of information

Up until this point we have assumed that the noise in the bias of the manager's privately disclosed forecast, $V_{\varepsilon MP}$, is exogenously fixed. This assumption is reasonable, given our interpretation of this noise as reflecting uncertainty over the manager's objective function. We could alternatively interpret the noise as representing the variance of the manager's privately communicated forecast. Under this interpretation it is reasonable to assume that the manager might have some discretion over $V_{\varepsilon MP}$. In this sub-section we allow the manager to choose $V_{\varepsilon MP}$ and explore how the forces underlying expectations management influence the amount of information that the manager privately communicates to the analyst. For this analysis we assume that the manager's choice of $V_{\varepsilon MP}$ is observable to the analyst. This assumption captures the notion that the manner in which the manager communicates with the analyst provides the analyst with insight into the precision of his private forecast. Allowing the manager to endogenously choose the level of noise leads to the following:

Proposition 2. *Assume that at the beginning of the period the manager can choose the level of noise, $V_{\varepsilon MP}$, in his privately communicated forecast and that the analyst can observe his choice. Then:*

a. if the manager cannot publicly commit to the level of noise, he would set $V_{\varepsilon MP} = 0$ if $c_{MF} < \frac{(V_m+V_{\varepsilon z})(V_{\varepsilon MP}V_{\varepsilon z}+V_{\varepsilon MF}(V_{\varepsilon MP}+V_{\varepsilon z}))}{V_{\varepsilon MF}((V_{\varepsilon MF}+2V_{\varepsilon z})(V_m+V_{\varepsilon MF})+2V_{\varepsilon z}^2)}$, and would set $V_{\varepsilon MP} = \infty$, otherwise;

b. if the manager can publicly commit to the level of noise, it would be optimal for him to set $V_{\varepsilon MP} = \infty$;

c. if the manager can publicly commit to the level of noise that he introduces into his public forecast, it would be optimal for him to set $V_{\varepsilon MF} = \infty$.

If the manager could choose the level of noise in his private forecast, he would set it to zero for values of c_{MF} sufficiently small. To understand the intuition behind this result, recall that in determining her forecast, the analyst places positive weight on the manager's public and private disclosures, *MF* and *MP*, respectively. Recall also that the manager positively biases *MF* for the purpose of guiding investors' expectations. By providing a precise private forecast, the manager minimizes the weight that the analyst places on his (upwardly-biased) public forecast and maximizes the weight placed on his (downwardly-biased) private guidance. However, the cost to the manager of biasing his private forecast is at its highest when there is no noise (since, by Corollary 2, he maximizes the level of private bias in this case). If the magnitude of the mean public forecast bias is sufficiently large (that is, if the cost parameter for the public forecast bias, c_{MF}, is sufficiently low), then the benefit to the manager exceeds the cost and the manager would choose $V_{\varepsilon MP} = 0$. Otherwise, the manager would choose $V_{\varepsilon MP} = \infty$ and the optimal level of private bias would be zero.

Since investors set the post-earnings announcement price rationally, there is no ex-ante benefit to the manager in biasing his forecasts. Therefore, if he could commit, ex-ante, not to engage in expectations management and not incur the cost of biasing, it would be in his interest to do so. By publicly committing to $V_{\varepsilon MP} = \infty$ (which is equivalent to not providing a private forecast), the manager accomplishes just that. His private forecast becomes useless to the analyst and, as a result, there is no reason for him to bias his public forecast. Consequently, it becomes optimal for the manager to set both biases equal to zero.

The manager can alternatively ensure that he does not bias his forecasts by committing to set $V_{\varepsilon MF} = \infty$ (which is equivalent to not providing a public forecast). By doing so, the condition that $c_{MF} < \frac{(V_m + V_{\varepsilon z})(V_{\varepsilon MP} V_{\varepsilon z} + V_{\varepsilon MF}(V_{\varepsilon MP} + V_{\varepsilon z}))}{V_{\varepsilon MF}((V_{\varepsilon MF} + 2V_{\varepsilon z})(V_m + V_{\varepsilon MF}) + 2V_{\varepsilon z}^2)}$ (see part (a) of the proposition) would never be satisfied (since the right-hand side would equal zero), and it would again be optimal for the manager to set $V_{\varepsilon MP} = \infty$. Since the sole purpose of providing the private forecast is to divert the analyst's attention from the upwardly biased public forecast, by committing not to provide a public forecast, the manager is implicitly committing not to communicate privately with the analyst. Of course, this result should not be taken to imply that it is never optimal to publicly release managerial forecasts; there are many reasons, not modeled in this paper, why a manager might choose to do so. Rather, it should be taken as highlighting an additional cost of issuing a public forecast – the cost of the accompanying private guidance provided to the analyst.

