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Performance, growth and earnings management

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Abstract We study the relationship between the amount of managed earnings and firms' earnings performance and expected growth in a reporting model, where managers manipulate earnings to influence the valuation of firms' equity while bearing a cost that is increasing and convex in the amount of managed earnings. In the unique revealing equilibrium to the model, firms with higher performance and growth over-report earnings by a larger amount because price responsiveness increases with earnings performance and growth. And earnings quality, defined as the proportion of true economic earnings in total reported earnings, increases with earnings performance but decreases with earnings growth. We conduct empirical tests on a large sample and a restatement sample using different proxies for earnings management. Results from the large sample tests support our predictions while results from the restatement sample tests are mixed. Our study provides an alternative explanation to the positive relationship between discretionary accruals estimated from the Jones model and firms' performance and growth.

Keywords Earnings management · Rational expectation · Earnings performance · Growth

JEL Classification G3

Earnings management has attracted extensive research in the accounting field.[1] Most research in this area requires a proxy for the amount of managed earnings.[2] Typically researchers use empirical models to decompose total accruals into non-discretionary accruals and discretionary accruals. Discretionary accruals are then used as a proxy for earnings management and are linked to different potential incentives[3] or used as a measure of earnings quality.

The most widely used discretionary-accruals models are variations of the Jones model.[4] Prior empirical studies find that discretionary accruals estimated from these Jones models are correlated with performance and expected future earnings growth. Dechow, Sloan, and Sweeney (1995) and Kasznik (1999) document that discretionary accruals estimated from the Jones model are positively related to return of assets. McNichols (2000) further shows that discretionary accruals from both the Jones model and the modified Jones model are positively related to analysts' forecasts of long-term earnings growth. The conventional explanation for the evident relationship between discretionary accruals and firms' performance and growth is that Jones models are mis-specified in identifying discretionary accruals. However, to draw the conclusion of mis-specification from the existence of the relationship, an implicit assumption is required, that is, the amount of managed earnings should have no relationship with firms' performance or growth. So far, no theoretical or empirical research has studied the validity of this assumption. As noted in Abarbanell and Lehavy (2003b, p. 30), this assumption "can be challenged on logical grounds and, somewhat circularly, on the grounds that no evidence in the empirical literature supports this assumption."[5]

The research objectives of our paper are twofold. First, we suggest a rational setting in which the optimal amount of managed earnings is positively related to firm's performance and growth. In our model, managers manage earnings to influence stock price. The endogenously determined market response to reported earnings is more sensitive for firms with higher

[1] For detailed discussions of earnings management literature, see Healy and Wahlen (1999), Kothari (2001), Schipper (1989), and other review papers.

[2] An exception is Burgstahler and Dichev (1997b), who examined the distribution of reported earnings and used the discontinuity around specific thresholds as evidence of earnings management. However, this research method cannot identify the amount of managed earnings (see Healy & Wahlen, 1999).

[3] Popular incentives include market based incentive, debt covenant, bonus and political costs. See, for example, Defond and Jiambalvo (1994), Rees, Gill, and Gore (1996), Teoh, Welch, and Wong (1998a, b) etc.

[4] These include the time-series Jones model (Jones, 1991), cross-sectional Jones model (DeFond & Jiambalvo, 1994) and modified Jones model (Dechow, Sloan, & Sweeney, 1995).

[5] Abarbanell and Lehavy (2003b) suggested that the amount of managed earnings could be positively relates to firm's performance and growth and used it to explain the asymmetry in the distribution of analysts forecast errors. Dechow et al. (1995) and Kothari, Leone, and Wasley (2005) also recognized the possibility. However the above studies do not provide analytical explanations or direct empirical evidence for the existence of the relationship.

performance or growth potential, which gives managers of these firms greater motivation to overstate earnings. Second, by conducting empirical tests on two data sets using different proxies for the amount of managed earnings, we provide evidence supporting our theory.

We study a one-period model in which there is a risk-neutral manager and a competitive and risk-neutral equity market. After privately observing the economic (true) earnings, the manager chooses the level of reported earnings to maximize his utility, which is an increasing function of the equity's market value. The amount of managed earnings is defined as the difference between reported earnings and true earnings.[6] The manager has to bear a cost for earnings management and the cost is increasing and convex in the amount of managed earnings. Without the ability to observe the true earnings, the market evaluates the firm's equity according to its expectation of the true earnings conditional on the observed reported earnings.

