

WHY DO MANAGERS VOLUNTARILY RELEASE EARNINGS FORECASTS?

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Managers often release earnings forecasts in advance of actual earnings announcements. It would appear that managers should at best be indifferent to such release given that the actual earnings will be disclosed at a future date. However, if the manager's objective is to maximize his firm's market value and he has control of production decisions, he may be motivated to release an earnings forecast. The reason is that the forecast release gives investors a more favorable assessment of the manager's ability to anticipate economic environment changes and to adjust production plans accordingly. Forecast release can thereby translate into a higher firm market value.

1. Introduction

Corporate managers often release an internally generated forecast of quarterly or annual earnings in advance of the actual earnings announcement. Penman (1980), for example, found over 2,000 instances of annual earnings forecast disclosure reported in *The Wall Street Journal* over a six-year period. While several empirical studies examine such disclosure,¹ there has been little theoretical work devoted to explaining why they take place. The purpose of this paper is to provide one such explanation.

On the surface it seems difficult to understand why a manager would be motivated to release an earnings forecast in any period, even assuming that such release is costless, given that the actual earnings must be reported by the end of the period. If the only thing conveyed to investors by the forecast disclosure was the manager's earnings estimate, then the disclosure would simply advance the time at which investors learn something about the firm's earnings. The market value of the firm at the end of the period, after the actual earnings had been reported, however, would be unaffected by the forecast

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¹See, for example, Ajinkya and Gift (1984), Patell (1976), Penman (1980) and Waymire (1984).

release (since the estimated earnings becomes irrelevant for valuation at that time). A manager whose goal it is to maximize this market value (as will be the case if his compensation is tied to the end-of-period firm value) should then be indifferent to the release of an earnings forecast.

The key to understanding why, despite this, a manager might still be motivated to disclose a forecast is the observation that such a disclosure may give investors more information useful for valuing the firm than just an estimate of the period's earnings.² The act of forecast release, itself, may also provide a positive signal to the market about the firm's value. To see this, note that since one of the manager's roles is to choose the firm's optimal production level, the firm's market value at the end of any period will be a function of investors' perceptions of his ability to anticipate future changes in the firm's economic environment and adjust the firm's production plan accordingly. While this ability cannot be directly observed by investors, the manager can provide some information about it by releasing an updated earnings forecast each period when and if the manager observes any changes that period in the firm's economic condition. If there are changes in the present period, the sooner the forecast is released the more favorably will investors assess the manager's ability to recognize changes as they arise in future periods. This, in turn, implies that the end-of-period market value of the firm, after the earnings report has been issued, will actually be higher if an earnings forecast is released during the period than if no disclosure is made. If the manager's goal is to maximize this market value, he will thus be motivated to release his earnings forecast regardless of the nature of the private information it conveys, whether it represents good news, causing investors' earnings expectations to rise, or bad news.^{3,4}

The fact that forecast release gives investors a more favorable assessment of the manager's ability to spot changing economic conditions and to adjust production to them is also shown to result in the empirical prediction, consistent with the findings of Patell (1976), Penman (1980) and Waymire (1984) that the average share price change at the time of forecast disclosure will

²If investors are risk-averse a public release of information may also cause them to adjust their consumption-portfolio plans. In such a case the effect on the investors' utility levels will, in general, be ambiguous. [See, for example, Ohlson and Buckman (1981).] However, in the model presented here investors' consumption-portfolio decisions will remain unchanged since all investors are assumed to be risk-neutral.

³Diamond (1985) provides an alternative explanation for such managerial behavior. He hypothesizes that forecasts would be released in order to eliminate the need for investors to collect their own costly information about the firm's future prospects. Ajinkya and Gift (1984) and Lees (1981) posit another explanation. They suggest that managers release earnings forecasts in order to correct any 'unrealistic' estimates in the marketplace concerning the firm's earnings. However, it is unclear why managers would be motivated to make such disclosures given that the earnings must be reported in any case at the end of the period.

⁴This conclusion only holds strictly for the case where forecast disclosure is costless. If disclosure is costly, then forecast release is not guaranteed. This point is further discussed below.

be positive.⁵ While Penman suggests that this result is due to a bias on the part of managers toward releasing good news, the analysis here demonstrates that this is not necessary in order for such a relation to exist. The explanation provided is consistent with Patell's conjecture that the positive share price change may be due, at least in part, to information conveyed by the act of forecast release itself.

This explanation differs in several respects from an alternative theory, as developed in Verrecchia (1983), for the voluntary disclosure of private information. In his model a manager who seeks to maximize firm value and who is in possession of private information will have an incentive to disclose it if it conveys good news in order to receive a higher firm valuation from investors. Aware of this behavior, investors will interpret the absence of a disclosure as meaning that the manager possesses bad news and will consequently bid down the price of the firm in that case. Because of this reaction on the part of investors, all managers, except for those with the most negative news, will be motivated to voluntarily release their information in equilibrium, assuming that there are no costs of disclosure.⁶ This result is similar in nature to that of Akerlof (1970) in the setting of a used car market. There he shows that if the quality of each car cannot be observed, then in equilibrium only those cars with the lowest quality will remain in the market. Verrecchia's conclusion arises even though the manager's private information is not used in the firm's production decision. It results because in Verrecchia's setting, the information is assumed not to come out over the manager's relevant time horizon if he does not reveal it himself. Therefore, for the manager's information to have a positive impact on firm value, the manager must voluntarily disclose it.

This conclusion, however, is not readily applicable to the release of an earnings forecast because the manager's information must come out by the end of the period, through the actual earnings announcement. The information will be incorporated into the end-of-period market value of the firm whether or not the manager discloses a forecast himself. Because of this, the manager has no incentive to release his forecast just to inform investors about his expectation for earnings. Rather, as shown here his incentive comes from his desire to inform them that he has observed changes in the firm's economic environment which have caused him to change his expectation of earnings. He is using the release of the forecast to provide a signal to investors of his ability to anticipate future changes. This motive is similar to that of the workers in Spence's (1973,1974) labor market model to obtain education in order to provide a signal to employers of the worker's (unobserved) productivity.

