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Joint Use of Earnings Management and Earnings Guidance

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Section 1: Introduction

A large empirical literature documents that many firms manage earnings (Kothari, Leone and Wasley 2004). Firms may have a number of goals in managing their earnings. One possibility is that managers aim at a level of earnings that will trigger extra compensation (Healy 200X). Many papers suggest, however, that one goal of earnings management is to generate forecast errors with the greatest mass at zero, and with substantially more small positive than small negative errors. This paper focuses on the use of earnings management to affect forecast errors and neglects its other possible uses. A second literature documents that many firms engage in expectations management ("guidance") to affect analysts' forecasts (Matsumoto 2002, Hutton 2003 and Brown 2002). This is the first paper to model how earnings management and guidance are jointly determined in order to affect forecast errors.

Earnings management and guidance are expensive; when both show increasing marginal cost, a firm will often use a combination of the two, to achieve its goals more precisely and cheaply—two tools are better than one. Many observers find it intuitively obvious that firms jointly determine their earnings management and guidance. It is unclear, however, what relationship should be expected between the two. Some argue that earnings management and guidance substitutes, in the sense that an increase in one is accompanied by a reduction in the other (Brown and Pinello, 2005; Matsumoto, 2002). Or are they complements,? This paper's model, however, predicts that earnings management and guidance are complements, in the sense that an increase in one is accompanied by an increase in the other. Tests reported below are consistent with the model's predictions.

Earnings management and guidance have differing comparative advantages in affecting forecast errors. Guidance is useful for moving the analyst's priors to incorporate information the firm has before the analyst's final forecast is made. Earnings management is useful in dealing with any surprises the firm finds in the forecast, and in dealing with any information the firm receives after the forecast but before the firm's earnings announcement. Thus, both earnings management and guidance affect the forecast error, but guidance is useful for affecting forecasted earnings, and earnings management announced earnings. Put another way, regarding guidance the firm is the first mover—the firm provides guidance before the forecast is released; regarding earnings management the analyst is the first mover—the analyst's forecast is released before the firm makes its final decisions on earnings management.

In this paper's model of earnings management and guidance, the firm obtains the distribution of forecast errors its desires by adhering strictly to a decision rule that analysts know. The manager is assumed to want forecast errors with the greatest mass at zero, and with substantially more small positive than small negative errors. In some periods, however, the manager decides that his best alternative is to acquiesce in large negative forecast errors. This usually occurs when the manager faces temporary items or one time charges, which are more likely to be income decreasing than income increasing (Fairfield Sweeney and Yohn, 1996).

The manager's ability to generate the desired distribution of forecast errors by adhering to his decision rule is based on three assumptions. First, the analyst announces her forecast before the firm announces its earnings. Because the analyst releases her forecast before the firm announces its earnings, the firm is able to take account of the analyst's forecast in managing its announced earnings, or announced earnings depend in part on forecasts. Second, each analyst forms 'noisy' rational expectations, taking into account the information contained in the guidance that the firm gives. Consistent with rational expectations, the analyst is assumed to know how the decision rule the firm uses to manages its announced earnings. Further, the analyst sets her forecast equal to her expectation of the firm's announced earnings (this assumes the analyst's criterion function weights equally a negative or positive error of the same absolute value). Third, on occasion the firm allows large negative forecast errors to occur. (The large negative forecast errors considered here are generally closely related to big baths, under any of various definitions of big baths in the literature.) As a result of these large negative forecast errors, in periods when they do *not* occur, forecast errors tend to be small and more often positive than negative.

To test the model's prediction that earnings management and guidance are positively correlated, simultaneous equations describing earnings and forecasts are estimated; the errors from these equations contain the unobservable earnings management and guidance, respectively, and thus positive correlation of these errors is consistent with the model. These equations are estimated with OLS, with SUR techniques and with rank regression, on IBES data for forecasts and on IBES and COMPUSTAT data for earning, for the sample period 1990 to 2002. For all estimation techniques, the correlation coefficient of errors from the earnings and forecasts equations is 0.78, significantly positive and thus consistent with the model's predictions. Prior research has developed metrics of the extent of earnings and expectation management (see Matsumoto 2002); firms with higher earnings and expectations management, in terms of these metrics, show higher correlation in errors from the earnings and forecasts equations than do firms with lower earnings and expectations management (0.88 versus 0.71). Results are also consistent with conditions under which firms are more likely to be successful in manipulating earnings' forecasts: Correlations are higher for larger firms, for firms with a greater number of analyst forecasts and for growing firms, and are lower for firms with greater dispersion in analyst forecasts.

In the remainder of this paper, Section 2 discusses the literature. Section 3 discusses the model of earnings management and guidance. Section 4 discusses the empirical tests. The data and the results are in Section 5, with a summary and some conclusions in Section 6.

Section 2: Previous Literature

Managers of a publicly traded firm must periodically announce the firm's earnings. Managers have many goals regarding these announcements. One well-known hypothesis is that managers strongly want to avoid announcing smaller earnings than expected, that is, want to avoid negative forecast errors (Burgstahler and Dichev 1997); less strongly, managers may desire to announce larger earnings than expected, or desire positive forecast errors. Many studies present evidence that managers affect announced earnings through earnings management (Jones 1991). In addition, many studies present evidence that managers also affect analysts' forecasts by use of guidance (Matsumoto 2002). Related, Bartov et al. (2002) show that the proportion of zero or positive forecast errors calculated using the last available analyst forecast is higher than the forecast error calculated using the beginning of the quarter forecast, consistent with the view that more often than not managers successfully "talk down" analyst expectations during the quarter. Thus, managers have some control over both the earnings they announce and analysts' earnings forecasts, and through these two channels, managers ***may*** have some control over the sign and size of forecast errors.

Abarbanel and Lehavy (2003) document three properties of the distribution of forecast errors across firms and over time. (a) The greatest mass is at zero. (b) The distribution shows substantially greater number of small positive than small negative errors. (c) There are more large negative than large positive forecast errors. The model developed below generates such a distribution.

Though analysts' forecasts are valuable to users in a number of ways, many observers argue that ceteris paribus forecasts are more valuable the more accurate they are (Loh and Mian 2004). Analysts thus have incentives to make accurate forecasts, though there is substantial controversy about the appropriate metric for forecast accuracy (Gu and Wu 2003). Mikhail et al. (1999) show that analyst turnover is related to analysts' forecast accuracy, consistent with analysts attempting to avoid being fooled by managers. This suggests that an adequate model of firm-analyst interaction must not depend on the firm systematically fooling the analyst.

Section 3. A Model of Earnings Management and Guidance

True underlying earnings for period t are

(1) $X^*_t = f(\Omega_t) + e_t,$

where e_t is an error that is independent of all elements in Ω_t, the information set generally available in period t. Table 1 lists definitions of the main variables. After announcing t-1 earnings, the manager's best guess of X^*_t is $E_{man} X^*_t = f(\Omega_t)$, where E_{man} is his expectations operator, and e_t is mean-zero and symmetric random variable with time-constant variance σ^2_e. As period t goes on, however, he comes to know $X^*_t = f(\Omega_t) + e_t$.[1] (Firm and analyst subscripts are omitted where this will not cause confusion.)

The Analyst. Relative to the manager's earnings announcement, the analyst is the "first mover": she announces her forecast FX_t and then the firm announces its earnings X_t. Analyst j has 'noisy' rational expectations of true earnings $X^*_{i,t}$,

(2) $E_{ana,j} X^*_t = f(\Omega_t) + \omega^{mis}_{j,t},$

where E_{ana} is her expectations operator; her misestimate $\omega^{mis}_{j,t}$, the noise in her estimate, is mean-zero, symmetric and uncorrelated with e_t: $E_{ana}\ \omega^{mis}_{j,t} = 0 = E_{ana}\ e_t$, $E_{ana}\ (\omega^{mis}_{j,i,t})^2 = \sigma^2_{\omega mis,i}$, $E_{ana}\ (\omega^{mis}_{i,t}\ e_t) = 0$. σ^2_{ei}, $\sigma^2_{\omega misi}$ may differ across i, and $\sigma^2_{e,i} > / < \sigma^2_{\omega mis,i}$, though $\sigma^2_{e,i}$, $\sigma^2_{\omega mis,i}$ are time-constant for convenience. The analyst also receives guidance $\omega^{gui}_{i,t}$ from the manager. The analyst finds it smarter to take account of guidance rather than simply ignore it,[2, 3] but she filters $\omega^{gui}_{i,t}$ through a coefficient of sensitivity, $0 \le \kappa \le 1$, discussed below.

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[1] At the expense of some tedious algebra, the firm can be allowed to have noisy rational expectations at the time it announces its earnings.

[2] Because the firm is assumed to give the same guidance to each analyst, ω^{gui}_t has no analyst-subscript. In the early part of this paper's sample period, the manager was permitted to give differential guidance to analysts, and withhold

Guidance depends on the error $e_t = e_{1,t} + e_{2,t}$, $E\, e_t = 0 = E\, e_{1,t} = E\, e_{2,t} = E\,(e_{1,t}\, e_{2,t}) = 0$. The manager knows the first part $e_{1,t}$ before the analyst's forecast, and communicates some of $e_{1,t}$ as guidance, though with noise. (Figure 1 shows the timing of the analyst's forecast announcement and the firm's earnings announcement.) The manager provides guidance $\omega^{gui}_t = E\omega^{gui}_t + e'_{1,t}$, where $e'_{1,t}$ is an error, $E\, e'_{1,t} = 0 = E\,(e'_{1,t} \mid e_{1,t}) = 0$; $e'_{1,t}$ might represent the manager's hand trembling or noise in communication. After receiving guidance, the analyst's information set is $[\Omega_t + \omega^{mis}_{j,t} + \omega^{gui}_t] = [\Omega_t + \omega^{mis}_{j,t} + E\omega^{gui}_t + e'_{1t}]$.[4] Let the analyst take $E_{ana}\,(e_{1,t} \mid \omega^{gui}_t) = \kappa\, \omega^{gui}_t$, where $0 < \kappa = \sigma^2_{e1} / (\sigma^2_{e1} + \sigma^2_{e'1}) < 1$ and $0 < \sigma^2_{e1}, \sigma^2_{e'1}$ are time-constant. The analyst's $E_{ana}\, X^*_t$ is thus

(3) $\quad E_{ana}\, X^*_t = [f(\Omega_t) + \omega^{mis}_t] + \kappa\, \omega^{gui}_t,$

and hence, $(X^*_t - E_{ana}\, X^*_t) = [f(\Omega^*_t) + e_t] - [f(\Omega_t) + \omega^{mis}_{j,t} + \kappa\, \omega^{gui}_t] = e_t - \omega^{mis}_{j,t} - \kappa\, \omega^{gui}_t$. Note that the manager provides the guidance ω^{gui}_t before the analyst reveals her final forecast of period t; relative to the analyst's forecast, the manager is thus the first mover.

The analyst understands that the firms sets announced earnings X_t as

(4) $\quad X_t = X^*_t + \varepsilon^{man}_t = [f(\Omega_t) + e_t] + \varepsilon^{man}_t = [f(\Omega_t) + (e_{1,t} + e_{2,t})] + \varepsilon^{man}_t,$

where ε^{man}_t is earnings management, and $E_{ana}\, \varepsilon^{man}_t = \gamma$. Suppose the analyst aims at a forecast error of zero, or sets

(5) $\quad FX_t = E_{ana}\, [X_t \mid f(\Omega_t) + \omega^{mis}_{j,t} + \omega^{gui}_t];$

the analyst's forecast is thus assumed to be "rational." Note that this criterion function assumes she gives equal weight to a negative or positive error of the same absolute value. The analyst knows

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guidance from the market. The SEC's REG FD (August 2000), prohibits firms from disclosing materially different guidance (Bushee et al. 2004), with the intent that all analysts and the market as a whole receive the same guidance.

[3] Because analyst turnover is positively related to analysts' forecast accuracy (Mikhail et al. 1999), analysts are assumed to compete by producing superior forecasts. By assumption, no analyst is able to forecast e_t. If the manager has credibility, however, the analyst can try to improve her forecasts taking optimal account of guidance.