In the unique revealing equilibrium in our model, the manager truthfully reveals the economic earnings when it is less than 0 and manipulates earnings upwards when the economic earnings is positive. The firm's equity price is 0 when reported earnings is negative and when the reported earnings is positive, the equity price is a strictly increasing function of reported earnings. Since the economic earnings is the only private information that the manager has, in equilibrium the market fully filters out the earnings management and correctly prices the firm's equity.

Because of the convexity of the cost function, it would be much more costly for managers with higher reported earnings to maintain the same proportion of managed earnings. The market rationally expects this and the sensitivity of price response to reported earnings (price responsiveness hereafter) increases with reported earnings, which induces managers with higher economic earnings to overstate earnings by a larger amount. However, the speed of increase in managed earnings in equilibrium is less than the speed of increase in reported earnings. As a result, there are less managed earnings in each extra dollar of reported earnings, which in turn justifies the increasing price responsiveness. In our equilibrium, the amount of managed earnings also increases with the firm's expected earnings growth. Because the market uses a dividend discount model to value the firm's equity, firms with higher growth rate have higher price responsiveness which triggers larger amount of managed earnings. Our predictions are consistent with evidence from Abarbanell and Lehavy (2003a), where the authors find that firms with higher stock price sensitivity to earnings news (proxy using higher level of stock recommendations) have higher unexpected (discretionary) accruals.

We propose a new definition of earnings quality: the proportion of true economic earnings in total reported earnings. In prior studies, the amount of managed earnings is widely used as the measure of earnings quality. Under

[6] The definition of amount of managed earnings is the same as ''reporting bias'' in Fischer and Verrecchia (2000). Our definition of is also consistent with that in Schipper (1989), who defines earnings management as disclosure management that intervenes in the external financial reporting process with the intention of obtaining some private gain.

this definition, firms with lower earnings quality (i.e. with larger amount of managed earnings) may actually have higher price responsiveness because a seemingly large amount of managed earnings may only represent a small percentage of total reported earnings. Our definition provides a new perspective of earnings quality, which is more consistent with price responsiveness. Our model predicts that earnings quality increases with firms' reported earnings and decreases with firms' expected growth.

We conduct empirical tests based on two samples using different proxies for the amount of managed earnings. The first sample contain all firm years during 1988–2001 with necessary information and the proxy for the amount of managed earnings is discretionary accruals from Kang and Sivaramakrishnan's (1995, hereafter KS) model. KS (1995) model uses additional controls over non-discretionary accruals compared with Jones models without directly controlling reported earnings or expected growth. KS (1995) also enables us to use a large sample to test our predictions about earnings quality, which has never been tested before. The second proxy for the amount of managed earnings is the restated amount of earnings (reported earnings announced initially—reported earnings restated) hand-collected from restatement announcements identified as results of accounting irregularities. Because the restated amount usually comes from investigations conducted by outside auditors, the SEC, or firms' internal auditors, it is unlikely to have the same type of measurement errors caused by model mis-specification. Tests on both samples provide consistent results that the earnings performance positively relates to the amount of managed earnings and earnings quality. However, for the effects of expected growth, we find mixed results. Results from the large sample are consistent with our prediction that the expected growth is positively related to the amount of managed earnings and negatively related to earnings quality. However, results from the smaller restatement sample concerning growth are not significant, possibly due to the lack of test power.

Our paper has implications for empirical studies in earnings management. Our model suggests that firms' performance and growth are important factors affecting the amount of managed earnings. Fully filtering out the discretionary accrual associated with performance or growth will not only reduce the test power and but also bias downwards the amount of managed earnings for firms with better performance or higher growth. Our model suggests whether the performance or growth should be controlled depends on research objectives. If the research objective is to measure the level of earnings management and link it to market efficiency or compare earnings management level among individual firms within a sample (e.g. all IPO firms), eliminating the effect of performance or growth may result in a biased measure. If the research objective is to test whether some events (e.g. IPO or SEO) trigger higher level of earnings management, controlling firms' performance and growth would be necessary. As illustrated in Dechow et al. (1995), not controlling performance and growth would cause omitted variables problem even if performance and growth affect earnings management.