⁵Ajinkya and Gift (1984), however, provide other evidence which suggests that the price change may be insignificantly different from zero.

⁶A similar type of argument is also made by McNichols (1984) to explain, under various scenarios, the voluntary disclosure of private information by managers.

Understanding the motivation behind the voluntary release of earnings forecasts is important to the debate over how active the Securities and Exchange Commission (SEC) should be in mandating information disclosure. In its 1977 report, the SEC's Committee on Corporate Disclosure stated that a voluntary system of corporate disclosure would be insufficient to cause all material information about firms to be released. They consequently recommended that the current system of required disclosure be continued.⁷ While the current system encompasses only historical data, the SEC has further considered regulating the disclosure of forward-looking data, specifically corporate earnings forecasts.⁸ The results of the present study have a bearing on such considerations.

In section 2 the economic setting is described. An analysis of the motivations for a manager to voluntarily release an earnings forecast is presented in section 3. This is followed in section 4 by a discussion of factors that may limit the frequency of forecast disclosure. A summary and conclusions section ends the paper.

2. The economic setting

The economic setting of this analysis is made as simple as possible to highlight the forces behind the voluntary release of managerial forecasts. There are two time periods in the model with dates $t = 0$ and $t = 1$ representing the beginnings of periods 1 and 2, respectively, and $t = 2$ denoting the end of period 2. There are many firms in the economy with one manager for each firm. There is also a risk-free asset available with a return set to zero, without loss of generality. Investors and managers are assumed to be risk-neutral.⁹

The manager of each firm j is prohibited from trading or holding shares in either his firm or in competitor firms.¹⁰ His compensation package consists of a fixed wage W_j paid at the end of each period, some non-negative fraction a_{ij} of period i 's earnings before managerial compensation (with a_{2j} set equal to zero for simplicity and without loss of generality) paid at the end of period i ,

⁷See Report of the Advisory Committee on Corporate Disclosure to the Securities and Exchange Commission (1977).

⁸See Securities and Exchange Commission (1973).

⁹In reality it is expected that at least the managers would be risk-averse given that their compensation is heavily linked to the fortunes of their firms. The risk-neutrality assumption is introduced here solely to abstract from problems which would arise due to differences in preferences between shareholders and managers. These problems would needlessly complicate the analysis without substantially affecting the results.

¹⁰The restriction on trading in the shares of the manager's firm is made in order to abstract from the motivation to release a forecast so as to affect the price at which the shares are traded. Prohibiting the manager from holding shares in his own firm, however, is made solely to simplify the presentation and does not affect any of the analysis. Further, the ban on the holding of shares in competitor firms is made so as to ensure that the manager works in the best interests of his firm.

plus some positive fraction b_{1j} of the value of the firm at the end of period 1, again gross of the manager's compensation, and paid at the end of that period.¹¹ (Since it is not needed for clarity, the subscript j will be dropped from the ensuing analysis.)

Firm j faces uncertainty each period over the unit price to be received for that period's output. One of S possible states of nature will occur in the period, with the unit price to be realized differing across states. (Each state is assumed to imply the same unit price for either of the two periods.) At the beginning of each period all investors (including the manager) agree on the probability, π_s , of any state s occurring that period (with the probability assumed to be the same for both periods) and so agree on the expected unit price to be received by firm j , given by \bar{k}_0 . During each period the manager may privately observe one of R possible signals, denoted by r , which he can use to revise the probability of each state s occurring that period to $\pi_{s|r}$ (again assumed to be the same for both periods) and to revise his expectation of the unit price for the period to \bar{k}_r .¹² The probability of any signal r occurring is p_r . The time of arrival of this information within any period i , denoted by γ_i (expressed as a fraction of a period), is stochastic, with probability distribution $g(\gamma_i)$, assumed stationary over the two periods. The smaller is γ_i the earlier the manager receives information during the period, with $\gamma_i = 0$ meaning that the signal is received at the beginning of the period and $\gamma_i = 1$ meaning that no signal is received during the period.¹³ The form of the distribution $g(\gamma_i)$ depends on the manager's ability to anticipate or discern changes in the firm's economic situation which would cause the price of its product to change, such as a downturn or upturn in demand for the product. The more quickly he is able to observe these changes, the greater will be the probability of low γ 's occurring. Outside investors are assumed not to know the manager's ability with certainty and so do not know the exact distribution, $g(\gamma_i)$. The uncertainty is specified here by investors only knowing the family from which $g(\gamma_i)$ comes but not knowing the value of one of the parameters of the distribution, denoted by μ . The investors have some prior distribution for μ , given by $h(\mu)$, with upper limit μ_u and lower limit μ_L . Their predictive distribution for γ_i is

¹¹Tying compensation to actual earnings is a feature often found in practice and is useful in motivating the manager to expend effort. (The effort decision is not explicitly modelled here since it would not add insights to the analysis.) Linking compensation to firm value is often observed and is useful in motivating the manager to look after the long-term interests of shareholders. The exact form of the compensation scheme, however, is not important to the analysis as long as it motivates the manager to maximize the end-of-period market value of the firm, given his effort level.

¹²The similarity between the two periods in terms of state prices and probabilities is made solely to simplify the presentation and does not affect any of the results.