[4] The model requires that guidance is uncorrelated with the error the analyst makes in forecasting earnings management. Though the firm's choice of guidance ω^{gui}_t affects $\varepsilon^{man}_t = m[f(\Omega_t) + e_t - FX_t] = m(e_t - \omega^{mis}_{j,t} - \omega^{gui}_t - \gamma) = m(e'_{1t} + e_{2t} - \omega^{mis}_{j,t} - \gamma)$, guidance ω^{gui}_t is uncorrelated with $m(e'_{1t} + e_{2t} - \omega^{mis}_{j,t} - \gamma)$, from $E\,[\omega^{gui}_t\,(e'_{1t} + e_{2t}) = 0$.

that $X^*_t = f(\Omega_t) + e_t$, takes $E_{ana}\, e_{1,t} = \kappa\, \omega^{gui}_t$, and understands X^*_t - $E_{ana}\, [X^*_t \mid f(\Omega_t) + \omega^{mis}_{j,t} + \omega^{gui}_t]$ $= e_t - \omega^{mis}_t - \kappa\, \omega^{gui}_t$, though she cannot observe X^*_t, $f(\Omega_t)$, $e_{1,t}$ or $e'_{1,t}$. Thus, she sets

(6) $$FX_t = E_{ana}\, X_t = E_{ana}\, X^*_t + E_{ana}\, \varepsilon^{man}_t = [f(\Omega_t) + \omega^{mis}_t + \kappa\, \omega^{gui}_t] + \gamma.$$

Earnings Management. The analyst is the first mover relative to earnings management, revealing her forecast before the firm decides on ε^{man}_t and hence X_t. The model below assumes that in periods without big-bath behavior the manager desires forecast errors with the greatest mass at zero, and with substantially more small positive than small negative errors. The manager does not, however, aim directly at this goal. Instead the manager adopts a decision rule that leads to the desired outcome when the analyst knows the rule and the manager rigidly adheres to it; the decision rule used here is one of many giving qualitatively similar results. Suppose ε^{man}_t depends negatively on $(X^*_t - FX_t)$, or

$$\varepsilon^{man}_t = m(X^*_t - FX_t) = m[f(\Omega_t) + e_t - FX_t], \quad m' < 0, \quad m(0) = 0;$$

as noted above, the manager knows both $X^*_t = f(\Omega_t) + e_t$ and FX_t when he sets ε^{man}_t (Figure 1). Figure 2 shows two possibilities for the function $\varepsilon^{man}_t = m(X^*_t - FX_t)$. (i) The firm's reaction function has $m(0) = 0$, $m'(0) < -1$. Suppose to start $m(X^*_t - FX_t)$ is symmetric around zero. More precisely, if v_t is any mean-zero, symmetric random variable, then $E\, m(v_t) = 0$; a tractable example is the line ab over the range $(-\infty, \infty)$ in Figure 2. In such a linear case, $m(X^*_t - FX_t) = m'(0) \times (X^*_t - FX_t)$, or for ab, $m(X^*_t - FX_t) = -(1/2)\,(X^*_t - FX_t)$.[5] For purposes of generating this paper's prediction that earnings management and guidance show positive correlation, this model is significant. (ii) Alternatively, suppose ε^{man}_t responds ***a***symmetrically to $(X^*_t - FX_t)$, in particular, responds less in absolute value to $|(X^*_t - FX_t)| >> 0$ if $(X^*_t - FX_t)$ is negative rather than positive. As an example, instead of the line ab in Figure 2, suppose m(.) is the ***piece-wise linear*** relationship ab_1c_1, or $m' = -1/2$ for $(X^*_t - FX_t) \geq c_1 < 0$, but $\varepsilon^{man}_t = m(X^*_t - FX_t) = 0$ for $(X^*_t - FX_t) < c_1 < 0$, giving a large negative forecast error of $(X^*_t - FX_t) < c_1 < 0$. The discussion below uses this reaction function, because it generates a distribution of forecast errors that matches the asymmetrical empirical distribution that Abarbanell and Hehavy (2003) document, as discussed below; model (i) generates a forecast error distribution that is symmetrical.

Relationship between Earnings Management and Guidance. It is worthwhile to show intuitively that earnings management ε^{man}_t and guidance ω^{gui}_t are positively related, $\partial\varepsilon^{man}_t / \partial\omega^{gui}_t > 0$, in models (i) and (ii). Suppose true underlying earnings are X^*_t = \$11.00 and the forecast conditional on no guidance is FX_t = \$10.00, giving the "gap" $(X^*_t - FX_t)$ = \$1.00.[6] The firm then adopts earnings management of $\varepsilon^{man}_t = -1/2\,(X^*_t - FX_t)$ = -\$0.50, and announces earnings of \$10.50 = \$11.00 - \$0.50 (= $X^*_t + \varepsilon^{man}_t$). Alternatively, suppose that guidance is positive and this leads to a higher forecast of FX_t = \$10.30 (or $\kappa\,\omega^{gui}_t$ = \$0.30), so that the gap becomes $(X^*_t - FX_t)$ = \$11.00 - \$10.30 = \$0.70, earnings management becomes $\varepsilon^{man}_t = -1/2\,(X^*_t - FX_t)$ = -\$0.35, or ε^{man}_t rises algebraically (though $\varepsilon^{man}_t < 0$ in both cases). Thus, the change in earnings management arising from an increase in guidance is -\$0.35 - (-\$0.50) = +\$0.15 > 0. In graphical terms, suppose that guidance is $\omega^{gui}_t = 0$ and $(X^*_t - FX_t)$ is given by the distance 0p in Figure 2, implying that the firm sets $\varepsilon^{man}_t = 0p' < 0$. If ω^{gui}_t is increased, raising FX_t by pq and reducing $(X^*_t - FX_t)$ by (pq), then ε^{man}_t increases algebraically by q'p' to 0q' > 0p.

The Analyst's Forecast. The analyst sets $FX_t = E_{ana}\,[X_t \mid f(\Omega_t) + \omega^{mis}_{j,t} + \omega^{gui}_t]$. From (6),

$$FX_t = E_{ana}\,X^*_t + E_{ana}\,\varepsilon^{man}_t = [f(\Omega_t) + \omega^{mis}_t + \kappa\,\omega^{gui}_t] + \gamma.$$

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[5] If $m' = -1$ over the function's range (as with the negatively sloped 45° line), then $\varepsilon^{man}_t = m(X^*_t - FX_t) = -(X^*_t - FX_t)$, and forecast errors are all zero, $(X_t - FX_t) = 0 = (X^*_t + \varepsilon^{man}_t) - FX_t = X^*_t - (X^*_t - FX_t) - FX_t = 0$.

[6] Note that for model (ii), the fact that $(X^*_t - FX_t)$ = \$1.00 > 0 ensures that $(X^*_t - FX_t) > c_1 < 0$.

A key assumption is this: in evaluating $E_{ana}\, \varepsilon^{man}{}_t = E_{ana}\, m(X^*{}_t - FX_t)$, the analyst inserts $E_{ana}\, X^*{}_t$, her best guess of $X^*{}_t$, giving $\varepsilon^{man}{}_t = m(E_{ana}\, X^*{}_t + e_t - FX_t)$. Thus, she sets

(8) $FX_t = E_{ana}\, X_t = E_{ana}\, X^*{}_t + E_{ana}\, \varepsilon^{man}{}_t = E_{ana}\, X^*{}_t + E_{ana}\, m[E_{ana}\, X^*{}_t + e_t - FX_t]$,[7]

and hence

(9) $FX_t - E_{ana}\, X^*{}_t = E_{ana}\, \varepsilon^{man}{}_t = \gamma = E_{ana}\, m(E_{ana}\, X^*{}_t + e_t - FX_t) < 0$,

where the Appendix shows that $E_{ana}\, \varepsilon^{man}{}_t = \gamma < 0$. From (9),

(10) $FX_t < E_{ana}\, X^*{}_t, \qquad \gamma < 0.$

Relationship between Earnings Management and Guidance, Again. From (1) and (10), $X^*{}_t = [f(\Omega_t) + e_t]$ and $FX_t = [E_{ana}\, X^*{}_t + \gamma] = [f(\Omega_t) + \omega^{mis}{}_t + \kappa\, \omega^{gui}{}_t + \gamma]$, earnings management is

(11) $\varepsilon^{man}{}_t = m(X^*{}_t - FX_t) = m(e_t - \omega^{mis}{}_t - \kappa\, \omega^{gui}{}_t - \gamma)$.

From (11), an increase in guidance $\omega^{gui}{}_t$ gives an increase in actual management $\varepsilon^{man}{}_t$, or $\partial\varepsilon^{man}{}_t / \partial\omega^{gui}{}_t = - \kappa\, m' > 0$, from $\kappa > 0$, $m' < 0$. Thus, the prediction: ***earnings management and guidance are complements***, in the sense that an increase in one is accompanied by an increase in the other.

The Unconditional Expectation of the Forecast Error. From (11) and $E_{ana}\, \varepsilon^{man}{}_t = \gamma$, the analyst's forecast error for earnings management is

(12) $\varepsilon^{man}{}_t - E_{ana}\, \varepsilon^{man}{}_t = m(e_t - \omega^{mis}{}_t - \kappa\, \omega^{gui}{}_t - \gamma) - \gamma$.

Using (12), and the fact that the unconditional forecasts of $\omega^{mis}{}_t$, $\omega^{gui}{}_t$ are $E\, \omega^{mis}{}_t = 0 = E\, \omega^{gui}{}_t$, the mathematical expectation of the forecast error is

(13) $E\,(X_t - FX_{j,t}) = E\,\{[f(\Omega_t) + e_t + \varepsilon^{man}{}_t] - [E_{ana}\, X^*{}_t + E_{ana}\, \varepsilon^{man}{}_t]\}$

$$= [f(\Omega_t) + E\, \varepsilon^{man}{}_t] - [f(\Omega_t) + E\, \omega^{mis}{}_t + \kappa\, E\, \omega^{gui}{}_t + \gamma] = \{E\, [m(e_t - \omega^{mis}{}_t\, \kappa\, \omega^{gui}{}_t - \gamma)] - \gamma\} < 0,$$

where the Appendix shows that $E\,(X_t - FX_{j,t}) < 0$.

[7] Note that $E_{ana}\, m[E_{ana}\, X^*{}_t + e_t - FX_t]$ is $E\,\{m[E_{ana}\, X^*{}_t + e_t - FX_t] \mid E_{ana}\, X^*{}_t, FX_t\}$.

A key result is this: In E $(X_{j,t} - FX_t) < 0$, the average is made up of many relatively small positive forecast errors, and a relatively few large negative forecast errors that are associated with big bangs. As the Appendix shows, if the mean of the large negative errors is substantially greater in absolute value than the overall negative mean forecast error [E $(X_{j,t} - FX_t) < 0$], then the median forecast error is positive.

Large Negative Forecast Errors and Big Baths. Big baths may be defined in a number of ways, but in any definition they are closely correlated with large negative forecast errors; when a manager decides to take a big bath, a large negative forecast error is thus a usual concomitant. The manager's behavior in big-bath cases appears to depend on two considerations. First, the manager may believe that, ceteris paribus, the market views the big bath as good news rather than bad news (Francis, Hanna and Vincent 1996). The market may know that the firm has problems and may believe that by acknowledging these problems the firm signals its decision to correct them. Second, the firm may think the signal most effective if it comes all at once—several relatively small, disappointing earnings announcements may be taken as bad news, not signals of determination to fix problems (Skinner, 1996).

A Testable Model of Earnings Management and Earnings Guidance. From (11), this paper's model predicts that earnings management and guidance are complements: increases in one are associated with increases in the other. Consider formulations that allow tests of this prediction.