5.4 Introducing noise into the accounting reporting system

Finally in this section, we extend our analysis to the case where there is noise in the accounting reporting system ($V_{\varepsilon e} > 0$). The next set of results follow immediately from Proposition 1:

Corollary 4. *When $0 < V_{\varepsilon e} < \hat{V}_{\varepsilon e}$, equilibrium is characterized by:*

a. $\beta_{MF} > 0$ and $\beta_{AF} < 0$; and

b. $\bar{b}_{MF} > 0$ and $\bar{b}_{MP} < 0$,

where $\hat{V}_{\varepsilon e} \equiv p_m V_m$. When $V_{\varepsilon e} > \hat{V}_{\varepsilon e}$, the inequalities are reversed.

When $V_{\varepsilon e} > 0$, the analyst's forecast provides information to investors about the period's real earnings, as a whole, in addition to providing information about the two earnings components. If the noise in the accounting reporting system is sufficiently low ($V_{\varepsilon e} < \hat{V}_{\varepsilon e}$), the primary role of the analyst's forecast is to convey information about the current period's earnings components and the nature of equilibrium is identical to that when the noise is zero ($V_{\varepsilon e} = 0$). The end-of-period price varies inversely with the analyst's forecast, consistent with Bartov et al. (2002) and Kasznik and McNichols (2002), and the manager has an incentive to manage his public forecast upward while privately guiding the analyst's forecast downward.

The opposite is true when the reporting system is sufficiently noisy ($V_{\varepsilon e} > \hat{V}_{\varepsilon e}$). In this case, the primary role of the analyst's forecast is to provide investors with information about the first period's total real earnings. As a result, the end-of-period price is an increasing function of the analyst's forecast. This motivates the manager to privately guide the analyst's forecast upward, while biasing his own public forecast downward. These actions have a positive impact on investors' estimate of the analyst's private information and, consequently, on their expectation of the period's real earnings. The market premium for beating analysts' forecasts that Bartov et al. (2002) and Kasznik and McNichols (2002) document is predicted to be negative.

6 Private information sharing and public expectations management in a general setting

In this section we show that under general information structures, a necessary condition for public expectations management to exist is that the manager and analyst share private information. To do so we preserve the sequence of events of the previous sections, but allow for the manager and analyst to have arbitrary information endowments. We also generalize the cost of managerial forecast bias. For simplicity, and without loss of generality, we do not allow the manager to engage in earnings management. This means that the manager reports earnings of $e_{1r} = e_1$. Finally, in order to show that, absent private information sharing, there cannot be public expectations management, we do not allow any private communication between the manager and the analyst (that is, the manager is not allowed to provide a private forecast to the analyst). Denote by I_M the private information that the manager possesses at date 1, before releasing his public forecast, MF. Denote by I_A the private information that the analyst observes at date 2 before releasing her forecast, AF, to the market. As in our previous analysis, investors use their observations of MF, AF, and e_1 to set the post-earnings announcement price at the end of period 1:

$$P_1(MF, AF, e_1) = e_1 + E\left[e_2 | MF, AF, e_1\right], \tag{15}$$

where $E\left[e_2 | MF, AF, e_1\right]$ is investors' expectation of period 2 earnings, given their information at the end of the first period. The manager's objective is to maximize his expected utility, as given by:

$$E\left[U\right] = E[P_1(MF, AF, e_1) | I_M] - c, \tag{16}$$

where c is the cost of expectations management. Our only assumption with respect to c is that it is positive if the manager manages expectations and zero, otherwise.