¹³In this setup, then, the precision of the signal is independent of the time it is received. However, this assumption can be relaxed without changing the results to be presented below.

then given by

$$g^*(\gamma_i) = \int_{\mu_L}^{\mu_U} g(\gamma_i|\mu) h(\mu) d\mu, \quad (1)$$

where $g(\gamma_i|\mu)$ is the distribution for γ_i given that μ is the correct value of the unknown parameter. The prior distribution on μ , and therefore the predictive distribution, can be updated by investors during the first period based on their inference of the particular value of γ , γ_1 , that is realized in that period. As shown below, this inference will be based on when and if the manager releases an earnings forecast (which is prepared using the information in any signal received). Denote the revised posterior distribution for μ given γ_1 by $h(\mu|\gamma_1)$. Then, the revised predictive distribution, $g^*(\gamma_2|\gamma_1)$, is given by

$$g^*(\gamma_2|\gamma_1) = \int_{\mu_L}^{\mu_U} g(\gamma_2|\mu) h(\mu|\gamma_1) d\mu. \quad (2)$$

The investors' predictive distribution is assumed to have the following stochastic dominance property:

$$\int_0^{\bar{\gamma}_2} g^*(\gamma_2|\gamma_1) d\gamma_2 \geq \int_0^{\bar{\gamma}_2} g^*(\gamma_2|\gamma_1'') d\gamma_2, \quad \forall \bar{\gamma}_2 \in (0, 1) \quad \text{if } \gamma_1 < \gamma_1'', \quad (3)$$

with the inequality being strict for at least one $\bar{\gamma}_2$. That is, given two different values for γ_1 , the revised predictive distribution derived with the use of the larger value first order stochastically dominates the distribution derived with the use of the smaller value.^{14,15} The greater the γ_1 , the more does the predictive distribution shift to the right. In other words, the later the manager receives new information this period, the smaller will investors estimate the probability that he will be able to collect information early in succeeding periods. They will have a less favorable assessment of the manager's ability to obtain new information about his firm in a timely manner.

It is assumed that the firm produces output continuously throughout each period for sale at the end of the period and that the manager can use any information he receives to costlessly change the firm's production plan. However, it is assumed that, if the manager desires to change the production level in period i upon receipt of information, there is a time lag of length s_i ,

¹⁴As will be shown below, this property is sufficient to guarantee that the manager will release his earnings forecast if it is costless to do so. Even if the predictive distribution did not have this property, the manager may still release his forecast; however, there would be distributions for which the manager would not be motivated to make the disclosure.

¹⁵It should be clear from the discussion to this point that the assumption of stationarity of the distribution of γ_i is not crucial to the analysis. What is important is that investors be able to use the observed value of γ_1 to update their predictive distribution of γ_2 in the second period.

expressed as a fraction of a period, before production can be adjusted to the new level.¹⁶ The magnitude of the time lag is assumed to be stochastic, having a stationary distribution given by $l(s_i)$, known by both the manager and investors, and independent of the value of γ_i . However, while the manager can observe the lag that will be required to change the production level in any given period, the specific value of s_i is not observable by investors. For simplicity and without loss of generality it is assumed that if the production level is changed during the first period, it can be immediately and costlessly readjusted to the level appropriate to the null information, \bar{k}_0 , at the start of the second period.

Finally, in order to focus solely on the manager's motivation to voluntarily release truthful forecasts it is assumed that there is an incentive for the manager not to misrepresent his private information.¹⁷ This means, in particular, in the context here that the manager will not disclose an updated earnings forecast and will not change the firm's production plan before he has actually received any new information.

3. The voluntary release of earnings forecasts

3.1. Preliminaries

For each of the two periods the manager has two sets of decisions to make. He must first decide on the rate of input appropriate for the firm's production process given the null information, \bar{k}_0 . In addition, conditional on receiving a signal r at time γ_i of period i , he must decide how to use this information to adjust the rate of input and must also decide when to release the information, if at all, through an updated earnings forecast.¹⁸

Since the manager is risk-neutral and the risk-free rate of interest is zero, the manager's decisions are made with the objective of maximizing his expected total compensation over the two periods. With the manager's compensation a function of first-period earnings before managerial compensation and the

¹⁶The reason for the introduction of this time lag into the analysis will become clear below.

¹⁷Such an incentive would arise if shareholders could verify, at the end of any period, the veracity of any forecast disclosed in that period and impose a large penalty if the manager is found to have lied. This assumption of ex-post verification of information disclosed is not uncommon and can be found, for example, in Grossman (1981), Milgrom (1981) and Verrecchia (1983). In reality, though, it is expected that ex-post verification will be more difficult to obtain for earnings forecasts than for some other types of information announcements, such as that of the firm's actual earnings. The effects of admitting the possibility of the manager releasing false forecasts, however, is not considered in this paper.

¹⁸Technically, the manager could adjust the rate of input continually throughout each period. However, as will be shown, it is optimal for the manager to set one rate of input from the beginning of the period until the time of signal receipt and another rate for the remainder of the period.

end-of-period-1 market value of the firm before managerial compensation, it is therefore necessary to derive expressions for the manager's expectations of these quantities at the beginning of the first period before the manager's decision problem can be analyzed. (Where it will not cause confusion, the descriptor 'before managerial compensation' applied to first-period earnings and to the end-of-period market value of the firm will be omitted in the ensuing discussion.) In order to derive these expressions note, first, that if the manager observes a signal r at time γ_1 of period 1 and finds that it takes time s_1 to change the firm's production plan in response to the new information, his expectation for the period's earnings, $E_M(G_1|r, \gamma_1, s_1)$, at time γ_1 is given by

$$E_M(G_1|r, \gamma_1, s_1) = (\gamma_1 + s_1)(\bar{k}_r f(q_0^1) - q_0^1) + (1 - \gamma_1 - s_1) \\ \times (\bar{k}_r f(q_r^1) - q_r^1) - C\delta_1 \quad \text{if } \gamma_1 + s_1 < 1, \quad (4)$$

$$= \bar{k}_r f(q_0^1) - q_0^1 - C\delta_1 \quad \text{if } \gamma_1 + s_1 \geq 1, \quad (5)$$