The researcher observes the announced earnings X_t, but does not observe the components of X_t, where $X_t = X^*_{i,t} + \varepsilon^{man}_{i,t}$, the true underlying earnings is $X^*_{i,t} = f_i(\Omega^*_t) + e_{i,t}$ and the firm's earnings management is $\varepsilon^{man}_{i,t}$. Suppose, however, the researcher explains $X_{i,t}$ by say an autoregression,

(14) $$X_{i,t} = \alpha_{0,i} + \sum^4_{h=1} \alpha_{h,i} X_{i,t-h} + e_{i,t} + \varepsilon^{man}_{i,t} + u_{i,t} = \alpha_{0,i} + \sum^4_{h=1} \alpha_{h,i} X_{i,t-h} + \varepsilon_{i,t}.$$

The error $\varepsilon_{i,t} = e_{i,t} + \varepsilon^{man}_{i,t} + u_{i,t}$ is the sum of the unobservable error ($e_{i,t}$) in $X^*_{i,t}$, unobservable earnings management ($\varepsilon^{man}_{i,t}$), and the error term $u_{i,t}$ which contains effects of omitted variables. (Use of a fourth-order autoregression is discussed below, as is the use of more sophisticated explanations of earnings.) Analyst j's forecast of firm i is $FX_{j,i,t} = f_i(\Omega_t) + \omega^{mis}_{j,i,t} + \kappa_i\ \omega^{gui}_{i,t} + E_{ana,j}\ \varepsilon^{man}_{i,t}$, where $E_{ana}\ \varepsilon^{man}_{i,t} \equiv \gamma_i$. Suppose that $f_i(\Omega_t)$ depends linearly on the information in Ω_t, but the analyst's information set also contains items of which the market and the firm are unaware. Either these items relate to the analyst's "feel" and cannot be specified, or they can in principle be specified but the market and firm do not know the values the analyst uses. For this paper, approximate the analyst's private information as $FX_{IND,i,t}$, the composite forecast of all analysts for all firms in the industry save the firm i. An operational model of the analyst's forecast is

(15) $FX_{j,i,t} = \beta_{i,0} + \sum^{4}_{h=1} \beta_{i,h}\ X_{t-h} + \beta_{i,5}\ FX_{IND,i,t} + \omega_{j,i,t}$,

where $X_{i,t-h}$ are included in Ω_t and $E_{ana}\ \varepsilon^{man}_{i,t} \equiv \gamma_i$ is included in $\beta_{i,0}$. The error $\omega_{i,t} = \omega^{mis}_{i,t} + \kappa\ \omega^{gui}_{i,t} + v_{i,t}$ is the sum of the analyst's misestimate (ω^{mis}_{t}) of X^*_t, the effects of guidance ($\kappa\ \omega^{gui}_{t}$), and the error term $v_{j,i,t}$ which contains effects of omitted variables.[8] The variables of interest, $\varepsilon^{man}_{i,t}$ and $\omega^{gui}_{i,t}$, are unobservable, but are contained in the errors $\varepsilon_{i,t}$ and $\omega_{i,t}$ in (14)-(15). If the model in (14)-(15) is valid, then ε_t and ω_t should show positive correlation, $\rho_{\varepsilon\omega} > 0$, from the terms ε^{man}_{t} and ω^{gui}_{t}. Note that $E\ (\varepsilon_{i,t}\ \omega_{i,t}) = E\ [(e_{i,t} + \varepsilon^{man}_{i,t} + u_{i,t})\ (\omega^{mis}_{i,t} + \kappa\ \omega^{gui}_{i,t} + v_{i,t})]$. Assume that $E\ [e_{i,t}\ (\omega^{mis}_{i,t} + v_{i,t}) = 0 = E\ [\varepsilon^{man}_{i,t}\ (\omega^{mis}_{i,t} + v_{i,t})] = E\ [u_{i,t}\ (\omega^{mis}_{i,t} + \kappa\ \omega^{gui}_{i,t} + v_{i,t})]$. (The possibility of $E\ (u_{i,t}\ v_{i,t}) > 0$ is discussed below.) Then, $\rho_{\varepsilon\omega} = E\ [\kappa\ \omega^{gui}_{i,t}\ (e_{i,t} + \varepsilon^{man}_{i,t})]\ /\ [E\ (\omega_{i,t})^2 + E\ (\varepsilon^{man}_{i,t})^2]^{1/2}$. If the firm's earnings management and guidance are negligible, $\varepsilon^{man}_{t} \approx 0$, $\omega^{gui}_{j,t} \approx 0$, then $\rho_{\varepsilon\omega} \approx 0$.

Section 4: Tests Based on This Paper's Model

4.1 *Empirical Specification of This Paper's Model*.

[8] The errors $u_{i,t}$ and $v_{j,i,t}$ may also include other effects of misspecification (e.g., non-linearity) ignored here.

The system (14)-(15) is estimated estimated three ways. First, it is estimated simultaneously using SUR (Zellner, 1963) techniques. There is no difference between OLS and SUR if the explanatory variables are the same in both equations. The forecast equation is identified by the assumption that the analyst has private information, which the manager does not know, about the earnings of other firms she follows—as a proxy for this information, (15) includes the mean forecast of all other firms in the same industry as the current firm, FX_{IND}. Second, (14) and (15) are estimated separately using OLS. Third, (14) and (15) are estimated separately using rank regression.

4.2 *Econometric Issues*

Three issues discussed here are explored in the results below. First, the covariance matrix of parameter estimates may be misestimated by failure to account for correlations of errors across firms. For example, $\varepsilon_{i,t}$, $\varepsilon_{i+s,t}$, $s \neq 0$, may be correlated and similarly for $\omega_{i,t}$, $\omega_{i+s,t}$; not that this is a problem even in SUR, because SUR takes account only of correlations of $\varepsilon_{i,t}$, $\omega_{i,t}$. Taking account of possible across-firm covariances is difficult, because the panel has a relatively small number of periods T, and estimates of covariances converge in T, not N. One approach is to rely on OLS, where the parameter estimates are unbiased, though they are not efficient. Thus, the estimates of $\varepsilon_{i,t}$, $\omega_{i,t}$ are unbiased, though not efficient, and they are consistent. Hence, the sample variances of $\varepsilon_{i,t}$, $\omega_{i,t}$ and their sample covariance go, and thus the estimate of $\rho_{\varepsilon\omega}$, are consistent. To be sure, the estimated parameter covariances—the estimated covariances of the α_h, β_h—are biased and inconsistent, but significance tests of the α_h, β_h are not the primary concern here.[9]

[9] Another alternative is to use GMM to estimate system (14)-(15). Note, however, that if the instruments in the GMM procedure are the same as used in OLS, and the optimal weighting matrix is chose, then the GMM parameter estimates are the same as the OLS estimates, and hence the GMM parameter estimates are unbiased, even though they are not efficient. Thus, the sample variances of $\varepsilon_{i,t}$, $\omega_{i,t}$ and their sample covariance, and hence the estimate of $\rho_{\varepsilon\omega}$, are consistent. As with OLS, the GMM estimated covariances of the α_h, β_h are biased and inconsistent

Second, from the theoretical model the errors $\varepsilon_{i,t} = e_{i,t} + \varepsilon^{man}_{i,t} + u_{i,t}$ and $\omega_{j,i,t} = \omega^{mis}_{j,i,t} + \kappa\, \omega^{gui}_{t} + v_{j,i,t}$ are correlated positively through $\varepsilon^{man}_{i,t}$ and ω^{gui}_{t}. $\varepsilon_{i,t}$ and $\omega_{i,t}$ may also be correlated, however, either positively or negatively, through the omitted variables represented by $u_{i,t}$ and $v_{i,t}$. $X_{t-1} \ldots X_{t-4}$ enter both (14) and (15), but if X_{t-5}, X_{t-6}, etc., also enter both, with positive coefficients, then ceteris paribus $E\,(u_{i,t}\, v_{i,t}) > 0$. This is explored below by experimenting with more lags X_{t-j} and also by including other likely variables, thereby reducing the variances of $u_{i,t}$ and $v_{j,i,t}$ and their covariance.

The strategy of experimenting with additional variables may not be wholly successful because (i) the researcher overlooks some variables or the literature does not mention them, or (ii) the omitted variables are unobservable. Another strategy is to stratify the data relative to an observable. One approach is to stratify the data on variables correlated with high or low values of ε^{man}_{t}, of ω^{gui}_{t} or of both. For example, when using metrics for earnings management and guidance, the model predicts that firms at the high end of both earnings management and guidance should have larger estimated $\rho_{\varepsilon\omega}$ than firms at the low end of each. Table 6 reports results for data stratified by measures of earnings and expectations measurement.

Another approach is to stratify the data to reduce noise, $u_{i,t}$ and $v_{i,t}$; for example, if multiple analysts follow the firm, likely it has lower noise and thus higher correlation,

$$\rho_{\varepsilon\omega} = [E\,(\varepsilon^{man}_{t}\, \omega^{gui}_{t}) + E\,(u_{i,t}\, v_{i,t})] \,/\, [(Eu_{i,t}^{2})^{1/2}\, (Ev_{i,t}^{2})^{1/2}\, (E\varepsilon^{man}_{i,t}{}^{2})^{1/2}\, (E\omega^{gui}_{i,t}{}^{2})^{1/2}].$$

Table 7 reports results for data stratified on (a) number of analysts, (b) standard deviation of analyst forecasts, (c) total assets, (d) market-to-book ratio, (e) skewness of earnings, (f) sales growth.

Third, the $\alpha_{h,i}$, $\beta_{i,h}$ in (14)-(15) may differ across i: Imposing cross-sectionally constant coefficients may cause serious misspecification. At a minimum, this must be explored. For example, one might suppose that the $\alpha_{h,i} = \alpha_h$, etc., for all firms within a given industry k, but not necessarily across industries. If the coefficients differ across industries in an important way, then likely the system of the earnings and forecast equations should be estimated separately for each industry. Table 8 reports results for the case where the time series for each firm are fitted individually.

4.3 *Measures of earnings management and expectations management*

Previous papers have estimated the size of earnings management (Jones 1991) and expectations management (Matsumoto 2002). Such metrics are used below in some estimates of (14)-(15). Operationally, earnings management is found as the Discretionary Accruals Proxy (DAP), the residual from cross section estimation of the modified Jones model (Dechow et al., 1995). Expectations management is found as the unexpected forecast (UEF), following Matsumoto (2002)[10].

To estimate the discretionary accrual model, define total accruals (TA) as the change in accounts receivable, inventory, accounts payable, income tax payable, and other current assets plus the depreciation expense for the quarter, deflated by lagged total assets to reduce heteroskedasticity in residuals. These items are from the cash flow statement; in COMPUSTAT item numbers, TA = [(Data103 + Data104 + Data105 + Data106 + Data107 - Data77) / lagged Data44]. The Jones model discretionary accrual is estimated cross-sectionally each quarter using all firm-quarter observations with the same two-digit SIC code:

(16) $TA_{i,t} = \beta_0 + \beta_1 (1/ASSETS_{i,t-1}) + \beta_2 \Delta SALES_{i,t} + \beta_3 PPE_{i,t} + \varepsilon_{i,t}$,

where $\Delta SALES_{i,t}$ is change in sales for firm i in consecutive quarters and PPE_{it} is net property, plant and equipment, both variables scaled by lagged total assets, $ASSETS_{i,t-1}$. $\Delta REC_{i,t}$ is the change in accounts receivable. Using the estimated coefficients from (16), non discretionary accruals (NDA) as:

(17) $NDA_{i,t} = \hat{A}_0 + \hat{A}_1 (1/ASSETS_{i,t-1}) + \hat{A}_2 (\Delta SALES_{i,t} - \Delta REC_{i,t}) + \hat{A}_3 PPE_{i,t}$.

Discretionary accruals proxy (DAP) are calculated as $DAP_{i,t} = TA_{i,t} - NDA_{i,t}$. When DAP is high (low) managers are said to be manipulating earnings upward (downward).

Expectations management is calculated in a manner similar to Matsumoto (2002). Expected forecasts are defined as:

(18) $\Delta X_{j,t} / P_{j,t-4} = \alpha_t + \alpha_{1,t} (\Delta X_{j,t-1} / P_{j,t-5}) + \alpha_{2,t} CRET_{j,t} + \varepsilon_{j,t}$,

where

$\Delta X_{j,t} / P_{j,t-4}$: firm j's earnings per share in period t less its earnings per share four periods earlier, reported in IBES, deflated by price per share four periods earlier;

$\Delta X_{j,t-1} / P_{j,t-5}$: firm j's earnings per share in period t-1 less its earnings per share four periods earlier, reported in IBES, deflated by price per share five periods earlier;

$CRET_{j,t}$: cumulative abnormal returns, from 10 days after previous earnings announcement to 10 days before current announcement (Abarbanell and Lehavy, 2003).

The regression is estimated each quarter for each two digit SIC code, including the firm of interest, similar to the calculation of the DAP. The estimated coefficients from the above regression are used to calculate an expected change in earnings ($E(\Delta X_{j,t})$), an expected forecast ($E[F_{j,t}]$) and a forecast error ($UEF_{j,t}$) as:

$E(\Delta X_{j,t}) = [\hat{a}_{0t} + \hat{a}_{1,t} (\Delta X_{j,t-1} / P_{j,t-5}) + \hat{a}_{2,t} CRET_{j,t}] * P_{j,t-4}$

$E[F_{j,t}] = X_{j,t-4} + E(\Delta X_{j,t})$

$UEF_{j,t} = F_{j,t} - E[F_{j,t}]$

[10] The measure used here follows Dechow et al. (1995). Unlike Matsumoto (2002), they do not exclude the firm for which expectations management is calculated from the industry regression.

If managers successfully keep expectations low to avoid negative earnings surprises, then UEF will be negative; note that a low (high) UEF is indicative of higher (lower) expectations management.

The estimated correlation $\rho_{\varepsilon\omega}$ between errors in (14)-(15) is expected to be higher (lower) for firms with high (low) earnings management and expectation management.

Section 5: Data and Discussion of Results

5.1 *Data*

The variables used in these tests are defined as:

X_{t-j}: Earnings for quarter t as reported in I/B/E/S actual file, j = 0,4.

FX_t: Last summary forecast for quarter t prior to the actual earnings announcement taken from the I/B/E/S historical summary tape.