We organize the rest of the paper as follows. Section 1 discusses related theoretical literature. Section 2 describes the setup of the model and proves the existence of the equilibrium. Section 3 derives the properties of earnings management and earnings quality through static analysis. Section 4 empirically tests the predictions of the model. In Section 5, we conclude the paper.

1. Related theoretical literature

In this section, we briefly discuss prior theoretical models related to our study. Related empirical studies will be discussed when we present the comparative static results.

We follow the line of research where earnings management is studied in a valuation setting,[7] in which reported earnings is used for valuation purposes and managers' compensation is linked to firms' equity value. In these studies, the form of managers' compensation contract is taken as exogenously given and rational expectations of both managers and the market are considered. Stein (1989), using a stable state ''signal jamming'' model,[8] demonstrates that even a fully efficient market could lead managers who care about stock price to behave myopically. We inherit the ''signal jamming'' framework, in which the market is not fooled but the manager is ''trapped'' in earnings management. We drop the assumption of constant earnings management and demonstrate that in equilibrium with rational expectation, the amount of managed earnings could be correlated to firm's earnings and perceived future growth.

Our paper also relates to Abarbanell and Lehavy (2003), Fischer and Stocken (2004), and Fischer and Verrecchia (2000). Fischer and Verrecchia study the relation between earnings management and value relevance of reported earnings. Fischer and Stocken focus on the influence of the speculator's information on earnings management behavior and stock price efficiency. Our model is different from theirs in three ways. First, they introduce a noise to the motivation of earnings management, so the equity market could not fully back out the amount of managed earnings. In contrast, there is no uncertainty concerning managers' objective function in our model. Second, we drop their assumption of a linear pricing function and instead assume that managers have limited liability. This enables us to examine the relation between the amount of managed earnings and firm's performance. Third, we have different interpretations for price responsiveness. Price responsiveness in our model captures the quality of reported earnings and reflects the market's rational ''backing out'' process, while in Fischer and Verrecchia (2000) the price responsiveness reflects value relevance of reported earnings. Abarbanell and Lehavy (2003a) study the effect of stock price sensitivity on the incentives of

[7] Another line of literature studies earnings management in an agent-principle problem setting. Representative work includes Arya, Glover, and Sunder (1998), Demski (1998), Demski, Frimor, and Sappington (2004), Dye (1988), Evans and Sridhar (1996), and Liang (2004).

[8] Signal jamming model has also been employed in Fudenberg and Tirole (1986) and Holmstrom (1982).

earnings management. They present an intuitive model, which considers the existence of earnings targets. Our model couldn't address the issue of earnings targets, however we incorporate the rational expectation from both the market and the manager in a more rigorous setting.

Our model adds to a group of one-period earnings models.[9] Like other models using the one-period framework, our model cannot address earnings management with inter-temporal nature such as earnings smoothing, the reversal of accruals, and reputation maintenance incentives.[10] However, not all earnings management is inter-temporal in nature. For instance, both theoretical and empirical studies indicate that managers use classification shifting to boost the core earnings.[11] Unlike accrual management or the manipulation of real activities, classification shifting only affects the earnings of a single period. In addition, even though the reversal of accounting manipulations is often assumed, we do not really know how long it takes. Empirical studies (Leone & Horn, 1999; Murphy & Zimmerman, 1993; Pourciau, 1993) document that negative discretionary accruals often occur after management turnovers, which implies that managers may be able to manipulate earnings upwards without a full reversal throughout their tenure with the company.[12]

Another limitation of our model is that it doesn't provide explanations for the downward earnings management. In our one-period model, because manager would be better off from higher stock price, they have no incentives to manage earnings downwards. Models considering inter-temporal earnings management provide rationales for downward earnings manipulation. Our model applies to cases when firms face a clear motivation to inflate reported earnings, for example, in periods before firms' SEO, IPO, and stock acquisitions or before the execution of managers' options. Managers may need to manipulate down the reported earnings to rebalance the accrual, but it is not likely to happen in those periods. Dechow et al. (1995) find that firms with negative reported earnings have negative discretionary accruals. We would like to point out that all variations of the Jones model use the error term of an OLS regression as the proxy for discretionary accruals, which assumes implicitly that within every industry-year (quarter), the average discretionary accruals is 0. Therefore, discretionary accruals could only be a relative

[9] Such models include Baiman, Evans, and Noel (1987), Demski and Dye (1999), Evans and Sridhar (1996), Fischer and Verrecchia (2000), Guttman, Kadan, and Kandel (2004), Newman and Sansing (1993), and Verrecchia (1986).