where q_0^1 is the rate of input per period for the first period and $f(q_0^1)$, a concave function of the input level, is the rate of output per period for the first period chosen by the manager based on his initial expectation for the unit price, \bar{k}_0 , and q_r^1 is the rate of input and $f(q_r^1)$ is the rate of output chosen based on his revised expectation of the unit price, \bar{k}_r . All input is assumed to be financed internally with funds available at the beginning of period 1, with any funds not used in the production process earning the rate on the risk-free asset, zero. Since production takes place continuously, the production level will remain at q_0^1 for the fraction $\gamma_1 + s_1$ of the period (unless $\gamma_1 + s_1 \geq 1$ in which case it will remain at q_0^1 for the entire period), switching to q_r^1 for the remainder of the period. Total input for the period will be $(\gamma_1 + s_1)q_0^1 + (1 - \gamma_1 - s_1)q_r^1$ (as long as $\gamma_1 + s_1 < 1$), while total output will be $(\gamma_1 + s_1)f(q_0^1) + (1 - \gamma_1 - s_1)f(q_r^1)$. In order to calculate expected earnings, the output for each of the two parts of the period is multiplied by \bar{k}_r , the revised estimate of the average price per unit of output, and the value of the input (normalized to have a unit cost of 1) is subtracted from this total. δ_1 equals one if the manager decides to release an earnings forecast in the first period and zero otherwise while C is the cost of disclosure, assumed to be a constant with respect to the time of disclosure and the nature of the forecast disclosed.^{19,20}

¹⁹Formally, all of the manager's decision variables are functions of all of the information available to him. However, where it does not cause confusion this functional notation is omitted.

²⁰Having a constant cost is clearly an unrealistic assumption. For example, it is expected that competitive costs arising from forecast release will actually be higher the earlier in the period the disclosure takes place. The assumption is made only for simplicity and does not affect the basic nature of the results.

As of the beginning of the first period the manager's expectation for that period's earnings, $E_M(G_1)$, is given by the expectation of $E_M(G_1|r, \gamma_1, s_1)$ over all r, γ_1 , and s_1 :

$$\begin{aligned}
 E_M(G_1) = \sum_r p_r \left\{ \int_0^1 \int_0^{1-\gamma_1} [(\gamma_1 + s_1)(\bar{k}_r f(q_0^1) - q_0^1) \right. \\
 + (1 - \gamma_1 - s_1)(\bar{k}_r f(q_r^1) - q_r^1)] l(s_1) g(\gamma_1) ds_1 d\gamma_1 \\
 \left. + \int_0^1 \int_{1-\gamma_1}^1 (\bar{k}_r f(q_0^1) - q_0^1) l(s_1) g(\gamma_1) ds_1 d\gamma_1 \right\} - C\bar{\delta}_1,
 \end{aligned} \tag{6}$$

where $\bar{\delta}_1$ is the probability, as of the beginning of the period, that a forecast disclosure will be made.

The manager's expectation, at time γ_1 , of the end-of-period-1 market value of the firm conditional on signal r being observed at time γ_1 in the first period and on s_1 , $E_M(V_1|r, \gamma_1, s_1)$, is given by

$$E_M(V_1|r, \gamma_1, s_1) = F + E_M(G_1|r, \gamma_1, s_1) + E_1(G_2|\gamma_1). \tag{7}$$

$E_M(V_1|r, \gamma_1, s_1)$ is equal to the sum of three terms. The first term, F , is the level of internal funds at the beginning of period 1. The second term is the manager's time $t = \gamma_1$ expectation for earnings in the first period, $E_M(G_1|r, \gamma_1, s_1)$. The third term is the investors' end-of-period-1 expectation for second-period earnings, $E_1(G_2|\gamma_1)$. Since the market value of the firm at the end of period 1 will be determined by investors, it is their expectation of second-period earnings, rather than the manager's, that is relevant for valuation. (No such distinction is needed for first-period earnings since they will be known with certainty at the end of the period.) Their expectation will differ from the manager's because the investors can only use the predictive distribution for the time of signal receipt in the second period, γ_2 , rather than the actual distribution in calculating expected earnings. As mentioned above, this distribution will be revised by investors based on any inference they have of γ_1 . Assuming for the moment that they can exactly infer γ_1 (an assertion that will be substantiated below) $E_1(G_2|\gamma_1)$ is given by

$$\begin{aligned}
 E_1(G_2|\gamma_1) = \sum_r p_r \left\{ \int_0^1 \int_0^{1-\gamma_2} [(\gamma_2 + s_2)(\bar{k}_r f(q_0^2) - q_0^2) \right. \\
 + (1 - \gamma_2 - s_2)(\bar{k}_r f(q_r^2) - q_r^2)] l(s_2) g^*(\gamma_2|\gamma_1) ds_2 d\gamma_2 \\
 \left. + \int_0^1 \int_{1-\gamma_2}^1 (\bar{k}_r f(q_0^2) - q_0^2) l(s_2) g^*(\gamma_2|\gamma_1) ds_2 d\gamma_2 \right\} - C\bar{\delta}_2.
 \end{aligned} \tag{8}$$

Eq. (8) is similar to (6) with the second-period values of the various variables replacing their first-period values and with $g^*(\gamma_2|\gamma_1)$ used in the expectation instead of $g(\gamma_2)$. Note that the investors' expectation does not depend on any information concerning the firm's first-period performance outside of γ_1 . This is because the firm's earnings process in the second period is assumed independent of that in the first period.

Given this, the manager's time $t=0$ expectation for the end-of-period-1 market value of the firm, $E_M(V_1)$, is

$$E_M(V_1) = F + E_M(G_1) + E_1(G_2), \quad (9)$$

where $E_1(G_2)$ is the expectation of $E_1(G_2|\gamma_1)$ over all γ_1 .