$FX_{IND,t}$: Mean forecast of all other firms (except the current firm) in the same industry as the current firm.

Tables 1 and 2 provide summary statistics of the variables from IBES and COMPUSTAT. Table 3 and Figures 3.a and 3.b provide information of the distribution of forecast errors from IBES earnings and forecasts.

Data related to forecasts are taken from IBES, and data on announced earnings are taken from both IBES and Quarterly COMPUSTAT. Other financial statement variables are also gathered from COMPUSTAT. The IBES industry definitions are used to calculate median forecast of all other firms in the same industry (Ramnath 2002). The data span the period 1990 to 2002, giving T=52. Table 1 describes the final sample. For estimating (14)-(15), four non-missing quarterly forecasts prior to the current quarter as well as actual earnings in IBES are required. The forecast variable is defined as the median forecast by all analysts immediately prior to the earnings announcement. Table 2 shows the sample's descriptive statistics. The mean of the median analyst forecast is 0.225 or 22.5 cents per share; the mean earnings in IBES is 21.6 cents per share. These averages are similar to those in samples used in prior research (Ramnath et al. 2004). Actual earnings from COMPUSTAT are 18.7 cents a share, and the maximum is 1127 dollars a share. Earnings per share in COMPUSTAT differ from those in IBES because IBES's reported earnings clean up special items and restructuring charges. It is standard in this literature to truncate the distribution at 1% and 99% of the sample based on forecast error and actual and forecast earnings (Abarbanell and Lehavy, 2003), and this is done here. Because the distributions of earnings and forecasts are non-normal, rank regressions are used as a robustness check.

5.2 *Discussion of Empirical Results*.

5.2.1 *Distribution of Forecast Errors*

Table 3 shows the distribution of forecast errors. Similar to Abarbanell and Lehavy (2003), the mean forecast error is significantly negative, -0.122 (t-test statistic = -36.94, p-value = 0.0001), but the median is positive, 0.011. The forecast-errors distribution shows the two types of asymmetry, first documented in Abarbanell and Lehavy (2003).[11] First, the distribution shows a "middle asymmetry": the number of observations just above zero (N = 48,693) is greater than the number just below zero (N = 17,254). Second, the distribution shows a left-hand "tail asymmetry": the number of observations in the left tail is greater than the number in the right tail (recall that this paper interprets the left-hand-tail as arising in part from big baths). In Table 3, the forecast error at 5% of the distribution is -1.50 whereas at 95% of the distribution the error is 0.832. Table 3 also documents the effects on data of big baths by showing the distributions that result when truncated by excluding different levels of "big bath" earnings as defined by Francis et al. (1996). [12] With increasing truncation, the Big-Bath effects diminish: the mean becomes closer to zero and

[11] Not shown in the paper—available upon request from authors.

eventually becomes positive. For example, when the sample is truncated by excluding 25% of "big bath" earnings the mean forecast error is only one third of the value before any truncation. Further, when the sample is truncated by excluding 50% of "big bath" earnings, the mean forecast does not differ from zero (mean = -0.0009, p-value = 0.67); further, the "left tail asymmetry" almost disappears when the sample is truncated by excluding 50% of "big bath" earnings. Lastly, when the sample is truncated by excluding 75% of "big bath" earnings, the mean forecast error is significantly positive.

5.2.2 *Joint determination of earnings and forecasts*

The model in (14)-(15) is jointly estimated using SUR. Table 4 shows results when IBES data are used for earnings and forecasts. Each equation is highly significant, as are all variables. (Recall from Section 4 that the parameter estimates are consistent; the t-values, however, are likely inconsistent and overstated, and are reported only for the reader's information.) The estimated correlation coefficient of the two equations' errors is $\hat{\rho}_{\varepsilon\omega} = 0.78$; in a Breusch-Pagan test of independence, $\chi^2(1) = 75910$ and p-value = 0.0000, consistent with the hypothesis that earnings management and earnings guidance are jointly determined and tend to move together. In the estimate of (14), the coefficients on the prior period earnings are significantly positive with one and four quarters back earnings having the highest coefficients. This result is consistent with the results from Box Jenkins models that are employed to investigate the time series properties of earnings by prior literature (Brown et al. 1987). Further, the FX_{IND} variable is significantly positive (coefficient = 0.112, p-value = 0.001) in (15). The pseudo R-squares are 0.69 and 0.77: the model explains a substantial portion of variation in earnings and forecasts.

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[12] Francis et al. (1996) define "Big Bath" as a percentage (example, 5%, 25% etc.) of the distribution of decrease in earnings from last quarters earnings. In Table 3, the minimum forecast error is -6.96 in all truncations for big baths, because this observation does not represent a big bath under the Francis et al. definition.

Is there adequate time after the analyst's forecast for the firm to manage earnings? From Table 5, across all firms in 75% of cases manager has 9 days or more after the latest forecast to finagle earnings management.

When (14)-(15) are reestimated using either OLS or rank regression, the results are the same as with SUR, in the sense that $\hat{\rho}_{\varepsilon\omega} = 0.78$ in all three approaches.

5.2.2 Correlation of Errors from Misspecification

As discussed in Section 4, from the theoretical model the errors $\varepsilon_{i,t} = e_{i,t} + \varepsilon^{man}{}_{i,t} + u_{i,t}$ and $\omega_{j,i,t} = \omega^{mis}{}_{j,i,t} + \kappa\ \omega^{gui}{}_{t} + v_{j,i,t}$ are correlated positively through $\varepsilon^{man}{}_{i,t}$ and $\omega^{gui}{}_{t}$. $\varepsilon_{i,t}$ and $\omega_{i,t}$ may also be correlated, however, either positively or negatively, through the omitted variables represented by $u_{i,t}$ and $v_{i,t}$. Lagged earnings X_{t-j} enter both equations, with the last term X_{t-4} as (14) and (15) are written; but if X_{t-5}, X_{t-6}, etc., also enter both, with positive coefficients, then ceteris paribus $E(u_{i,t}\ v_{i,t}) > 0$. This issue is explored by experimenting with more lags X_{t-j} and also by including other likely variables, thereby reducing the variances of $u_{i,t}$ and $v_{j,i,t}$ and possibly their covariance.

Actual earnings X_{t-5} is added to both equations, and is significant in each. The correlation coefficient $\hat{\rho}_{\varepsilon\omega}$ after adding X_{t-5} is 0.758 vs. 0.780. In addition, along with X_{t-5}, the rate of return over the quarter ending two days before the earnings announcement and starting two days after the prior quarter's earnings announcement date is included in each equation. The rate of return is significant in both equations and the correlation coefficient of the error terms is 0.776 vs. 0.780. Of course, one can never be sure that the researcher has not overlooked important omitted variables that are positively correlated.

5.2.3 *Effects of Intensive Earnings Management and Guidance*

The correlation $\rho_{\varepsilon\omega} = E[\kappa\, \omega^{gui}_{i,t}\, (e_{i,t} + \varepsilon^{man}_{i,t})] / [E(\omega_{i,t})^2 + E(\varepsilon_{i,t})^2]^{1/2}$ should vary positively with how intensively firms manage earnings and expectations. Further, to the extent $\hat{\rho}_{\varepsilon\omega}$ does so, this is evidence that $\hat{\rho}_{\varepsilon\omega}$ does not arise solely from $E(u_{i,t}\, v_{i,t}) > 0$.

Table 6 shows results for estimates of (14)-(15) where data are stratified by choosing high and low values in the distributions of the stratified variable; "high" and "low" are the highest and lowest quartiles of data sorted on the particular variable. giving 16 ‘cells,’ from which the cell with the maximum for both earnings management and guidance is compared with the cell with the minimum for both earnings management and guidance. For discretionary accruals there are four cells; $\hat{\rho}_{\varepsilon\omega}$ is greater when DAP is large than small ($\hat{\rho}_{\varepsilon\omega} = 0.80$ vs. $\hat{\rho}_{\varepsilon\omega} = 0.76$), consistent with the model's predictions.[13] For expectations management, there are four cells; $\hat{\rho}_{\varepsilon\omega}$ is greater when expectations management is high than low ($\hat{\rho}_{\varepsilon\omega} = 0.84$ vs. $\hat{\rho}_{\varepsilon\omega} = 0.75$).[14]

A more powerful test examines earnings management and guidance together. The data are partitioned based on high (low) earnings management and high (low) expectations management, giving 16 cells. When comparing the cell with the maximum for both earnings management and guidance and the cell with the minimum for both earnings management and guidance, $\hat{\rho}_{\varepsilon\omega}$ is larger ($\hat{\rho}_{\varepsilon\omega} = 0.88$ vs. $\hat{\rho}_{\varepsilon\omega} = 0.71$), providing further evidence for joint determination of earnings management and guidance.

5.2.4 *Impact of Other Variables on the Joint Determination of Earnings and Forecasts*

Variables such as size, number of analysts, form of loss function for the analyst, growth and growth opportunities may affect the joint determination of earnings management and guidance

[13] When total rather than discretionary accruals are used, $\hat{\rho}_{\varepsilon\omega}$ is similar for high and low accruals ($\hat{\rho}_{\varepsilon\omega} = 0.81$ vs. $\hat{\rho}_{\varepsilon\omega} = 0.80$).

[14] Recall that from the definition of UEF, expectations management high when UEF is small, and low when UEF is high.

(Hutton 2003). Table 7 shows that $\hat{\rho}_{\varepsilon\omega}$ is higher for (a) firms followed by a larger number of analysts (Gu and Wu 2003), (b) firms where earnings are characterized by a lower standard deviation of analyst forecasts (Das et al. 1998), (c) larger firms, as measured by total assets (Wu, 1999), (d) firms with higher growth opportunities, where the market-to-book ratio is a proxy (Hutton 2003), and (e) firms with higher ex post growth (Hutton 2003).[15]

Gu and Wu (2003) contend that analysts' loss function might minimizes mean absolute error rather than squared error. Hence, the analyst could forecast the median rather than mean of the earnings distribution. The authors find that analyst forecast bias is higher when earnings are more left skewed, that is, the mean is lower than the median analyst forecast. When the sample is split based on the skewness of the earnings distribution, $\hat{\rho}_{\varepsilon\omega}$ is lower for higher skewness (i.e. when the mean and median are further from each other) than when the distribution has lower skewness (i.e. when the distribution is more symmetric) ($\hat{\rho}_{\varepsilon\omega}$ = 0.69 vs. $\hat{\rho}_{\varepsilon\omega}$ = 0.86).[16] Basu and Markov (2004) suggest that instead of quadratic loss functions analysts may face a linear loss function. If quantile (median) rather than OLS regressions are used to estimate (14)-(15), for the two median regressions $\hat{\rho}_{\varepsilon\omega}$ = 0.78 (p-value = 0.001). This suggests that even controlling for different loss functions that analysts may face, the data support the hypothesis that earnings and forecasts are jointly determined. In all cases in Table 7, the data strongly reject the null that $\rho_{\varepsilon\omega} \leq 0$ in Breusch-Pagan tests.

5.3 Industry analysis

The panel analysis in Table 4 assumes that the coefficients $\alpha_{i,h}$, $\beta_{i,h}$, δ_i are the same for i=1,N, but this may be a misspecification. Further, it is important to know how different results are

[15] Results are similar when (14) and (15) are estimated for firms followed by one analyst (correlation = 0.58, p-value = 0.000) versus firms followed by multiple analysts (correlation = 0.811, p-value = 0.000).

across industries. For this purpose, Table 8 shows correlations $\hat{\rho}_{\varepsilon\omega}$ for 11 IBES industry definitions. The average $\hat{\rho}_{\varepsilon\omega}$ is 0.7454, and the range is 0.633 to 0.829.

5.4 *Time series analysis*

Previous sub-sections used panel tests of whether earnings and forecasts are jointly determined. Another approach uses time series methods to estimate (14)-(15). The two equations are estimated with SUR for each firm that has at least 15 quarters of non-missing data over the sample period, and the $\rho_{\varepsilon\omega}$ for the error terms from the two equations is estimated. 2500 firms meet the criterion of at least 15 quarters of non-missing data. In these experiments, none of the estimated parameters is constrained to be the same across firms. The mean and median Pearson correlation of error terms across all firms are 0.69 and 0.76. Averages of the coefficients of the independent variables in (14) and (15) are similar to those obtained in panel analysis; the coefficient on $IBESX_{t-2}$, however, is negative in both equations and significant in the earnings equation (14).[17] Table 8 shows the results of the cross-section regression of the firm-specific $\hat{\rho}_{\varepsilon\omega}$ on the independent variables identified in Tables 6 and 7. Similar to results from panel analysis, firms with higher earnings management have greater joint determination of earnings and forecasts. Firms which indulge in greater expectations management also show greater joint determination of earnings and forecasts. Firms with greater number of analysts and greater skewness of earnings also show greater joint determination of earnings and forecasts. Different from panel analysis, however, larger firms exhibit lower joint determination of earnings and forecasts. By and large, these results are qualitatively similar to those documented by Hutton (2003) and Matsumoto (2002). This analysis lends credence to the panel analysis and gives some

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[16] Skewness is defined here as 1 ≥ [(min + max - 2*mean) / (max - min)] ≥ -1, where min is the minimum of the distribution, max is the maximum of the distribution, and values close to zero indicate a symmetric distribution —see Haberman (1996). Results are robust to using the traditional third moment definition of skewness.

assurance that panel results are not driven by lack of controls for firm characteristics. If rank regression is used to test the monotonic relation between $\hat{\rho}_{\varepsilon\omega}$ and its determinants, results are unchanged from when OLS is used.