In this setting we can show the following:

Lemma. *If, conditional on all possible realizations of public information at the end of the period, the manager and analyst do not share private information, then the manager will not engage in public expectations management.*

Recall that the goal of expectations management is to influence the inferences investors' draw about the analyst's private information from her publicly disclosed forecast. The manager attempts to achieve his goal by introducing a bias into his forecast, which is intended to alter investors' assessment of the probability distribution of I_A conditional on all publicly observable information. This probability distribution function is denoted by $f\left(I_A \left| MF, AF, e_1\right.\right)$. To prove the lemma we need only show that when the manager and analyst do not share private information, $f\left(I_A \left| MF, AF, e_1\right.\right)$ is unaffected by the manager's bias. The manager would then not have any incentive to engage in costly expectations management.

The proof of the lemma is straightforward. If private information is not shared, then I_M and I_A will be independent of each other. This implies that

$$f\left(I_A \left| MF, AF, e_1\right.\right) = f\left(I_A \left| MF, I_M, AF, e_1\right.\right) = f\left(I_A \left| I_M, AF, e_1\right.\right), \tag{17}$$

where the last equality makes use of the fact that the manager's forecast, *MF*, contains no value-relevant information incremental to I_M. Since *MF* does not enter into the last term in (17), the manager's forecast bias does not affect investors' inferences of I_A.

Intuitively, if forecast bias affects investors' assessment of I_A, then knowledge of the level of that bias will be of use to them. This directly implies that knowledge of I_M will also be useful (since investors can use I_M to infer the level of bias). Consequently, I_M cannot be independent of I_A. Alternatively stated, if a manipulation of the manager's forecast has an effect on investors' assessment of I_A, then it must be the case that the manager's private information is useful to investors in backing out the manipulation and, consequently, in improving their assessment.

We use the lemma to provide insight into the key role that the relation between the manager's and analyst's privately observed information about earnings plays in determining whether there will exist public expectations management.

Proposition 3. *If the manager and analyst observe independent information about first period earnings (that is, if I_M and I_A are independent, conditional on e_1), then the manager will not engage in public expectations management.*

The manager and analyst might observe independent private information about earnings if their information is drawn from different sources (for example, if the manager relies on sources internal to the firm, while the analyst makes use of sources external to the firm). In this case, absent private communication between the manager and the analyst, there will not be any public expectations management. This result is borne out in the setting just analyzed. There, the manager's and analyst's private information (z_m and z_i, respectively) were independent, conditional on realized earnings. If the manager did not communicate additional private information to the analyst (for example, if his private guidance were pure noise), then the manager's public forecast, *MF*, would be superfluous to investors and they would completely back it out from the analyst's forecast. (They can do so because, in that setting, they know exactly how the analyst incorporates *MF* into her forecast.) Consequently, changes in MF would not have any effect on the end-of-period price and the manager would have no reason to introduce bias into that forecast.

Proposition 3 extends this result to more general contexts. The result holds, for example, when investors are uncertain about the manner in which the analyst incorporates MF into her forecast. In that case, investors cannot completely back out MF from AF, and so changes in MF *will* affect price. Nevertheless, the manager would not manage his public forecast if he did not also communicate private information to the analyst. The reason is that if the manager and analyst did not share private information, then the manager would not have superior knowledge of the manner in which the analyst incorporates the manager's forecast into her own. Consequently, from the managers' perspective at date 1, investors would be able to back out his forecast from that of the analyst, *on average*, and correctly infer, on average, the analyst's private information, I_A. Variations in the manager's forecast would not have any effect on the market's inference of the analyst's private information, on average, and there would then be no incentive for the manager to engage in costly expectations management.

7 Summary and Conclusions

In this paper we analyze the driving forces behind expectations management, paying particular attention to the differing roles played by publicly-communicated and privately-communicated analyst forecast guidance. We show that the manager privately guides the analyst's forecast in order to influence the inferences investors draw from it about the analyst's private information. We find that investors only use the manager's public forecast to learn about his private communication with the analyst. As a result, when the manager privately guides the analyst's forecast downward (in order to take advantage of an inverse relation between her forecast and price), he also biases his public forecast *upward* (in order to reduce investors' assessment of the extent of the *downwardly*-biased guidance provided to the analyst). Consequently, the private bias can be thought of as playing the primary role in expectations management, with the public bias serving in a secondary capacity.