3.2. *The manager's decision problem*

The manager's decision problem can now be formally analyzed. At time $t=0$ the manager's objective is to

$$\begin{aligned} \text{maximize } E_M(N) = 2W + a_1 E_M(G_1) + b_1 E_M(V_1), \quad (10) \\ q_0^1, q_0^2, q_1^1, \\ q_1^2, \tau_1(\gamma_1) \end{aligned}$$

where $E_M(N)$ is the manager's time $t=0$ expectation for his total compensation, N , over the two periods. $\tau_1(\gamma_1)$ is the time of forecast release in period 1 (expressed as a fraction of a period) given that the manager observes a signal at time γ_1 . $\tau_1(\gamma_1) = \gamma_1$ signifies that the forecast is released as soon as the signal is observed, while $\tau_1(\gamma_1) = 1$ signifies that no forecast is released. All other variables are as previously defined. Technically, the manager must also decide whether or not to release any private information received in period 2; however, as demonstrated below the manager will be indifferent to such release in the last period of a multi-period model as long as such release is costless.

Since the manager's initial choice for the rate of input, q_0^1 , for the first period will affect his compensation only through its effect on that period's earnings, q_0^1 will be set in that period so as to maximize the manager's time $t=0$ expectation of these earnings, $E_M(G_1)$. Given (6), the q_0^1 which maximizes $E_M(G_1)$ will be that q_0^1 which maximizes $\sum_r p_r (\bar{k}_r f(q_0^1) - q_0^1)$. Since $\sum_r p_r \bar{k}_r \equiv \bar{k}_0$, this is equivalent to maximizing $\bar{k}_0 f(q_0^1) - q_0^1$, the expected value of output less input, where the expectation is taken with respect to the null information, \bar{k}_0 . This results in an optimal q_0^1 which satisfies

$$\bar{k}_0 f'(q_0^1) - 1 = 0. \quad (11)$$

Analogously, once the manager receives updated information on the expected price by observing a specific signal r in the first period, he will adjust

the input level to q_r^1 so as to maximize the revised expected value of output less input, $\bar{k}_r f(q_r^1) - q_r^1$, giving an optimal q_r^1 which satisfies

$$\bar{k}_r f'(q_r^1) - 1 = 0. \quad (12)$$

At this point it is easy to verify that the manager will find it optimal to make his production decisions in the same way in the second period as he does in the first. This follows from the fact that the manager's second-period choices affect his compensation only through their effect on investors' expectation of second-period earnings, $E_1(G_2|\gamma_1)$, given by (8). The manager therefore wants to choose production levels which maximize this expectation. An examination of this expression reveals that the first-period optimal production levels, satisfying (11) and (12), also maximize $E_1(G_2|\gamma_1)$ and so are optimal from the manager's viewpoint for the second period. This result is not surprising given the similarity between the two periods.²¹

The manager's final decision is over the time, $\tau_1(\gamma_1)$, at which he will release an earnings forecast in period 1 given that he observes private information at time γ_1 . Note that the timing of the release, if there is one at all, will not affect either period's earnings since the manager's optimal production decisions are independent of whether or not he releases a forecast. The release will not affect the manager's compensation by its effect on investors' expectation of first-period earnings since the manager is compensated at the end of the period, after the actual earnings have been announced. The release, however, will have an impact on the manager's compensation by affecting investors' expectation of second-period earnings and therefore the market value of the firm at the end of the first period. As discussed above, given that the manager sets the input level at q_0^2 (the appropriate production level corresponding to the null information expected price, \bar{k}_0) in the second period until and unless he receives new information, only switching to q_r^2 (the appropriate production level corresponding to the more accurate expected price, \bar{k}_r) once he observes signal r , investors' expectation of second-period earnings depend on their predictive distribution for the time of signal receipt, γ_2 , in that period, a distribution revised given investors' inference of when (or if) the manager received a signal in the first period. Assuming, temporarily, that the cost of disclosure, C , equals zero, this implies that the manager can cause investors' expectation for second-period earnings, and therefore the market value of the firm, to be greatest by conveying as early a receipt time in period 1 as possible. This can be accomplished through the release of an updated forecast of earnings incorporating his private information as soon as the information is observed. This is demonstrated in the following proposition:

²¹Note also that these production levels are independent of γ_1 and so are independent of whether or not investors are able to infer γ_1 from the manager's actions. This follows because the earnings processes of the two periods are independent of each other.

Proposition. Given costless disclosure, the manager will release an updated earnings forecast in the first period as soon as he receives new information about expected earnings.

Proof. As a first step in the proof it must be shown that $E_1(G_2|\gamma_1)$, given by (8) (with C set equal to zero), increases as γ_1 decreases. To show this it is sufficient to show that $E_1(G_2|\gamma_1) - \sum_r p_r(\bar{k}_r f(q_0^2) - q_0^2)$ increases as γ_1 decreases since $\sum_r p_r(\bar{k}_r f(q_0^2) - q_0^2)$ is independent of γ_1 . This expression can be written, using (8), as follows:

$$\begin{aligned} & E_1(G_2|\gamma_1) - \sum_r p_r(\bar{k}_r f(q_0^2) - q_0^2) \\ &= \sum_r p_r \left\{ \int_0^1 \int_0^{1-\gamma_2} (1 - \gamma_2 - s_2) [(\bar{k}_r f(q_r^2) - q_r^2) \right. \\ &\quad \left. - (\bar{k}_r f(q_0^2) - q_0^2)] l(s_2) g^*(\gamma_2|\gamma_1) ds_2 d\gamma_2 \right\}. \end{aligned} \quad (13)$$