5.4 *Robustness tests*

Various robustness tests are performed to test whether results are sensitive to econometric or data limitations; tables of the results are not included, but are available from the authors. Instead of using the actual values of earnings and forecasts, rank regressions are estimated using SUR for system (14)-(15), with $\hat{\rho}_{\varepsilon\omega}$ = 0.78; the Breusch-Pagan test statistic = 72,663 with a p-value = 0.000. This result suggests that even for a general form of (14) and (15), the data are consistent with joint determination of earnings management and guidance.

Instead of using IBES earnings, COMPUSTAT earnings per share (item # 9) are used to estimate the system, with $\hat{\rho}_{\varepsilon\omega}$ = 0.93; the Breusch-Pagan test statistic is 81,601 with a p-value = 0.000. This suggests that even if managers are manipulating GAAP earnings values rather than "street" earnings values, earnings management and guidance are jointly determined.

To test whether using SUR estimation techniques affects results substantially, OLS is used to estimate (14) and (15) separately, with $\hat{\rho}_{\varepsilon\omega}$ = 0.78 and the p-value = 0.001. To test whether particular periods affect results, (14) and (15) are estimated for each quarter. Over the sample period, $\hat{\rho}_{\varepsilon\omega}$ = 0.770 for both the mean and median. The minimum $\hat{\rho}_{\varepsilon\omega}$ is 0.636 (quarter 1 in 1990) and the maximum $\hat{\rho}_{\varepsilon\omega}$ is 0.860 (quarter 1 in 2002). Interestingly, $\hat{\rho}_{\varepsilon\omega}$ appears to be increasing in time. In a formal test, where the $\hat{\rho}_{\varepsilon\omega}$ from estimating (14)-(15) by year quarter is regressed on a time variable taking values 1 (for quarter 1 in 1990) to 52 (quarter 4 in 2002), the coefficient on

[17] Similar to the discussion in Section 4, the t-values are likely inconsistent and overstated; they are reported solely for the reader's information.

time is 0.0015 (t-statistic = 3.26, p-value = 0.002). This is consistent with evidence that suggests that managers seek to avoid negative surprises more often in recent years (Brown 2001).

Abarbanell and Lehavy (2003) show that the distribution of forecast errors exhibits two types of asymmetries—middle and tail asymmetries. This suggests testing whether the joint determination of earnings and forecasts is different for different slices of the distribution of forecast errors. When (14)-(15) are estimated for each quarter of the forecast error distribution, $\hat{\rho}_{\varepsilon\omega}$ is significant for each quarter of the distribution, and is $\hat{\rho}_{\varepsilon\omega} = 0.70$ for the bottom quarter (most negative forecast errors) and $\hat{\rho}_{\varepsilon\omega} = 0.88$ for the top quarter (highest positive forecast errors). Results are similar when top and bottom deciles of the forecast error distribution are used.

6. Summary and Conclusions

Many firms manage earnings (Kothari, Leone and Wasley 2004), at least in part to generate forecast errors that have greatest mass at zero, with relatively more small positive than negative errors. Many firms also use expectations management ("guidance") to affect analysts' forecasts (Matsumoto 2002, Hutton 2003 and Brown 2002) and thus forecast errors. This is the first paper to model the joint determination of earnings management and guidance. Though it is intuitively obvious that firms jointly determine earnings management and guidance, the relationship to be expected between the two is unclear: they might be substitutes, as Brown and Pinello (2005) and Matsumoto (2002) argue, or they might be complements. In this paper's model, earnings management and guidance are complements—the two move in the same direction. Tests reported here are consistent with this prediction.

Guidance is useful for moving the analyst's priors to incorporate information the firm has before the analyst's final forecast is made. Earnings management is useful in dealing with surprises the firm finds in the forecast, and in dealing with any information the firm receives after the forecast but before the firm's earnings announcement. Thus, earnings management and guidance affect the forecast error in different ways. Further, the firm is the first mover in providing guidance before the forecast is released; regarding earnings management, however, the analyst is the first mover, releasing her forecast before the firm makes its final decisions on earnings management.

In this paper's model, the firm obtains its desired distribution of forecast errors through strict adherence to a decision rule known to analysts. The manager is assumed to want forecast errors that have greatest mass at zero, with relatively more small positive than negative errors. In some periods, however, the manager thinks his best alternative is to acquiesce in large negative forecast errors, typically when facing temporary items or one time charges, which are more likely to be income decreasing than income increasing (Fairfield Sweeney and Yohn, 1996).

Earnings management and guidance are expensive. Assuming both have increasing marginal cost, the firms will often combine the two, achieving its goals more precisely and cheaply. These tools are complements—an increase in one is accompanied by an increase in the other.

To test the prediction that earnings management and guidance are positively correlated, equations describing earnings and forecasts are estimated; the errors from these equations contain the unobservable earnings management and guidance, respectively, and thus positive correlation of these errors is consistent with the model. These equations are estimated with SUR techniques, with OLS and with rank regression on IBES and COMPUSTAT data for the sample period 1990 to 2002. The correlation coefficient of errors from the earnings and forecasts equations is 0.78 in SUR, OLS and rank regression, and is significantly positive, consistent with the model's predictions. Prior research has developed metrics of the extent of earnings and expectation management (see Matsumoto 2002); firms with higher earnings and expectations management, in terms of these metrics, show higher correlation in errors from the earnings and forecasts equations than do firms with lower earnings and expectations management (0.88 versus 0.71). Results are also consistent with conditions under which firms are more likely to be successful in manipulating earnings' forecasts: Correlations are higher for larger firms, for firms with a greater number of analyst forecasts and for growing firms, and are lower for firms with greater dispersion in analyst forecasts.

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Definitions of Symbols

$X^*_{i,t}$: *true* underlying earnings in period t for firm i

$e_{i,t}$: mean-zero, symmetric error term to true underlying earnings

$\Omega_{i,t}$: information set regarding firm i in period t

$X_{i,t}$: the firm's *announced* earnings at the end of period t

$f_i(\Omega_t)$: rational expectation of true underlying earnings $X^*_{i,t}$ *before* $e_{i,t}$ is revealed

$E_{ana,j}\ X^*_{i,t}$: analyst j's 'noisy' rational expectation of $X^*_{i,t} = f_i(\Omega_t) + \omega^{mis}_{j,i,t}$

$\omega^{mis}_{j,i,t}$: mean-zero, symmetric error in analyst j's 'noisy' rational expectation of $X^*_{i,t}$

$\sigma^2_{\omega mis,j,i}$: the variance of $\omega^{mis}_{j,i,t}$ ($\sigma^2_{\omega mis,j,i}$ is assumed time-constant for convenience)

$\varepsilon^{man}_{i,t}$: firm i's earnings management in period t
(giving announced earnings $X_t = X^*_t + \varepsilon^{man}_t = f(\Omega_t) + e_t + \varepsilon^{man}_t$)

γ_i: Expected value of $\varepsilon^{man}_{i,t}$, $E_{ana}\ \varepsilon^{man}_{i,t} = \gamma_i$

$\omega^{gui}_{i,t}$: guidance supplied by firm i management to all analysts for earnings at t

κ: filter analyst applies to $\omega^{gui}_{i,t}$

$\varepsilon_{i,t}$: error in the test equation for earnings, $\varepsilon_{i,t} = e_{i,t} + \varepsilon^{man}_{i,t} + u_{i,t}$

$u_{i,t}$: component of the error in the test equation for earnings that arises from omitted variables

$\omega_{j,i,t}$: error in the test equation for forecasts, $\omega_{j,i,t} = \omega^{mis}_t + \omega^{gui}_t + v_{j,i,t}$

$v_{j,i,t}$: component of the error in the test equation for forecasts that arises from omitted variables

cov, var: sample covariance and variance operators

Table 1
Sample Selection

Sample construction from IBES for years 1990 to 2002

Procedure	*Number of Forecasts*
Total Number of quarterly earnings forecasts	1,140,057
Number of median (of each analysts last forecast) forecasts prior to earnings announcement date during : 1971 to 2002	283,281
Number of median (of each analysts last forecast) forecasts prior to earnings announcement dates: 1990 to 2002	227,006
Number of median (of each analysts last forecast) forecasts for industry sectors in which there are at least five firms (to calculate the FIND variable)	223,417
Number of forecasts in current quarter for which there are non missing forecasts for four prior quarters and actual earnings in IBES	124,726

Table 2
Descriptive Statistics and Variable Description

This table details descriptive statistics for key variables used in the following regressions. The data spans the years 1990 to 2002. The variables are winsorized at the 1% and 99% in keeping with prior literature.

Panel A: Descriptive statistics

Variable	N	Mean	Median	Std. Dev.	Min.	Max.
MEDEST	124726	0.225	0.190	0.303	-0.65	1.31
IBESX	124726	0.216	0.190	0.335	-0.89	1.39
EPS	109724	0.187	0.178	5.177	-55.5	1127
FX_{IND}	124726	0.176	0.150	0.108	-0.02	0.43

Panel B: Variable Description

Variable	Definition
FX_{IND}	Median forecast of all ***other*** firms in the same industry (defined by IBES) (minimum number of firms in the industry to qualify = 5)
IBESX	Actual earnings defined by IBES for quarter (t)
$IBESX_{t-i}$	Actual earnings recorded in IBES tapes for quarter (t-i) i = 1 to 4
EPS_t	Actual earnings per share (Basic, excluding Extraordinary items) from COMPUSTAT (Item 9) for quarter (t)
EPS_{t-i}	Actual earnings per share (Basic, excluding Extraordinary items) from COMPUSTAT (Item 9) for quarter (t-i). i = 1 to 4.
MEDEST	Median IBES analyst forecast prior to Earnings announcement date for current quarter (t) for each firm.
FE_t	Forecast error defined as (Actual EPS_t – Forecast EPS_t) / $Price_{t-1}$
$CRET_t$	Cumulative abnormal returns, from 10 days after previous earnings announcement to 10 days before current quarter's announcement

Table 3
Distribution of Forecast Errors.

Distribution of forecast errors at different levels of truncation, based on the big bath definition of Francis et al. (1996). Francis et al. (1996) define "big bath" as a percentage (example, 5%, 25% etc.) of the distribution of decreases in earnings from last quarters earnings. T-test of mean of forecast error shown in parenthesis in the Mean column. Francis et al. (1996) define "Big Bath" as a percentage (example, 5%, 25% etc.) of the distribution of decrease in earnings from last quarters earnings. In the table below, the minimum forecast error is -6.96 in all truncations, because this observation does not represent a big bath under the Francis et al. definition.

Truncation	Minimum	5%	50%	95%	Maximum	Mean	Standard Deviation
No Truncation	-6.96	-1.50	**0.011**	0.832	2.81	**-0.122***** (-36.94)	1.09
5% of Big Bath sample	-6.96	-1.36	0.014	0.827	2.81	-0.097*** (-31.08)	1.02
25% of Big Bath sample	-6.96	-1.09	0.021	0.84	2.81	-0.0448*** (-15.49)	0.909
50% of Big Bath sample	-6.96	-0.891	0.027	0.889	2.81	-0.0009 (-0.33)	0.849
75% of Big Bath sample	-6.96	-0.778	**0.035**	0.954	2.81	**0.031***** (10.17)	0.840

Table 4: IBES Earnings (forecast) as a function of prior period earnings (and median industry forecast) – *SUR*

(9) $IBESX_t = \alpha_0 + \alpha_1 IBESX_{t-1} + \alpha_2 IBESX_{t-2} + \alpha_3 IBESX_{t-3} + \alpha_4 IBESX_{t-4} + \varepsilon_t$

(10) $MEDEST_t = \beta_0 + \beta_1 IBESX_{t-1} + \beta_2 IBESX_{t-2} + \beta_3 IBESX_{t-3} + \beta_4 IBESX_{t-4} + \beta_4 FX_{IND} + \omega_t$

This table shows the estimated Seemingly Unrelated Regressions (Zelner 1976) coefficients from the earnings and forecast equations. Actual earnings and forecasts are from IBES.