When the costs of public and private expectations management are equal, we show that the manager chooses to bias his private forecast more than he biases his public forecast. This is because private expectations management has a greater effect on the post-earnings announcement stock price than does public expectations management. We also find that the magnitudes of the private and public forecast biases increase in the precision of the information that the manager privately communicates to the analyst. This result highlights the important role that Regulation Fair Disclosure (which was designed to limit the amount of private communication between the manager and analyst) may play in limiting the level of private *as well as* public expectations management.

If the manager has the ability to choose the precision of the information privately communicated to the analyst, then he will set precision as high as possible, as long as the cost of public expectations management is sufficiently low. This will maximize the levels of private and public forecast bias. In contrast, if the cost of expectations management is high enough, the manager will set precision at its lowest possible level, minimizing the private and public bias. This highlights the importance of the cost of public expectations management in determining the manager's incentives to communicate privately with the analyst. We also show that if the manager has the flexibility to choose whether to release a public forecast, he will opt not to provide one. His decision serves as a commitment device, ensuring that the manager does not communicate privately with the analyst and does not engage in expectations management.

Our analysis also reveals that the quality of the reporting system plays a crucial role in determining the direction of the public and private forecast biases. When reporting quality is high, the manager will privately guide the analyst's forecast downward, while biasing his public forecast upward. The opposite is true when reporting quality is low. While in the former case we predict that there will be a market premium for firms that beat analysts' expectations, in the latter case we expect the premium to be negative. This link between the market premium and the quality of a firm's reporting system has not previously been recognized in the literature.

Appendix

Proof of Proposition 1. We begin by taking as given the conjectured forms of AF and P_1, and show that they are fulfilled in equilibrium. Using these conjectures, the end-of-period price less the costs of biasing is given by

$$\beta_0 + (\beta_{MF} + \beta_{AF}\gamma_{MF})\, MF + \beta_{AF}\gamma_{MP} MP + \beta_{AF}(\gamma_0 + \gamma_i i_1) + \beta_e e_{1r} \\ - \frac{c_{MF}}{2}(b_{MF} - \varepsilon_{MF})^2 - \frac{c_{MP}}{2}(b_{MP} - \varepsilon_{MP})^2 - \frac{c_e}{2} b_e^2. \qquad (18)$$

At date 1 the manager chooses b_{MF} and b_{MP}, and at date 3 the manager chooses b_e, in order to maximize the expectation of (18), given his information set at each date and given his conjectures. The first order conditions for the expectation of (18) with respect to b_{MF}, b_{MP}, and b_e yield:

$b_{MF} = \frac{\beta_{MF} + \beta_{AF}\gamma_{MF}}{c_{MF}} + \varepsilon_{MF}$;

$b_{MP} = \frac{\beta_{AF}\gamma_{MP}}{c_{MP}} + \varepsilon_{MP}$; and

$b_e = \frac{\beta_e}{c_e} > 0$.

The second order conditions are $c_{MF} > 0$, $c_{MP} > 0$, and $c_e > 0$, which are satisfied.

We therefore have

$MF = z_e + \frac{\beta_{MF} + \beta_{AF}\gamma_{MF}}{c_{MF}} + \varepsilon_{MF}$;

$MP = z_e + \frac{\beta_{AF}\gamma_{MP}}{c_{MP}} + \varepsilon_{MP}$; and

$e_{1r} = e_1 + \varepsilon_{e1} + \frac{\beta_e}{c_e}$.

At date 2, the analyst observes the three normally distributed random variables, *MF*, *MP*, and i_1, and forms expectations about a fourth normally distributed random variable, e_{1r}. The solution to $AF(MF, MP, i_1) = E\left[e_{1r} | MF, MP, i_1\right]$ is

$AF(MF, MP, i_1) = \gamma_0 + \gamma_{MF} MF + \gamma_{MP} MP + \gamma_i i_1$, where

$\gamma_0 = \frac{\beta_e}{c_e} - \frac{V_m + V_{\varepsilon e}}{D}\left(V_{\varepsilon MP}\frac{\beta_{MF} + \beta_{AF}\gamma_{MF}}{c_{MF}} + V_{\varepsilon MF}\frac{\beta_{AF}\gamma_{MP}}{c_{MP}}\right)$;

$\gamma_{MF} = \frac{(V_m + V_{\varepsilon e})V_{\varepsilon MP}}{D} > 0$;

$\gamma_{MP} = \frac{(V_m + V_{\varepsilon e})V_{\varepsilon MP}}{D} > 0$;

$\gamma_i = \frac{V_{\varepsilon MP}V_{\varepsilon z}+V_{\varepsilon MF}(V_{\varepsilon MP}+V_{\varepsilon z})}{D} > 0$; and

$D \equiv V_{\varepsilon MF}V_{\varepsilon MP} + (V_{\varepsilon MF} + V_{\varepsilon MP})(V_m + V_{\varepsilon e} + V_{\varepsilon z})$.