Note next that

$$\int_0^{1-\gamma_2} (1 - \gamma_2 - s_2) [(\bar{k}_r f(q_r^2) - q_r^2) - (\bar{k}_r f(q_0^2) - q_0^2)] l(s_2) ds_2 \quad (14)$$

increases as γ_2 decreases since

$$\bar{k}_r f(q_r^2) - q_r^2 > \bar{k}_r f(q_0^2) - q_0^2 \quad (15)$$

(given that q_r^2 is chosen so as to maximize $\bar{k}_r(q_r^2) - q_r^2$). Since $g^*(\gamma_2|\gamma_1')$ first order stochastically dominates $g^*(\gamma_2|\gamma_1)$ if $\gamma_1' > \gamma_1$ [by condition (3)], the fact that (14) increases as γ_2 decreases means that (13) is greater the smaller is γ_1 . To maximize investors' expectation for second-period earnings and therefore his own compensation the manager will therefore want investors to infer as early a receipt time as possible. This can be accomplished by the manager setting a release time $\tau_1(\gamma_1)$ equal to γ_1 , that is, by releasing his information through an updated earnings forecast as soon as he observes it.

To see that $\tau_1(\gamma_1) = \gamma_1$ is the only rational expectations equilibrium note first that if investors believe that $\tau_1(\gamma_1) = \gamma_1$, it is in the manager's best interest to actually set $\tau_1(\gamma_1) = \gamma_1$. If he instead set $\tau_1(\gamma_1) > \gamma_1$, delaying the release, then investors will interpret the manager's action as meaning that he received his private information later than he really did, resulting in a lower firm value and a lower managerial compensation. Therefore, if investors believe that $\tau_1(\gamma_1) = \gamma_1$, the manager's optimal strategy is to set $\tau_1(\gamma_1) = \gamma_1$; $\tau_1(\gamma_1) = \gamma_1$ is then a rational expectations equilibrium. In contrast to this, an equilibrium with $\tau_1(\gamma_1) > \gamma_1$ for at least some γ_1 cannot be consistent with rational expectations.

The proof of this will proceed by contradiction. There are two cases to consider:

(i) $\tau_1(\gamma_1)$ is strictly monotonically increasing with γ_1 in equilibrium. If this is true, investors can infer γ_1 exactly from observation of τ_1 . Given this consider two γ_1 's, γ_1^* and γ_1^{**} , where $\gamma_1^{**} = \tau_1(\gamma_1^*) > \gamma_1^*$. In this case if investors observe $\tau_1(\gamma_1^*)$, they infer that the manager received his private information at time γ_1^* and value the firm accordingly. But this implies that a manager who actually receives his information at time γ_1^{**} will not find it optimal to wait until time $\tau_1(\gamma_1^{**}) > \tau_1(\gamma_1^*)$ to reveal his information. Instead he will want to reveal it immediately, at time $\tau_1^*(\gamma_1)$, so that investors will infer that he received his information earlier (at time γ_1^*) than he actually did. As shown above, such action will result in a higher firm value and in a higher level of managerial compensation. But such action also means that a release time of $\tau_1(\gamma_1^*)$ will correspond to two γ 's, γ_1^* and γ_1^{**} . Consequently, having $\tau_1(\gamma_1) > \gamma_1$, for at least some γ_1 is inconsistent with $\tau_1(\gamma_1)$ being strictly monotonically increasing with γ_1 in equilibrium.

(ii) $\tau_1(\gamma_1)$ is not strictly monotonically increasing with γ_1 in equilibrium. In this case there will be instances where two or more γ_1 's correspond to the same τ_1 . For example, there will be γ_1^* and γ_1^{**} , $\gamma_1^* < \gamma_1^{**}$, such that $\tau_1(\gamma_1^*) = \tau_1(\gamma_1^{**})$. (This example can be generalized to allow for more than two γ_1 's to correspond to the same τ_1 without affecting the proof.) Note that since the manager does not release a forecast before he has received one, $\tau_1(\gamma_1^*) = \tau_1(\gamma_1^{**}) \geq \gamma_1^{**} > \gamma_1^*$. Also note that by observing $\tau_1(\gamma_1^*)$ investors cannot infer whether the manager received his information at time γ_1^* or γ_1^{**} and so must value his firm taking into account that there is a positive probability that $\gamma_1 = \gamma_1^*$ and that $\gamma_1 = \gamma_1^{**}$. But since firm value is a decreasing function of the γ_1 inferred by investors (as shown above) this implies that a manager actually receiving his information at time γ_1^* would obtain a higher firm valuation and compensation if investors were able to infer for certain that $\gamma_1 = \gamma_1^*$. He will therefore be motivated to disclose his information immediately, rather than wait until time $\tau_1(\gamma_1^*) = \tau_1(\gamma_1^{**})$, in order to distinguish himself to investors from a manager receiving his information at time γ_1 . But this behavior contradicts the assumption that $\tau_1(\gamma_1)$ is not strictly monotonic. Consequently, having $\tau_1(\gamma_1) > \gamma_1$ for at least some γ_1 is inconsistent with $\tau_1(\gamma_1)$ not being strictly monotonically increasing with γ_1 in equilibrium.

The only rational expectations equilibrium is therefore one in which $\tau_1(\gamma_1) = \gamma_1$, where the manager releases his information as soon as he receives it. Q.E.D.

The intuition behind this proposition is straightforward. The smaller the γ_1 inferred by investors in the first period the more will investors revise downward their predictive distribution for γ_2 . The greater will they assess the probability

that the manager will be able to collect information on changing economic conditions early in the future period and adjust production accordingly. This will in turn increase the end-of-period market value of the firm and the manager's compensation. The manager therefore has an incentive to disclose, as quickly as possible, the fact that he has received new information in the first period by announcing an updated earnings forecast.