Variable	Dependent variable $IBESX_t$	Dependent variable $MEDEST_t$
Intercept	0.0050***	0.008***
	(6.81)	(12.28)
$IBESX_{t-1}$	0.429***	0.356***
	(163.84)	(174.00)
$IBESX_{t-2}$	0.024***	0.022***
	(8.29)	(9.73)
$IBESX_{t-3}$	0.045***	0.042***
	(15.00)	(18.10)
$IBESX_{t-4}$	0.484***	0.500***
	(175.58)	(232.40)
FX_{IND}	0.112***	
	(42.91)	
N	124726	
Pseudo R-Square	0.69	0.77
Chi-Square	286,225	421,204

Correlation of residuals $\hat{\varepsilon}_{it}$ and $\hat{\omega}_{it}$: 0.780

Breusch-Pagan test of independence: $\chi^2(1) = 75,910$; p-value = 0.0000.

Table 5. Days between latest forecast and earnings announcement date

	Mean	Median	Min	**25%**	75%	Max	N
All	33.58	24	0	**9**	53	113	96516
High	79.8	79	59	68	90	113	22241
Low	4.8	5	0	1	8	11	28051

High: Largest quartile. Low: Smallest quartile. The numbers in each quartile differ because of ties.

Table 6. Impact of Earnings and Expectation Management Defined by prior Literature on Joint Determination of Earnings Management and Guidance

(9) $IBESX_t = \alpha_0 + \alpha_1 IBESX_{t-1} + \alpha_2 IBESX_{t-2} + \alpha_3 IBESX_{t-3} + \alpha_4 IBESX_{t-4} + \varepsilon_t$

(10) $MEDEST_t = \beta_0 + \beta_1 IBESX_{t-1} + \beta_2 IBESX_{t-2} + \beta_3 IBESX_{t-3} + \beta_4 IBESX_{t-4} + \beta_4 FX_{IND,t} + \omega_t$

This table describes the correlation coefficient of error terms from the earnings and forecast equations using SUR estimated separately for high and low values of earnings and expectation management. High and low refer to the highest and lowest quartiles of the data for metrics of earnings and expectation management. Accruals are calculated from the Cash Flow statement. DAP is calculated according to Dechow et al.'s (1995) modification of Jones (1991) model. Expectation management is calculated following Matsumoto (2003).

Variable	Low	High
Signed Discretionary Accruals (DAP)	0.76	**0.80**
Expectation Management (UEF)	0.75	**0.84**
Earnings and Expectation management (UEF and DAP)	0.71	**0.88**

Table 7. Impact of Other Variables on Joint Determination of Earnings Management and Guidance

In this table the data are stratified based on some determinants shown by prior research to affect the behavior of analysts and earnings and expectations management. "High" and "low" are defined as the top and bottom quarter of the distribution of the data based on the particular variable of interest.

Correlation coefficient of error terms from equations 1 and 2 using SUR. "High" and "Low" as the top and bottom quarter of the distribution based on the variable of interest

Variable	Low	High
Number of Analysts (ANALYS)	0.64	0.86
Standard Deviation of Analyst Forecasts	0.83	0.80
Total Assets (LNTA)	0.66	0.83
Market to Book ratio (MB)	0.73	0.80
Skewness of Earnings (SKEW)	0.69	0.86
Sales Growth (GTH)	0.72	0.79

Table 8. SUR system, by industry (using IBES industry definitions)

Industry	Correlation Coefficient
1	0.656
2	0.633
3	0.775
4	0.781
5	0.795
6	0.750
7	0.829
8	0.725
9	0.811
10	0.721
11	0.723
Average	**0.7454**

Table 9: Determinants of the correlation in error terms of the time series estimation of earnings and forecast equations

(9) $IBESXi_{,t} = \alpha_0 + \alpha_1 \, IBESX_{i,t-1} + \alpha_2 \, IBESX_{i,t-2} + \alpha_3 \, IBESX_{i,t-3} + \alpha_4 \, IBESX_{i,t-4} + \varepsilon_t$

(10) $MEDEST_t = \beta_0 + \beta_1 \, IBESX_{\, i,t-1} + \beta_2 \, IBESX_{\, i,t-2} + \beta_3 \, IBESX_{\, i,t-3} + \beta_4 \, IBESX_{\, i,t-4} + \beta_4 \, FX_{IND} + \omega_t$

$Corr(\varepsilon_t, \omega_t) = \beta_0 + \beta_1 \, LNTA_t + \beta_2 \, ANALYS_{t-2} + \beta_3 \, DAP_{-3} + \beta_4 \, UEF_{t-4} + \beta_4 \, SKEW + \beta_4 \, GTH + \omega_t$

This table describes the determinants of the correlation in error terms from the earnings and forecast equations. These two equations are estimated jointly using Seemingly Unrelated Regressions (Zelner 1976), separately for each firm in a time series framework, where each firm has at least 15 non missing observations. Actual earnings and forecasts are extracted from IBES.

Variable	Expected Sign	Coefficients
Intercept		0.57*** (17.76)
Size (LNTA)	+	-0.0001*** (-3.93)
# of Analysts (ANALYS)	+	0.014*** (12.61)
Discretionary accruals (DAP)	+	7.54*** (2.95)
Expectations management (UEF)	-	-0.156*** (-2.87)
Skewness of earnings (SKEW)	+	0.086*** (5.22)
Sales Growth (GTH)	+	0.016 (0.56)
N	2554	
Adjusted R-Square	0.09	
F-Value	42.19***	

Appendix I. Proofs

1. Proof that $E_{ana}\, \varepsilon^{man}_t = \gamma < 0$.

The analyst sets $FX_t = E_{ana}\, X^*_t + E_{ana}\, \varepsilon^{man}_t$, where

(A.1) $E_{ana}\, X^*_t = [f(\Omega_t) + \omega^{mis}_t + \kappa\, \omega^{gui}_t]$

and

(A.2) $E_{ana}\, \varepsilon^{man}_t = \gamma$.

True underlying earnings are

(A.3) $X^*_t = f(\Omega_t) + e_t = E_{ana}\, X^*_t + e_t - \omega^{mis}_t - \kappa\, \omega^{gui}_t = E_{ana}\, X^*_t + e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, \omega^{gui}_t$

and thus

(A.4) $(X^*_t - FX_t) = E_{ana}\, X^*_t + e_t - \omega^{mis}_t - \kappa\, \omega^{gui}_t - FX_t$
$= E_{ana}\, X^*_t + e_t - \omega^{mis}_t - \kappa\, \omega^{gui}_t - E_{ana}\, X^*_t - \gamma = e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, \omega^{gui}_t - \gamma$.

The analyst knows $e_{1,t} + e'_{1,t} = \omega^{gui}_t$. Let her take $e_{1,t} = \kappa\, \omega^{gui}_t$ and $\omega^{mis}_t = 0$. Then, she takes $X^*_t - FX_t = e_{2,t} - \gamma$. Hence, $\varepsilon^{man}_t = m(X^*_t - FX_t) = m(e_{2,t} - \gamma)$, where $m(X^*_t - FX_t) = -(1/2)(X^*_t - FX_t)$ for $(X^*_t - FX_t) \geq c < 0$, $m(X^*_t - FX_t) = 0$ for $(X^*_t - FX_t) < c$. Let $e_{2,t} \sim \sigma_{e2} N_{e2}(0, 1)$, with density $p(e_{2,t})$. Write $e_{2,t} = \sigma_{e2}\, x_t$, where $x_t \sim N_{e2}(0, 1)$ with density $p(x_t)$. $E_{ana}\, \varepsilon^{man}_t = \gamma$ is found from the non-linear equation

(A.5) $E_{ana}\, m(e_{2,t} - \gamma) = \{[-(1/2) \int_{e2\geq(c+\gamma)}^{\infty} (e_{2,t} - \gamma)\, p(e_{2,t})\, dv] + [-(0) \int_{-\infty}^{(c+\gamma)>e2} (e_{2,t} - \gamma)\, p(e_{2,t})\, dv]\}$
$= \{[-(1/2) \int_{x\geq(c+\gamma)/\sigma e2}^{\infty} \sigma_{e2}\, x_t\, p(x_t)\, dv] + (\gamma / 2)\, [\int_{x\geq(c+\gamma)/\sigma e2}^{\infty} p(x_t)\, dv]\}$
$= \{[-(1/2)\, \sigma_{e2} \int_{x\geq(c+\gamma)/\sigma e2}^{\infty} x_t\, p(x_t)\, dv] + (\gamma / 2)\, [\int_{x\geq(c+\gamma)/\sigma e2}^{\infty} p(x_t)\, dv]\} = \gamma$.

Note that $[-(1/2) \int_{x\geq(c+\gamma)/\sigma e2}^{\infty} x_t\, p(x_t)\, dv] < 0$, because $[\int_{x\geq(c+\gamma)/\sigma e2}^{\infty} x_t\, p(x_t)\, dv] > 0$ from $[\int_{-\infty}^{\infty} x_t\, p(x_t)\, dv] = 0$; note further that, if $F(x_t)$ is the cumulative distribution function for x_t, then $1 > [\int_{x\geq(c+\gamma)/\sigma e2}^{\infty} p(x_t)\, dv] = [F(\infty) - F(c + \gamma)] > 0$ from $[F(\infty) - F(-\infty)] = 1$ and $F' > 0$. Hence,

(A.6) $\gamma = [-(1/2)\, \sigma_e \int_{x\geq(c+\gamma)/\sigma e2}^{\infty} x_t\, p(x_t)\, dv] / \{1 - [F(\infty) - F((c + \gamma)/\sigma_{e2})] / 2\} < 0$.

2. Proof that $E\,(X_t - FX_{j,t}) = E\,[\varepsilon^{man}_t - E_{ana}\, \varepsilon^{man}_t] = \{E\,[m(e_t - \omega^{mis}_t - \kappa\, \omega^{gui}_t - \gamma)] - \gamma\} < 0$.

From (A.4), the unconditional value of $(X^*_t - FX_t)$ is

(A.7) $(X^*_t - FX_t) = e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, \omega^{gui}_t - \gamma = e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, (e_{1,t} + e'_{1,t}) - \gamma$
$= (1 - \kappa)\, e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, e'_{1,t} - \gamma$,

where $e_{1,t}$, $e_{2,t}$, ω^{mis}_t, $e'_{1,t}$ are mutually uncorrelated. Thus,

(A.8) $\varepsilon^{man}_t = m(X^*_t - FX_t) = m[(1 - \kappa)\, e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, e'_{1,t} - \gamma] = m(z_t - \gamma)$,

where

$z_t \equiv (1 - \kappa)\, e_{1,t} + e_{2,t} - \omega^{mis}_t - \kappa\, e'_{1,t}$,

$\sigma^2_z = (1 - \kappa)^2\, \sigma^2_{e,1} + \sigma^2_{e2} + \sigma^2_{\omega} + \kappa^2\, \sigma^2_{e'1}$,

$z_t \sim N_z(0, \sigma^2_z) = \sigma_z\, N_z(0, 1)$.