[10] A group of studies focus on the managers' inter-temporal earnings management. These study include Chaney and Lewis (1995), Fudenberg and Tirole (1995), Kirschenheiter and Melumad (2002), Ronen and Sadan (1985), Sankar and Subramanyam (2001), and Trueman and Titman (1988).

[11] McVay (2005) shows that managers shift expenses from core expenses (cost of goods sold and selling, general, and administrative expenses) to special items. Bradshaw and Sloan (2002) find evidence that managers exclude some corporate expenses when releasing street earnings. Dye (2002) studies a model of ''classifications manipulation'' in which accounting reports consist of one of two binary classifications.

[12] The negative discretionary accrual may also come from the ''reserve creating'' behavior of the new managers.

measure of earnings management within a particular industry-year (quarter). When we have an observation with a negative discretionary accrual, we only know that the level of earnings management is below industry average. But we cannot tell whether the manager is manipulating upwards or downwards the firm's economic earnings.

2. The model

2.1. Model setup

Our model is a one-period game with two players: a risk-neutral manager of an all-equity[13] firm and a competitive, risk-neutral equity market. The firm yields economic earnings of $\tilde{x}$ for the period. $\tilde{x}$ is a random variable that is distributed over $(-\infty, +\infty)$. If the firm is not liquidated at the end of the period, we assume that its future economic earnings exhibit a constant growth rate, i.e. $x_{t+1} = (1+g)x_t$.[14] During the period, the manager privately observes the realization of the firm's true economic earnings x, and then releases reported earnings r. The manager is not restricted to truthfully reveal the true economic earnings. We define the amount of managed earnings as the difference between reported earnings and firm's economic earnings: $m = r - x$. The equity market cannot observe the realized economic earnings therefore prices the firm's equity based on the reported earnings. We assume that the firm's liquidation value is 0. Because of the limited liability of equity holders, the equity market prices the firm as:

$$p[r] = \text{Max}[E[v|r], 0]$$

where $E[v|r]$ is the expected firm value when the firm is not liquidated. If at the end of the period $E[v|r]<0$, the firm will be liquidated and equity holders will get nothing.

When the equity market is perfectly competitive and risk-neutral, $E[v|r]$ is the rational expectation of the discounted value of all future cash inflows, conditional upon the reported earnings r:

$$E[v|r] = \frac{E[\tilde{x}|r] \times (1+d)}{d-g}$$

where $E[\tilde{x}|r]$ is the expected economic earnings conditional on reported earnings of r, d is the firm's cost of capital and g is the perceived sustainable growth rate of earnings and $d>g$.

[13] Assuming the firm is an all-equity firm is just for simplicity. Our model and analysis can easily extend to firms with debt.

[14] In our model, economic earnings x refers to firms' core earnings, which would reoccur with a constant growth rate. x does not include extraordinary items.

We assume that the manager benefits from a higher stock price and bears a cost when $r \neq x$. For every value of x, the manager chooses a level of r to maximize the following objective function:

$$\underset{r}{\text{Max}}\ a\hat{p}(r) - c(r-x)^2$$

where $a\hat{p}(r)$ represents the manager's benefit by reporting r and we refer a as the ''compensation coefficient.'' In this paper, we set $a>0$, because on average managers benefit more from a higher stock price. For instance, managers would try to boost the stock price before IPO, SEO or before stock acquisitions if their interest lies with the existing shareholders'.[15] Also if managers' compensation package includes stock options or stock holdings, a higher stock price grants him higher compensation for that period.[16] $\hat{p}(r)$ is the pricing function that the manager expects the market would use.