This result is in contrast to Verrecchia (1983) where the manager's motivation to disclose his private information comes from his desire to convey the nature of that information to investors, rather than just the fact that such information has been received by him. Here, even though investors do use the updated earnings forecast to revise their valuation of the firm during the first period, this by itself is unimportant to the manager given that the actual earnings must come out by the end of the period. Furthermore, it is clear that the manager need not specifically release his entire earnings forecast to convey to investors that he has received new information. He could equivalently just disclose his private information about the average selling price for the firm's output. Doing so provides investors with the same signal of the manager's information gathering ability as does the disclosure of the full earnings forecast.²²

It should be clear that the conclusion of the Proposition will extend to all but the last period in a multi-period model. In the last period (period 2 in the model presented here) the manager will be indifferent as to the release of an earnings forecast, if the release is costless, given that knowledge of the manager's ability to anticipate changes in economic conditions is irrelevant to investors at that time.

The previous argument notwithstanding, the release of a forecast in the first period would still be a matter of indifference to the manager if investors could infer the time of signal receipt, γ_1 , through an examination of the earnings statement. However, there is not enough information in the earnings statement for them to do so. Assuming that the number of units sold is given in the

²²In principle the manager might be able to simply announce the fact that he has received private information without giving any details of it. For this to be a feasible alternative it must be possible to verify, ex-post, that the manager actually received his information at the time that he announced that he did. If such verification were possible, however, there would really be no need for any disclosure at all. Investors could simply perform an investigation at the end of the period to discover γ_1 .

It is implicitly being assumed in this paper that such verification is either not possible or is subject to more error than the verification of an earnings forecast announced by the manager; the release of an earnings forecast will then be a more credible signal and so will be used in equilibrium. There are two reasons why this is a plausible assumption. First, while to verify an earnings forecast investors must find documents in the firm supporting the forecast, to verify γ_1 investors must, in addition, verify that these documents were prepared at the time the manager announced that they were prepared. Second, with the penalty for misrepresenting γ_1 likely to be lower than for misrepresenting an earnings forecast, the manager would have more of an incentive to try to lie if all he were to announce was γ_1 .

earnings report investors do know that

$$\begin{aligned} \text{Units sold} &= (\gamma_1 + s_1)f(q_0^1) + (1 - \gamma_1 - s_1)f(q_r^1) \quad \text{if } \gamma_1 + s_1 < 1, \quad (16) \\ &= f(q_0^1) \quad \text{if } \gamma_1 + s_1 \geq 1, \quad (16') \end{aligned}$$

while given the stated level of expenses investors know that

$$\begin{aligned} \text{Expenses} &= (\gamma_1 + s_1)q_0^1 + (1 - \gamma_1 - s_1)q_r^1 \quad \text{if } \gamma_1 + s_1 < 1, \quad (17) \\ &= q_0^1 \quad \text{if } \gamma_1 + s_1 \geq 1. \quad (17') \end{aligned}$$

Investors also know the value of q_0^1 , satisfying (11). From (16) and (17) [or (16') and (17')] investors can determine $\gamma_1 + s_1$ but cannot separately infer γ_1 . Because they do not know all of the parameters of the firm during the period (in particular s_1 is unknown to them) investors cannot determine γ_1 exactly if it is not revealed through the release of an earnings forecast. Given $\gamma_1 + s_1$ and the distribution of s_1 investors will only be able to form a distribution for γ_1 . This implies, in particular, that if the actual γ_1 is the lowest one consistent with $\gamma_1 + s_1$ and the distribution of s_1 , the manager will prefer to directly reveal it by releasing a forecast. Investors' expectation of second-period earnings will be higher as a result of doing so. By taking this behavior into account, investors will consequently revise upward their distribution for γ_1 given $\gamma_1 + s_1$. But then, using the same line of reasoning, if the actual γ_1 is the lowest one consistent with this revised distribution, the manager will also prefer to directly reveal it. The equilibrium of this process is therefore one in which the manager will prefer to release a forecast, no matter how large γ_1 is, rather than let investors try to discern γ_1 from the earnings statement.²³

There are a few additional features of this analysis worth noting. First, although the ability to make production changes is the basis by which the timing of forecast disclosure affects firm value, the manager will release a forecast even if a signal is observed too late to make production changes during the current period. This is because the effect of the forecast release is to change investors' perceptions of how quickly the manager will receive information and adjust the production plan in future periods, not in the current one. Second, the analysis provides an explanation for why managers would be

²³ Given this argument it is clear what role uncertainty about s plays – it renders investors incapable of determining γ_1 directly from the earnings statement. For this conclusion to hold, however, it is not crucial for the uncertainty to be about the time to adjust production or even that there be a time lag at all. There just must be some parameter of the firm whose value cannot be determined by investors so that the exact value of γ_1 cannot be found from the earnings statement. Given the large number of parameters which go into determining the firm's earnings it is reasonable to expect that such uncertainty will exist.

willing to disclose forecasts of lower than expected earnings as well as forecasts of higher than expected earnings. It is true that the market value of a firm will fall at the time of the disclosure of an earnings forecast if it conveys bad news; however, the firm's market value at the end of the period, when the actual earnings are reported, will be higher than it would have been had the bad news only come out through the actual earnings announcement.

The preceding analysis assumed that there were no costs of disclosure. However, in reality such costs may exist. For example, forecast release in the first period may benefit firms in competition with the manager's firm and thereby result in a decrease in first-period earnings. To see the impact of such costs, consider that the manager has observed signal r at time γ_1 . Then the manager will disclose his forecast only if

$$b_1 [E_1(G_2|\gamma_1) - E_1(G_2|\gamma_1 + s_1)] > (a_1 + b_1)C, \quad (18)$$

where $E_1(G_2|\gamma_1 + s_1)$ is used here to denote investors' expectation of second-period earnings given that no disclosure is made (so that only $\gamma_1 + s_1$ can be discerned from the earnings statement). The left-hand side of (18) then represents the increase in the manager's compensation due to the higher estimate of second-period earnings that results if the forecast is released. The right-hand side represents the decrease in his compensation coming from the fact that first-period earnings and consequently the end-of-period firm value are lowered by the cost of disclosure. Clearly, given $\gamma_1 + s_1$, if the competitive costs are large enough, the manager will prefer not to reveal his forecast regardless of the magnitude of γ_1 . As competitive costs decrease, a point will be reached where for the lowest γ_1 consistent with $\gamma_1 + s_1$ the manager will prefer to release his forecast. As competitive costs decrease further the range of γ_1 for which the manager will prefer to release his forecast will increase.