Then, let

$z_t = \sigma_z\, x_t, \qquad x_t \sim N_Z(0, 1)$,

with density $p(x_t)$. Thus,

(A.10) $\varepsilon^{man}_t = m(X^*_t - FX_t) = m(\sigma_z\, x_t - \gamma)$, giving

(A.11) $\gamma_z = E\,\varepsilon^{man}{}_t = E\,[m({}_2e_t - \omega^{mis}{}_t - \gamma)] = E\,m(z_t - \gamma)$
$= [- (1/2)\ {}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} \sigma_z\,(x_t - \gamma)\,p(z_t)\,dv] + [-(0)\ {}_{-\infty}\int^{((c+\gamma)/\sigma z)>x} \sigma_z\,(x_t - \gamma)\,p(z_t)\,dv]\}$
$= [- \sigma_z\,(1/2)\ {}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} x_t\,p(x_t)\,dv] + (\sigma_z\,\gamma / 2)\,[{}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} p(x_t)\,dv]$
$= [- \sigma_z\,(1/2)\ {}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} x_t\,p(x_t)\,dv] + (\sigma_z\,\gamma / 2)\,[F(\infty) - F((c + \gamma)/\sigma_z)].$

Then, from $\sigma_z > \sigma^2{}_{e2}$, it follows that $0 > (c+\gamma)/\sigma_z > (c+\gamma)/\sigma_{e2}$ (for $c, \gamma < 0$) and

(A.12) $E\,(X_t - FX_{j,t}) = E\,[\varepsilon^{man}{}_t - E_{ana}\,\varepsilon^{man}{}_t] = \{E\,[m({}_2e_t - \omega^{mis}{}_t - \gamma)] - \gamma\} = \gamma_z - \gamma$
$= \{[- \sigma_z\,(1/2)\ {}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} x_t\,p(x_t)\,dv] - [- \sigma_{2e}\,(1/2)\ {}_{x\geq(c+\gamma)/\sigma 2e}\int^{\infty} x_t\,p(x_t)\,dv]$
$+ (\sigma_z\,\gamma / 2)\,[F(\infty) - F((c + \gamma)/\sigma_z)] - (\sigma_{2e}\,\gamma / 2)\,[F(\infty) - F((c + \gamma)/\sigma_{2e})]\} < 0,$

because
$\{[- \sigma_z\,(1/2)\ {}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} x_t\,p(x_t)\,dv] + [\sigma_{2e}\,(1/2)\ {}_{x\geq(c+\gamma)/\sigma 2e}\int^{\infty} x_t\,p(x_t)\,dv]\} < 0$
from $[{}_{x\geq(c+\gamma)/\sigma z}\int^{\infty} x_t\,p(x_t)\,dv] > [(1/2)\,\sigma_{2e}\ {}_{x\geq(c+\gamma)/\sigma 2e}\int^{\infty} x_t\,p(x_t)\,dv]$ and $\sigma_z = [\sigma^2{}_{2e} + \sigma^2{}_{\omega}]^{1/2} > \sigma^2{}_{2e}$, and
$+ (\gamma / 2)\,\{[F(\infty) - F((c + \gamma)/\sigma_z)] - [F(\infty) - F((c + \gamma)/\sigma_{2e})]\} < 0,$
because $\{[F(\infty) - F((c + \gamma)/\sigma_z)] - [F(\infty) - F((c + \gamma)/\sigma_{2e})]\} > 0$ from $0 > (c+\gamma)/\sigma_z > (c+\gamma)/\sigma_{2e}$ (for $c, \gamma < 0$), and $(\gamma / 2) < 0$.

3. The median forecast error is positive.

Define the means of forecast errors for the periods with and without large, negative forecast errors (LN and NLN), and the total sample, as $\mu_{(X - FX),LN}$, $\mu_{(X - FX),NLN}$, $\mu_{(X - FX)}$, where the total number of periods is $T = T_{NLN} + T_{LN}$, and $T_{NLN} >> T_{LN}$.

Under reasonable conditions, the mean of the forecast errors in periods without large, negative errors must be positive and relatively small, even though $\mu_{(X - FX)} < 0$. Note that $0 > \mu_{(X - FX),LN} < \mu_{(X - FX)} < 0$. Note further that for $(\mu_{(X - FX),LN} / \mu_{(X - FX)}) >> 0$ and large enough T_{LN} / T_{NLN}, it follows that $\mu_{(X - FX),NLN} > 0$ but is relatively small.

From $0 > \mu_{(X - FX),LN} < \mu_{(X - FX)} < 0$ and $0 < \mu_{(X - FX),NLN} > \mu_{(X - FX)} < 0$, it follows that the distribution of $(X_t - FX_t)$ is skewed to the left and thus under regularity conditions, the mean is smaller than the median.

Further, given $\mu_{(X - FX),LN}$, $\mu_{(X - FX),NLN}$, if the ratio T_{LN} / T_{NLN} is sufficiently small, then the median forecast error is positive.

Appendix II. Why the Representative Firm Uses Both Earnings Management and Guidance

The firm need not use both earnings management and guidance to affect forecast errors, but if both are subject to increasing marginal costs in the relevant ranges, as in Figure 4, the firm may choose an interior solution. Suppose that the costs of earnings management and guidance (C_m and C_g) have minima at $\varepsilon^{man}_t = 0$, $\omega^{gui}_t = 0$,[18] but are increasing in $|\varepsilon^{man}_t|$, $|\omega^{gui}_t|$, $C'_m(\varepsilon^{man}_t) >/< 0$ as $\varepsilon^{man}_t >/< 0$ (the dotted MC_m curve in Figure 4), $C'_g(\omega^{gui}_t) >/< 0$ as $\omega^{gui}_t >/< 0$, and $C''_m(\varepsilon^{man}_t)$, $C''_g(\omega^{gui}_t) > 0$. From above, note that $\omega^{gui}_t = E\omega^{gui}_t + e'_{1t}$, $E\, e'_{1t} = 0$; the firm can choose $E\,\omega^{gui}_t$ but not ω^{gui}_t, because it does not know e'_{1t} when setting $E\omega^{gui}_t$. Thus, $\kappa\,\omega^{gui}_t = \kappa\, E\omega^{gui}_t + \kappa\, e'_{1t}$

The expected costs for using ε^{man}_t, ω^{gui}_t, conditional on the firm's choice of $E\omega^{gui}_t$, are

$$E\,[C_m(\varepsilon^{man}_t) + C_g(E\omega^{gui}_t)] = E\,\{C_m[m[e_{1t} + (1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}_t - \kappa\, E\omega^{gui}_t - \gamma] + C_g(E\omega^{gui}_t)\}.$$

If $E\omega^{gui}_t$ is chosen to minimize expected costs, the first order condition in $E\omega^{gui}_t$ is

$$\begin{aligned} d\,E\,[C_m(\varepsilon^{man}_t) + C_g(E\,\omega^{gui}_t)] / d\,E\,\omega^{gui}_t &= E\,\{d\,[C_m(\varepsilon^{man}_t) + C_g(E\,\omega^{gui}_t)] / d\,E\,\omega^{gui}_t\} \\ &= E\,[C'_m\,(\partial\varepsilon^{man}_t / \partial\omega^{gui}_t) + C'_g] = 0 = [\varphi\,\kappa\,(1/2)\,E\,C'_m\,(\varepsilon^{man}_t) + C'_g\,(E\,\omega^{gui}_t)], \end{aligned}$$

where $(\partial\varepsilon^{man}_t / \partial\omega^{gui}_t) = -\,\varphi\, m'\,\kappa = \varphi\,(1/2)\,\kappa > 0$, $m' = -\,(1/2)$ in the range $(X^*_t - FX_t) > c_1 < 0$ in Figure 2 and $\varphi > 0$ is the probability of being in this range. The second order condition is

$$\begin{aligned} & d\,[\varphi\,\kappa\,(1/2)\,E\,C'_m\,(\varepsilon^{man}_t) + C'_g\,(E\,\omega^{gui}_t)] / d\,\omega^{gui}_t \\ &= E\,[\varphi\,\kappa\,(1/2)\,C''_m\,(\varepsilon^{man}_t)\,(\partial\varepsilon^{man}_t / \partial\omega^{gui}_t) + C''_g\,(E\,\omega^{gui}_t)] = [-\,\varphi^2\,\kappa^2\,(1/2)^2\,E\,C''_m + E\,C''_g] < 0, \end{aligned}$$

where $E\,C''_m$, $E\,C''_g > 0$. The manager knows e_{1t}, $\kappa\, E\omega^{gui}_t$, γ, which are fixed from his viewpoint.

Expand the expected marginal costs around zero, using the first two derivatives, C' and C'', and noting that $C'_m(0) = 0 = C'_g(0)$. Then,

$$\begin{aligned} E\,C'_m &= C''_m(0)\,E\,m(e_{1t} + (1 - \kappa)\,e'_{1t} + e_{2t} - \omega^{mis}_t - \kappa\,E\,\omega^{gui}_t - \gamma), \\ &= C''_m(0)\,E\,m[(1 - \kappa)\,e'_{1t} + e_{2t} - \omega^{mis}_t] + C''_m(0)\,\varphi\,(e_{1t} - \kappa\,E\,\omega^{gui}_t - \gamma), \\ E\,C'_g &= C''_g(0)\,E\,(E\,\omega^{gui}_t), \end{aligned}$$

Thus, from the FOC

$$[\varphi\,\kappa\,(1/2)\,E\,C'_m\,(\varepsilon^{man}_t) + C'_g\,(E\,\omega^{gui}_t)] = 0$$

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[18] If the firm never uses guidance, the cost of zero guidance are $C^{ng}_g(0) = 0$. If the firms sometimes uses guidance, the cost of $\omega^{gui}_t = 0$ in a given period is likely $C_g(0) > 0$. On the one hand, if $C^{ng}_g(0)$ and $C'_g(0)$ are sufficiently greater than $C_m(0)$, $C'_m(0)$, the firm omits guidance and uses only earnings management to influence forecast errors. On the other hand, if $C_m(0) \approx C_g(0)$, $C'_g(x) \approx C'_m(x)$ and C''_m, $C''_g >> 0$, then the firm minimizes $E\,[C_m(\varepsilon^{man}_t) + C_g(\omega^{gui}_t)]$ by on average using ω^{gui}_t to deal with e_{1t} and using ε^{man}_t to deal with e_{2t}. Note that the firm knows $e_{1,t}$ before FX_t is announced, and thus can use ω^{gui}_t to handle $e_{1,t}$. The firm knows $e_{2,t}$ only after FX_t is announced, and thus cannot use ω^{gui}_t to handle $e_{2,t}$. The firm could, however, use ε^{man}_t to handle both $e_{1,t}$, $e_{2,t}$.

$= \varphi\, \kappa\, (1/2)\, C''_m(0)\, E\, m[(1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}{}_t]$

$+ \varphi\, \kappa\, (1/2)\, C''_m(0)\, (e_{1t} - \kappa\, E\, \omega^{gui}{}_t - \gamma) + C''_g(0)\, (E\, \omega^{gui}{}_t),$

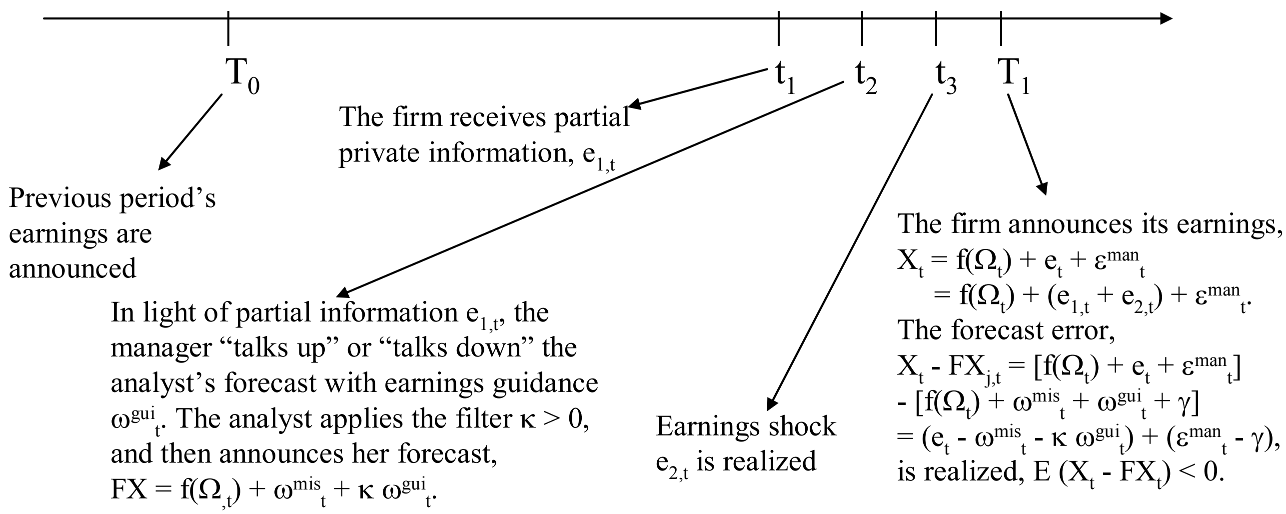
$E\, \omega^{gui}{}_t\, [C''_g(0) - \varphi\, \kappa\, (1/2)\, C''_m(0)] = - \varphi\, \kappa\, (1/2)\, C''_m(0)\, \{E\, m[(1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}{}_t] + (e_{1t} - \gamma)\},$

and

$E\, \omega^{gui}{}_t = - \varphi\, (1/2)\, \kappa\, C''_m(0)\, \{E\, m[(1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}{}_t] - \varphi\, (e_{1t} - \gamma)|\, /\, [C''_g(0) - \varphi\, \kappa\, (1/2)\, C''_m(0)].$

Note that, $\varphi\, \kappa\, (1/2)\, C''_m(0), C''_g(0) > 0$. If $C''_g(0) \approx C''_m(0)$, then $[C''_g(0) - \varphi\, \kappa\, (1/2)\, C''_m(0)] > 0$ because $0 < \varphi, \kappa < 1$. From $- \varphi\, \kappa\, (1/2)\, C''_m(0) < 0$, it follows that $\mathrm{sgn}(E\, \omega^{gui}{}_t) = - \mathrm{sgn}\{[E\, m[(1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}{}_t] - \varphi\, (e_{1t} - \gamma)]\}$. Further, from $E\, m[(1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}{}_t] < 0$, it follows that if $(e_{1t} - \gamma)$ is not too small in algebraic value, then $E\, \omega^{gui}{}_t > 0$, but if $(e_{1t} - \gamma)$ is small enough in algebraic value, so that $0 < \{- e_{it} + [E\, m[(1 - \kappa)\, e'_{1t} + e_{2t} - \omega^{mis}{}_t] + \varphi\, \gamma]\, /\, \varphi\}$, then $E\, \omega^{gui}{}_t < 0$.