$c(r-x)^2$ represents the cost that the manager has to bear when reported earnings r differs from x. The cost of earnings management could be resources and time spent on managing earnings. Managers also have to face the potential reputation loss, financial penalty, and legal liability, in case authorities discovered the earnings management. We adopt a quadratic cost function to capture the feature that both the cost and the marginal cost of earnings management are increasing in the amount of managed earnings. The convexity of the cost function is essential to the results of our model. And we feel that this assumption is reasonable. First, given the materiality principle, only those ''significant'' earnings management would attract auditors' or regulator's attention, which indicates the probability of being detected is convex in the amount of managed earnings. Beneish (1997) finds that firms within the top deciles of total accruals identified 59 of the 64 GAAP violators of their sample. Second, even the probability of being detected is simply increasing but not convex in the amount of managed earnings, the cost function could still be convex as long as the penalty of earnings management is positively related to the amount of managed earnings. This is consistent with the evidence in Palmrose, Richardson, and Scholz (2004), who document that the market return around restatements is positively related to the restated amount. Third, with the increase of earnings management, the available accounting tools become less; therefore more resources and time are needed to manage the same amount of

[15] For instance, Teoh et al. (1998a, b) found that managers manage earnings up prior to IPO and SEO, and Erichson and Wang (1999) documented earnings management before stock mergers. Managers sometimes will benefit from lower stock price, as in management buyout or stock repurchase. Our model does not apply to those situations.

[16] For studies on the association between earnings management and management stock option or stockholdings, see Bergstresser and Philippon (2004), Berns and Kedia (2003), and Cheng and Warfield (2005). According to Bergstresser and Philippon, the median exposure of CEO wealth to firm stock price tripled between 1980 and 1994, and doubled again between 1994 and 2000. Core, Guay, and Verrecchia (2003) also document the same trend.

earnings. Forth, the quadratic cost function is widely used in the literature (e.g. Fischer & Stocken, 2004; Fischer & Verrecchia, 2000).

2.2. The equilibrium

The equilibrium of our model consists of a continuous reporting function $r^*(x)$ for the manager and a continuous pricing function $p^*(r)$ for the market such that three conditions are satisfied:

First the manager's choice of reporting function must maximize the objective function given his or her expectation of how the market responds to the report:

$$r^*(x) \in \arg\max(a\hat{p}(r) - c(r-x)^2)$$

The first order condition of the manager's objective function is:

$$\text{FOC} : a\hat{p}(r) - 2c(r-x) = 0 \tag{1}$$

Second, for a certain level of reported earnings, the market forms a conjecture about the amount of managed earnings $\hat{m}(r)$ and prices the firm accordingly:

$$p^*(r) = \text{Max}\left[\frac{1+d}{d-g} \times (r - \hat{m}(r)), 0\right] \tag{2}$$

Finally both the manager's and the market's conjecture are rational:

$$\hat{p}(r) = p^*(r) \tag{3}$$

and

$$\hat{m}(r) = m^*(r) = r - x^*(r) \tag{4}$$

where $x^*(r)$ is the inverse function of $r^*(x)$.[17] We refer $m^*(r)$ as manager's earnings management function.[18]

Proposition 1 *There is a unique revealing equilibrium to the game. The pricing function has the following form*:

[17] For now we assume the relation between r and x is one to one. Later we are going to show that this assumption is satisfied in the revealing equilibrium.

[18] The manager observes x, chooses an amount of managed earnings m and reports earnings as r. We express m as a function of r because mathematically it is easier to get the expression of m in r and empirically r is observable.

$$p^*(r) = \begin{cases} \frac{a}{2cb^2}\left(e^{-\frac{2cb}{a}r} - 1\right) + \frac{r}{b}, \text{ when } r \geq 0; \\ 0, \text{ when } r<0; \end{cases} \tag{5}$$

And the earnings management function has the form of:

$$m^*(r) = \begin{cases} -\frac{a}{2cb}e^{-\frac{2cb}{a}r} + \frac{a}{2cb}, \text{ when } r \geq 0; \\ 0, \text{ when } r<0; \end{cases} \tag{6}$$

where $b = \frac{d-g}{1+d}$.