At date 3, investors observe the three normally distributed random variables, MF, AF, and e_{1r}, and form expectations about a fourth normally distributed random variable, e_1+e_2. The solution to $P_1(MF, AF, e_{1r}) = E(e_1 + e_2|MF, AF, e_{1r})$ is

$P_1(MF, AF, e_{1r}) = \beta_0 + \beta_{MF}MF + \beta_{AF}AF + \beta_e e_{1r}]$, where

$\beta_{MF} = -\left(V_{\varepsilon e} - \hat{V}_{\varepsilon e}\right)\frac{V_i(V_{\varepsilon MP}V_{\varepsilon z}+V_{\varepsilon MF}(V_{\varepsilon MP}+V_{\varepsilon z}))}{E}$;

$\beta_{AF} = \left(V_{\varepsilon e} - \hat{V}_{\varepsilon e}\right)\frac{V_i(V_{\varepsilon MF}+V_{\varepsilon z})[V_{\varepsilon MF}V_{\varepsilon MP}+(V_m+V_{\varepsilon e}+V_{\varepsilon z})(V_{\varepsilon MF}+V_{\varepsilon MP})]}{(V_m+V_{\varepsilon e})E}$;

$\beta_e = \frac{(1+p_m)V_m}{V_m+V_{\varepsilon e}} > 0$; and

$E \equiv (V_m + V_{\varepsilon e})^2 V_{\varepsilon MF}^2 + V_i\left(V_m V_{\varepsilon MF}^2 + V_{\varepsilon e}V_{\varepsilon MF}^2 + (V_{\varepsilon MF} + V_{\varepsilon z})\left(V_{\varepsilon MP}V_{\varepsilon z} + V_{\varepsilon MF}\left(V_{\varepsilon MP} + V_{\varepsilon z}\right)\right)\right)$;

$\hat{V}_{\varepsilon e} \equiv p_m V_m$.

The intercept, β_0, is given by $\beta_0 = \frac{A}{G}$, where

$$\begin{aligned} G &\equiv V_{\varepsilon MF}^2\left[(V_m + V_{\varepsilon e})^2 + V_i\left(V_m + V_{\varepsilon e} + V_{\varepsilon MP}\right)\right] \\ &\quad + V_i V_{\varepsilon MF}\left(V_{\varepsilon MF} + 2V_{\varepsilon MP}\right)V_{\varepsilon z} + V_i\left(V_{\varepsilon MF} + V_{\varepsilon MP}\right)V_{\varepsilon z}^2; \end{aligned}$$

$$\begin{aligned} A &\equiv -\frac{V_i^2\left(V_{\varepsilon e} - \hat{V}_{\varepsilon e}\right)^2 V_{\varepsilon MF}^2 (V_{\varepsilon MF} + V_{\varepsilon z})^2}{G c_{MP}} - \frac{V_{\varepsilon z}\left(V_{\varepsilon MP}V_{\varepsilon z} + V_{\varepsilon MF}\left(V_{\varepsilon MP} + V_{\varepsilon z}\right)\right)}{G c_e c_{MF}} \\ &\quad - \frac{1}{c_e}\frac{1}{V_m + V_{\varepsilon e}}\left(1 + p_m\right)V_m B; \end{aligned}$$

$$\begin{aligned} B &\equiv (1 + p_m)V_m\left(V_m + V_{\varepsilon e}\right)V_{\varepsilon MF}^2 + V_i V_m V_{\varepsilon MF}\left(V_{\varepsilon MF} - p_m V_{\varepsilon MP}\right) \\ &\quad - V_i p_m V_m\left(V_{\varepsilon MF} + V_{\varepsilon MP}\right)V_{\varepsilon z} \\ &\quad + V_i\left(V_{\varepsilon MF} + V_{\varepsilon z}\right)\left(V_{\varepsilon MF}V_{\varepsilon MP} + \left(V_{\varepsilon e} + V_{\varepsilon z}\right)\left(V_{\varepsilon MF} + V_{\varepsilon MP}\right)\right) \\ &\quad + \frac{c_e c_{MF} V_i^2\left(V_{\varepsilon e} - \hat{V}_{\varepsilon e}\right)^2 V_{\varepsilon MF}^2 (V_{\varepsilon MF} + V_{\varepsilon z})^2}{G}. \end{aligned}$$