Figure 1. Earnings Management, Earnings Guidance and the Forecast Error



Notes:

Analyst j forms noisy rational expectations, $E_{ana} X^*_t = f(\Omega_t) + \omega^{mis}_{j,t}$. X^*_t is true underlying earnings, E_{ana} is the analyst's expectations operator and ω^{mis}_t is a misestimate, a random deviation from the true rational expectations forecast.

In light of partial private information the firm receives before the analyst's forecast, the manager "talks up" or "talks down" the analyst's forecast by providing earnings guidance $\omega^{gui}_t = e_{1,t} + e'_{1,t}$, where $e'_{1,t} \sim N(0, \sigma^2_{e'1})$ is hand trembling or miscommunication.

The analyst accepts guidance, filters it with $1 > \kappa > 0$, and adds $\kappa\, \omega^{gui}_t$ to her expectation, giving $E_{ana} X^*_t = f(\Omega_t) + \omega^{mis}_t + \kappa\, \omega^{gui}_t$. The analyst sets her forecast $FX_t = E_{ana} X^*_t + E_{ana} \varepsilon^{man}_t = E_{ana} X^*_t + \gamma$, where ε^{man}_t is earnings management, $E_{ana} \varepsilon^{man}_t = \gamma < 0$, due to the **manager's** acquiescence in occasional large negative forecast errors.

The firm manages earnings according to $\varepsilon^{man}_t = m(X^*_t - FX_t)$, $m(0) = 0$, $m'(0) < 0$, and acquiesces in $m(X^*_t - FX_t) = 0$ for $(X^*_t - FX_t) < c < 0$. The firm sets guidance ω^{gui}_t before it knows FX_t, but knows FX_t when it sets ε^{man}_t and thus X_t. The firm announces earnings $X_t = f(\Omega_t) + e_t + \varepsilon^{man}_t$. The forecast error is $(X_t - FX_t) = f(\Omega_t) + e_t + \varepsilon^{man}_t - [f(\Omega_t) + \omega^{mis}_t + \omega^{gui}_t + \gamma] = [(e_{1,t} + e_{2,t}) + \varepsilon^{man}_t - \omega^{mis}_t - \omega^{gui}_t - \gamma)]$, and its unconditional expectation is $E(X^*_t - FX_t) < 0$.

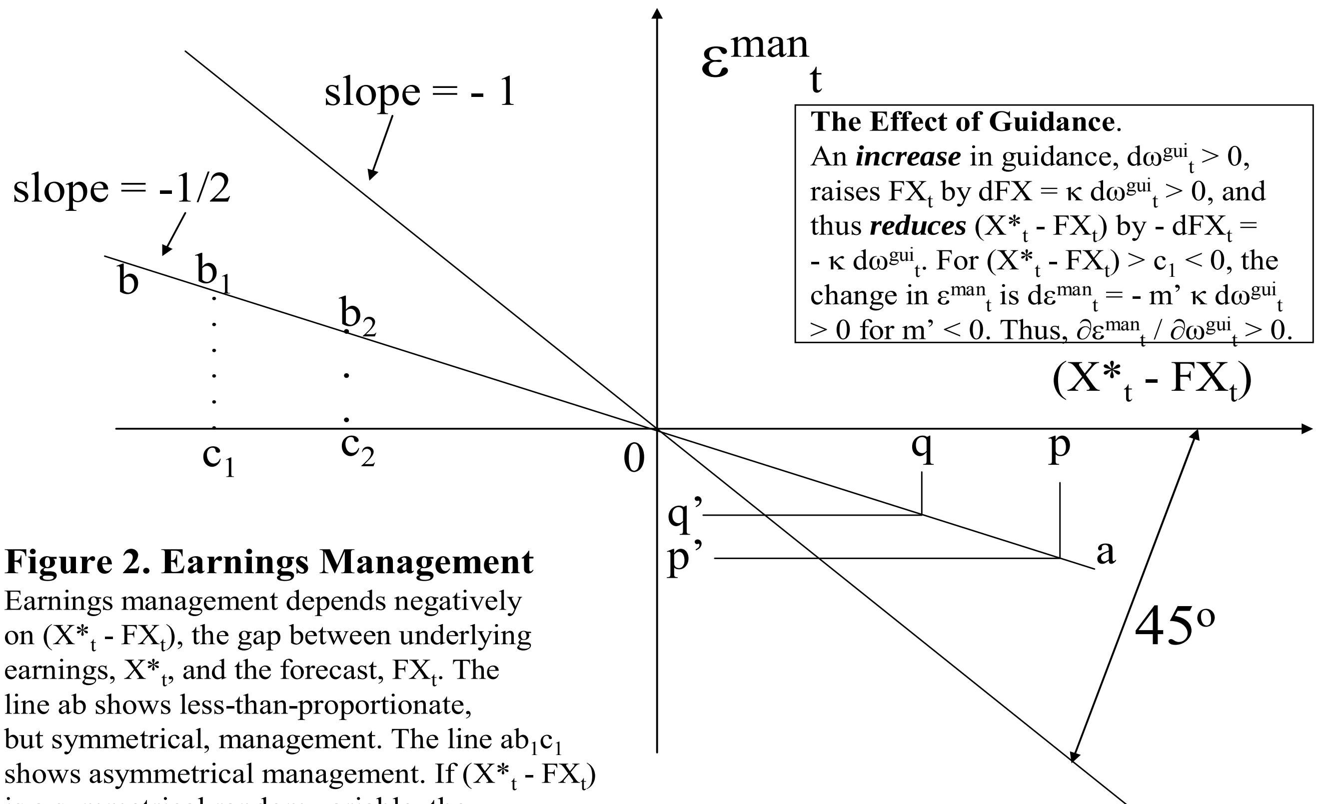
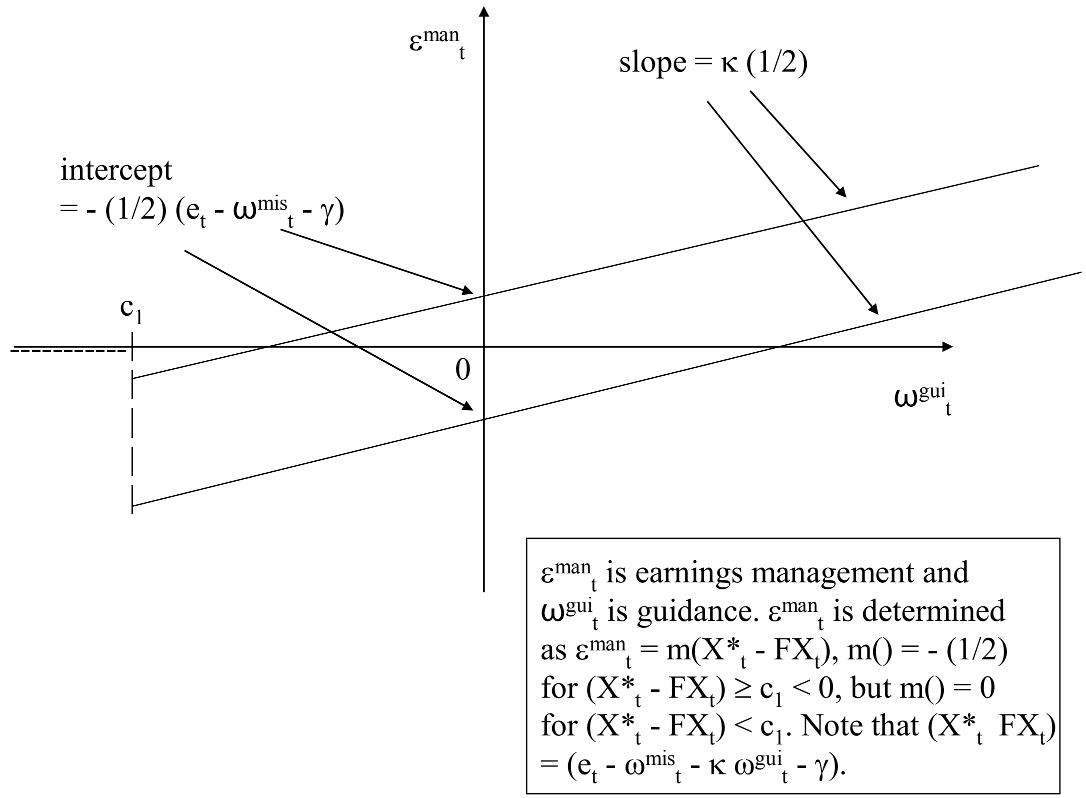


Figure 2. Earnings Management

Earnings management depends negatively on $(X^*_t - FX_t)$, the gap between underlying earnings, X^*_t, and the forecast, FX_t. The line ab shows less-than-proportionate, but symmetrical, management. The line ab_1c_1 shows asymmetrical management. If $(X^*_t - FX_t)$ is a symmetrical random variable, the curve ab_1c_1 (or ab_2c_2) implies $E\ \varepsilon^{man}_t = \gamma < 0$.

Figure 2.a


ε^{man}_t
slope = κ (1/2)
intercept
$= - (1/2)\,(e_t - \omega^{mis}_t - \gamma)$
c_1
0
ω^{gui}_t
ε^{man}_t is earnings management and ω^{gui}_t is guidance. ε^{man}_t is determined as $\varepsilon^{man}_t = m(X^*_t - FX_t)$, $m() = - (1/2)$ for $(X^*_t - FX_t) \geq c_1 < 0$, but $m() = 0$ for $(X^*_t - FX_t) < c_1$. Note that $(X^*_t \; FX_t)$ $= (e_t - \omega^{mis}_t - \kappa\, \omega^{gui}_t - \gamma)$.

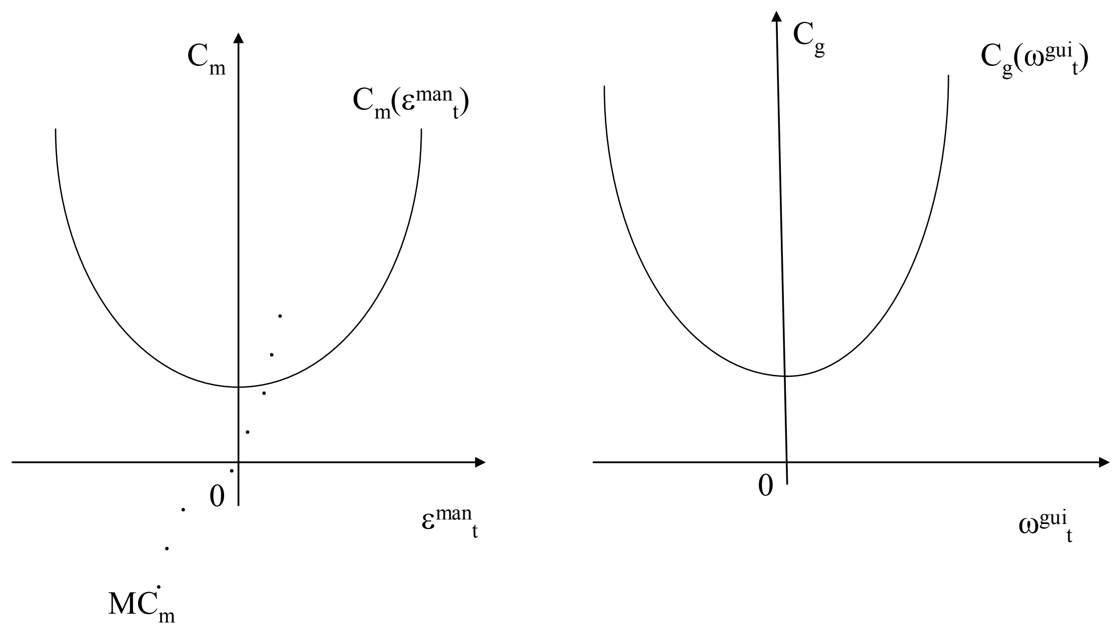


Figure 4. Costs of earnings management, $C_m(\varepsilon^{man}_t)$, and guidance, $C_g(\omega^{gui}_t)$. The dotted curve is marginal cost for earnings management.