In equilibrium, the manager truthfully reveals the economic earnings when the economic earnings is less than 0 and manipulates earnings upwards when the economic earnings is positive. The firm's equity price is always 0 when reported earnings is negative, and when the reported earnings is positive, the equity price is a strictly increasing function of reported earnings. Because the true earnings is managers' only private information, in our revealing equilibrium the market fully filters out the amount of managed earnings and correctly prices the firm's equity.

First, it is easy to see that in a revealing equilibrium if the manager observes $x \leq 0$, he will truthfully reveal the true earnings as the reported earnings. This is because if he chose reported earnings $r \neq x$, in a separating equilibrium the equity market would fully expect this behavior and find out that $x \leq 0$ and price the equity as 0. The manager would be better off by reducing the amount of managed earnings to 0, because the cost of earnings management would be the lowest and the equity price couldn't be lower than 0.

If the manager observes $x \geq 0$, he or she chooses certain reported earnings r. From Eqs. 1 to 4 we have the following differential equation:

$$ap_r^{*\prime} + 2cbp^* - 2cr = 0 \tag{7}$$

We assume that reported earnings is continuous on $(-\infty, +\infty)$. Because we have proven that $r = x$ when $x \leq 0$, we have the initial condition:

$$p(r = 0) = 0. \tag{8}$$

In Appendix A, we prove that when $r \geq 0$, the pricing function in a revealing equilibrium has the unique solution as described in Eq. 5. Plug Eq. 5 back to Eq. 1, we get an expression for the amount of managed earnings in terms of reported earnings as described in Eq. 6.

3. Comparative static analysis

In this section, we conduct static analysis of the equilibrium. Specifically, we investigate how the firm's observable characteristics (reported earnings performance and perceived future earnings growth) relate to the amount of

managed earnings, earnings quality and price responsiveness to reported earnings.[19] Our analysis focuses on firms with positive reported earnings, because in the unique equilibrium, when reported earnings is negative the manager does not manage earnings and the price is always 0.

3.1. The amount of managed earnings

We first examine the relation between the amount of managed earnings and reported earnings. The amount of managed earnings is measured as in Eq. 6. Taking the first order derivative with respect to r, we get:

$$\frac{\partial m}{\partial r} = e^{-\frac{2cb}{a}r} > 0 \tag{9}$$

The above inequality implies that the amount of managed earnings will increase with reported earnings. In other words, for each extra dollar of reported earnings, part of it will be managed earnings. The underlying reason is that because of the convexity of the cost function, it will be more costly for the manager with higher level of reported earnings to keep the same proportion of managed earnings in it. This is rationally expected by the market, so price responsiveness ($ap'(r)$, which is also the marginal benefit of earnings management) increases with reported earnings in equilibrium. To make the marginal cost $2c(r - x)$ equal to the marginal benefit, the manager will choose a larger amount of managed earnings.

Let $\alpha = \frac{a}{2cb}$. If we take the derivative of m with respect to α, we get:

$$\frac{\partial m}{\partial \alpha} = 1 - \left(1 + \frac{r}{\alpha}\right)e^{-\frac{r}{\alpha}} > 0 \tag{10}$$

where $\alpha = a/(2cb)$, and $b = (d - g)/(1 + d)$.

Proof See Appendix A.

Equation 10 indicates that the amount of managed earnings increases with the compensation coefficient a, decreases with the cost coefficient c, and increases with the firm's perceived future growth rate g. The economic meaning is as follows: When the manager's compensation plan is more sensitive to the firm's stock price, or when the growth rate of the firm is higher (which causes stock price to be more sensitive to firm's reported earnings), the marginal benefit of earnings management is higher, which induces larger amount of managed earnings. In contrast, when the cost coefficient is higher, the

[19] We conduct comparative static analysis with respect to r, because first r is observable by the market and x is not; and second it is not easy to get an expression of the earnings management in terms of x. In equilibrium, when $r<0$, $x = r$. When $r>0$, we have an exponential pricing function, which is strictly increasing in reported earnings. Because $p = x/b$, x is also strictly increasing in r. Therefore, the implicit function linking x and r is one-to-one.

manager incurs higher marginal cost from earnings management, which forces him to decrease the amount of managed earnings.