As shown above, the conjectured forms of AF and P_1 are fulfilled in equilibrium.

$\square$

Proof of Proposition 2. At the beginning of the period (before the manager acquires any private information), he chooses $V_{\varepsilon MP}$ to solve:

$$V_{\varepsilon MP} = \arg\max_{V_{\varepsilon MP}} E\left[U\right]. \tag{19}$$

The manager's expected utility is given by

$$\begin{aligned} E\left[U\right] &= E\left[P_1 - \frac{c_{MF}}{2}\left(b_{MF} - \varepsilon_{MF}\right)^2 - \frac{c_{MP}}{2}\left(b_{MP} - \varepsilon_{MP}\right)^2 - \frac{c_e}{2}b_e^2\right] \\ &= E\left[P_1\right] - \frac{c_{MF}}{2}\left(\frac{\hat{\beta}_{MF} + \hat{\beta}_{AF}\gamma_{MF}\left(V_{\varepsilon MP}\right)}{c_{MF}}\right)^2 - \frac{c_{MP}}{2}\left(\frac{\hat{\beta}_{AF}\gamma_{MP}\left(V_{\varepsilon MP}\right)}{c_{MP}}\right)^2 - \frac{c_e}{2}\left(\frac{\hat{\beta}_e}{c_e}\right)^2. \end{aligned}$$

The "^" notation above coefficients indicate that these are the conjectured coefficients that investors use when determining the firm's price at the end of the period. These conjectures are unaffected by the actual choice of $V_{\varepsilon MP}$. The analyst, though, observes the manager's choice of $V_{\varepsilon MP}$, and therefore, the γ's in her earning expectation are functions of $V_{\varepsilon MP}$.

The first derivative of the manager's expected utility with respect to $V_{\varepsilon MP}$ is

$$\begin{aligned} \frac{\partial E\left[U\right]}{\partial V_{\varepsilon MP}} = \frac{\partial E\left[P_1\right]}{\partial V_{\varepsilon MP}} &- \left(\hat{\beta}_{MF} + \hat{\beta}_{AF}\gamma_{MF}\left(V_{\varepsilon MP}\right)\right)\hat{\beta}_{AF}\gamma'_{MF}\left(V_{\varepsilon MP}\right) \\ &- \hat{\beta}_{AF}\gamma_{MP}\left(V_{\varepsilon MP}\right)\hat{\beta}_{AF}\gamma'_{MP}\left(V_{\varepsilon MP}\right). \end{aligned} \tag{20}$$

We next explore the conditions under which $\frac{\partial E[U]}{\partial V_{\varepsilon MP}} < 0$ (so that the manager chooses $V_{\varepsilon MP} = 0$), and the conditions under which $\frac{\partial E[U]}{\partial V_{\varepsilon MP}} > 0$ (so that the manager chooses $V_{\varepsilon MP} = \infty$). We start by examining $E\left[P_1\right]$ and $\frac{\partial E[P_1]}{\partial V_{\varepsilon MP}}$. From Proposition 1 we have

$$\begin{aligned} E\left[P_1\right] &= \hat{\beta}_0 + \hat{\beta}_{MF}E\left[MF\right] + \hat{\beta}_{AF}E\left[AF\right] + \hat{\beta}_e E\left[e_{1r}\right] \\ &= \hat{\beta}_0 + \hat{\beta}_{MF}E\left[\frac{\hat{\beta}_{MF} + \hat{\beta}_{AF}\gamma_{MF}}{c_{MF}} + z_e + \varepsilon_{MF}\right] + \hat{\beta}_{AF}\frac{\hat{\beta}_e}{c_e} + \hat{\beta}_e E\left[\frac{\hat{\beta}_e}{c_e} + e_1 + \varepsilon_{e1}\right] \\ &= \hat{\beta}_0 + \hat{\beta}_{MF}\frac{\hat{\beta}_{MF} + \hat{\beta}_{AF}\gamma_{MF}}{c_{MF}} + \hat{\beta}_{AF}\frac{\hat{\beta}_e}{c_e} + \frac{\hat{\beta}_e^2}{c_e}. \end{aligned} \tag{21}$$