How strong a role competitive costs will play in discouraging the release of earnings forecasts depends on the magnitude by which the release would raise investors' estimate of second-period earnings [assuming that γ_1 is such that $E_1(G_2|\gamma_1) > E_1(G_2|\gamma_1 + s_1)$ so that expected earnings would in fact increase]. This is a function of how sensitive the input level is to changes in information. As seen from (8), as the magnitude of

$$[\bar{k}_r f(q_r^2) - q_r^2] - [\bar{k}_r f(q_0^2) - q_0^2] \quad (19)$$

increases for each r , the gain from forecast release increases. In the worst case, if $q_0^2 = q_r^2$ for all r , so that the manager could not change the production level in response to new information, the manager would not have an incentive to release an earnings forecast no matter how low the competitive costs become. As the production function becomes less concave so that q_r^2 and $f(q_r^2)$ respond more to changes in information, it is more likely that the manager will release his information, given the level of competitive costs.

The preceding analysis leads to two empirical predictions. The first is that forecast release is more likely to be observed in firms that have low competitive costs of disclosure and in firms in which there is a greater ability to change input levels in response to new information. Among firms for which the production level can be more easily adjusted are those that have unused capacity and those that are labor-intensive because of the relative ease with which the amount of labor, as compared to the amount of machinery, used can be changed. Among firms with low competitive costs of disclosure are those either in a monopoly position or having a very large share of their product markets. Other firms with low competitive costs are those whose competitors have little excess capacity or that are capital-intensive so that they require a relatively long time to adjust production in response to the new information contained in the earnings forecast.

The second empirical prediction, one consistent with the results of studies by Patell, Penman and Waymire, is that the average share price change at the time of forecast release should be positive. However, whereas Penman suggests that this relation is due to a bias on the part of managers toward releasing good news, the analysis here demonstrates that such a bias is not necessary in order for such a relation to exist. To see how it arises here, note that since in this model a forecast conveying good news is as likely to be released as one conveying bad news, the average price change at the time of forecast release will be determined solely by the effect that the disclosure has on the investors' predictive distribution for γ_2 . Immediately before the forecast release in the first period investors will have already revised their predictive distribution to incorporate the fact that no disclosure has yet been made and that, if one does take place, it will occur somewhere between the present time and the end of the period. This implies that when the forecast is released at the present time investors will revise downward (toward lower γ 's) their predictive distribution for γ_2 . As shown above, such a revision will cause an upward change in the investors' expectation for second-period earnings and can similarly be shown to cause an upward change in expected first-period earnings. This revision therefore causes the average price change at the time of forecast release to be positive even though managers do not have a bias toward releasing good news. This explanation is consistent with Patell's conjecture that the positive average price change may be due, at least in part, to information provided by the act of forecast release itself.

4. A consideration which might limit the frequency of the disclosure of earnings forecasts

There is another consideration, not explicitly modelled here, which might cause a manager to limit the frequency with which he releases his internally generated earnings forecasts. It would arise where there is a chance that

shareholders could successfully sue the manager for releasing a misleading forecast. A successful suit is not possible in the model developed here because it is assumed that managers release only truthful forecasts. But if the possibility of releasing false forecasts is allowed such suits might be successful. In such a case, even if the manager disclosed a truthful forecast, shareholders might be able to successfully sue him if actual earnings deviated significantly from forecasted earnings, claiming that a misleading forecast was released. If the possibility of shareholders winning a large settlement in such a suit was relatively great, the manager might prefer not to disclose his forecast. Alternatively, to avoid the risk of being sued by shareholders the manager might prefer to privately disclose his forecast to a security analyst and have the analyst in turn release a forecast on his own part.²⁴ To the extent that investors can infer the actual source of the forecast, the manager would thereby still have succeeded in conveying to investors, although possibly with a time lag, that he has received new information about the firm's economic situation.

5. Summary and conclusions

It has been shown in this paper that a manager has an incentive to voluntarily release an internally generated forecast of earnings, even though the actual earnings must be reported at the end of the period, as long as the forecast release is costless. This result is due to the fact that the market value of the manager's firm is a function of investors' perceptions of his ability to anticipate future changes in the firm's economic environment and adjust the firm's production plan accordingly. Since the investors cannot directly observe his ability, the manager has an incentive to provide the most favorable information about it as possible by releasing an updated earnings forecast each period as soon as he observes changes in the firm's economic environment. The earlier that investors infer that the manager has received information the more favorably will they assess his ability to anticipate future changes and the higher will be the firm's market value and the level of the manager's compensation. The manager's motivation to release his earnings forecast therefore stems not from his desire to inform investors about his revised expectation for the period's earnings but rather from his desire to inform them that he has received new information about the period's earnings. This means that the manager will be just as willing to release bad news as he is to release good news. In turn this implies that the average price change at the time of forecast release will be positive, a result consistent with empirical evidence.

If there are costs to releasing a forecast, then its disclosure is not guaranteed. As demonstrated above, the manager may still be motivated to release his forecast; however, in deciding whether or not to do so he must now compare

²⁴ This point is also discussed in Ajinkya and Gift (1984) and Lees (1981).

the costs involved in the release with any benefits which might result as a consequence of investors changing their perceptions of his ability.

This study does not attempt to provide a complete explanation for why managers would release earnings forecasts. However, it does provide one plausible reason to expect such voluntary disclosures.

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