For the second equality we make use of the condition that $E\left[AF\right] = \frac{\hat{\beta}_e}{c_e}$ (which we subsequently verify to be true). For the third equality we make use of the fact that, as the beginning of the period, $E\left[z_e\right] = E\left[\varepsilon_{MF}\right] = E\left[e_1\right] = E\left[\varepsilon_{e1}\right] = 0$.

We now show that $E[AF] = \frac{\hat{\beta}_e}{c_e}$. Using Proposition 1 and rearranging the expression for AF we have:[6]

$$\begin{aligned}
AF &= \gamma_0 + \gamma_{MF} MF + \gamma_{MP} MP + \gamma_i i_1 \\
&= \gamma_0 + \gamma_{MF} \left(\frac{\hat{\beta}_{MF} + \hat{\beta}_{AF}\gamma_{MF}}{c_{MF}} + z_e + \varepsilon_{MF} \right) \\
&\quad + \gamma_{MP} \left(\frac{\hat{\beta}_{AF}\gamma_{MP}}{c_{MP}} + z_e + \varepsilon_{MP} \right) + \gamma_i i_1 \\
&= \frac{\hat{\beta}_e}{c_e} + \frac{(V_m + V_{\varepsilon e}) V_{\varepsilon MP}}{D} (z_e + \varepsilon_{MF}) \\
&\quad + \frac{(V_m + V_{\varepsilon e}) V_{\varepsilon MF}}{D} (z_e + \varepsilon_{MP}) + \frac{V_{\varepsilon MP} V_{\varepsilon z} + V_{\varepsilon MF} (V_{\varepsilon MP} + V_{\varepsilon z})}{D} i_1,
\end{aligned}$$

where D is given in Proposition 1. Since at the beginning of the period, $E[z_e] = E[\varepsilon_{MF}] = E[\varepsilon_{MP}] = E[i_1] = 0$, we have $E[AF] = \frac{\hat{\beta}_e}{c_e}$.

Using (20) and (21), the first derivative of the manager's expected utility becomes

$$\begin{aligned}
\frac{\partial E[U]}{\partial V_{\varepsilon MP}} = \hat{\beta}_{MF} \frac{\hat{\beta}_{AF}}{c_{MF}} \gamma'_{MF}(V_{\varepsilon MP}) - \left(\hat{\beta}_{MF} + \hat{\beta}_{AF} \gamma_{MF}(V_{\varepsilon MP}) \right) \hat{\beta}_{AF} \gamma'_{MF}(V_{\varepsilon MP}) \\
- \hat{\beta}_{AF} \gamma_{MP}(V_{\varepsilon MP}) \hat{\beta}_{AF} \gamma'_{MP}(V_{\varepsilon MP}).
\end{aligned}$$

Employing the expressions for the coefficients given in Proposition 1, and assuming that $V_{\varepsilon MP} = 0$, it is straightforward to see that the sign of $\frac{\partial E[U]}{\partial V_{\varepsilon MP}}$ is identical to the sign of $c_{MF} - \frac{(V_m + V_{\varepsilon z})(V_{\varepsilon MP} V_{\varepsilon z} + V_{\varepsilon MF}(V_{\varepsilon MP} + V_{\varepsilon z}))}{V_{\varepsilon MF}((V_{\varepsilon MF} + 2V_{\varepsilon z})(V_m + V_{\varepsilon MF}) + 2V_{\varepsilon z}^2)}$.

If the manager could publicly commit to the level of noise he introduces into his private forecast, then $E[P_1]$ would equal zero, independent of the choice of $V_{\varepsilon MP}$. Therefore, he would set $V_{\varepsilon MP} = \infty$, reducing the expected cost of biasing to zero. The manager could achieve a similar result if he could commit to the level of noise that he introduces into his public forecast. In this case, he would set $V_{\varepsilon MF} = \infty$ because this reduces $\frac{(V_m + V_{\varepsilon z})(V_{\varepsilon MP} V_{\varepsilon z} + V_{\varepsilon MF}(V_{\varepsilon MP} + V_{\varepsilon z}))}{V_{\varepsilon MF}((V_{\varepsilon MF} + 2V_{\varepsilon z})(V_m + V_{\varepsilon MF}) + 2V_{\varepsilon z}^2)}$ to zero and serves as a commitment device for him to also set $V_{\varepsilon MP} = \infty$. □

[6] For exposition simplicity, we suppress the dependence of AF on the γ's in the expression for the analyst's earnings expectation.

Proof of Proposition 3. To prove the proposition it is sufficient to show that $I_A \perp I_M \,|e_1$ implies that $I_A \perp I_M \,|(MF, AF, e_1)$. Given this, the lemma could then be used to conclude that if $I_A \perp I_M \,|e_1$, then the manager will not engage in public expectations management. The proof involves showing that $I_A \perp I_M \,|e_1 \implies I_A \perp I_M \,|(MF, e_1) \implies I_A \perp I_M \,|(MF, AF, e_1)$. For this proof, we use the generic conditional pdf, $f_{X|Y}\left(X\,|Y\right)$, to denote the pdf of a random variable X conditional on Y, and drop the subscript where it is not confusing.

The condition $I_A \perp I_M \,|e_1$ implies that:

$$f\left(I_A\,|e_1\right) = f\left(I_A\,|I_M, e_1\right) = f\left(I_A\,|I_M, MF, e_1\right), \tag{22}$$

where the last equality makes use of the fact that the manager's forecast, *MF*, contains no value-relevant information incremental to I_M. The condition $I_A \perp I_M \,|e_1$ also implies that:

$$f\left(I_A\,|e_1\right) = f\left(I_A\,|MF, e_1\right). \tag{23}$$

Combining (22) and (23), we have:

$$f\left(I_A\,|I_M, MF, e_1\right) = f\left(I_A\,|MF, e_1\right). \tag{24}$$

Therefore, $I_A \perp I_M \,|e_1$ implies that $I_A \perp I_M \,|(MF, e_1)$.

Similarly, employing the fact that AF contains no value-relevant information incremental to (MF, I_A), we have that $I_A \perp I_M \,|(MF, e_1)$ implies that

$$f\left(I_M\,|MF, e_1\right) = f\left(I_M\,|I_A, MF, e_1\right) = f\left(I_M\,|I_A, MF, AF, e_1\right), \tag{25}$$

and

$$f\left(I_M\,|MF, e_1\right) = f\left(I_M\,|MF, AF, e_1\right). \tag{26}$$

Combining (25) and (26) we have:

$$f\left(I_M \left| I_A, MF, AF, e_1\right.\right) = f\left(I_M \left| MF, AF, e_1\right.\right). \tag{27}$$

Therefore, $I_A \perp I_M \left|(MF, e_1)\right.$ implies that $I_A \perp I_M \left|(MF, AF, e_1)\right.$. $\square$

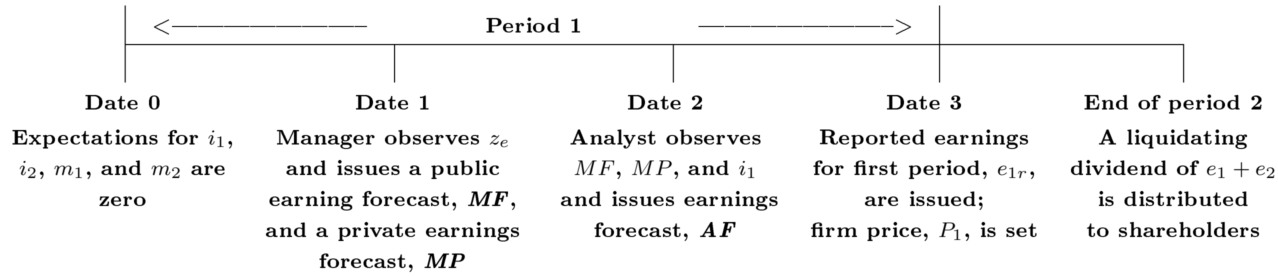

Figure 1: Timeline

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