We summarize the above properties about the amount of managed earnings in the following corollary:

Corollary 1 *The amount of managed earnings (1) increases with reported earnings*: $\partial m/\partial r \geq 0$; (2) increases with future earnings growth: $\partial m/\partial g \geq 0$; (3) increases with the sensitivity of managers' compensation to stock price: $\partial m/\partial a \geq 0$; and (4) decreases with the sensitivity of managers' cost to the amount of managed earnings: $\partial m/\partial c \leq 0$.

Corollary 1 predicts that the amount of managed earnings increases with reported earnings and future earnings growth. Extant empirical research has documented a positive relation between the firm's performance and discretionary accruals from Jones models (see Dechow et al., 1995; Kasznik, 1999; McNichols, 2000). McNichols (2000) also finds a positive relationship between firm's growth and discretionary accruals. The conventional explanation for the above phenomena is that Jones models are mis-specified in identifying non-discretionary accruals caused by performance increase or sales growth. Following researchers try to mitigate the mis-specification concern by adding more controls. For example, DeFond and Subramanyam (1998) control cash flows; Cheng and Warfield (2005) control earnings growth; Teoh et al. (1998a) match on industry and net income, while DeFond and Jiambalvo (1994) match on year and industry; Kasznik (1999) adjusts the median discretionary accruals with the same return on assets percentile; Kothari et al. (2005) propose to use performance matched control sample to adjust discretionary accruals.

However the conclusion of mis-specification in discretionary accruals is generally based on the assumption that the amount earnings management should have no relation with reported earnings or earnings growth. Our model provides an alternative explanation for the observed positive relationship, that is, when the rational manager maximizes his price-related compensation, and the market rationally adjust for the managed earnings, there exists a positive relation between earnings management and the reported earnings or future earnings growth.

Corollary 1 also predicts that the amount of managed earnings is positively related to the sensitivity of compensation to stock price. Gao and Shrieves (2002) find that earnings management is negatively related to salary and positively related to option and restricted stocks in the compensation plan. They also include measurement of the sensitivity of compensation to price changes and find a significant relationship with earnings management.

Corollary 1 also predicts that the amount of managed earnings is negatively associated with the sensitivity of managers' cost to the amount of managed earnings. Klein (2002) shows that the percentage of outsider directors on the firm's audit committee or board is negative related to the amount of managed earnings. This evidence is consistent with the prediction that a good monitor mechanism can impose higher cost to earnings management and help reduce

earnings management.[20] Becker, DeFond, Jiambalvo, and Subrammanyam (1998) document that firms with a big-6 auditor have smaller amount of managed earnings. Barton and Simko (2002) find that accumulated earnings management in the balance sheet constrains managers' ability to manage earnings.

3.2. The quality of reported earnings

In this section, we consider the relation between earnings quality and firm's reported earnings or growth. One commonly used definition of earnings quality is the difference between reported earnings and true earnings. According to this definition, firms with larger amount of managed earnings have lower earnings quality. However according to our model, even though firms with higher levels of true earnings choose a larger amount of managed earnings, their managed earnings is only a smaller percentage of total reported earnings (if everything else is the same). Since the price responsiveness is decided by the marginal percentage of true earnings in reported earnings, under the traditional definition firms with lower earnings quality (larger amount of managed earnings) would have higher price responsiveness.

Our arguments can be illustrated by a simple example. Assume there are two firms with the same total assets of 100. Firm A reports earnings as 20 while firm B reports earnings as 5. Then Firm A and B have ROA equal to .2 and .05 respectively. Let us say within the reported earnings of firm A, the amount of managed earnings is 2 while for firm B, 1.5 is managed earnings. From the level of earnings management, firm A has higher managed earnings. However, firm A has 10% of its earnings come from earnings management, while for firm B, 30% of its earnings come from earnings management. As illustrated above, the level of managed earnings may not be a good measure for earnings quality when the amount of managed earnings is positively related to reported earnings.

We define earnings quality as the proportion of true economic earnings in total reported earnings:

$$q = \frac{x}{r} = 1 - \frac{m}{r} = 1 - \left(-\frac{a}{2cb}e^{-\frac{2cb}{a}r} + \frac{a}{2cb}\right)/r \tag{11}$$

Under our definition, firms with higher percentage of managed earnings in total reported earnings have lower earnings quality. Our definition of earnings quality explicitly considers the relation between earnings management and reported earnings, and contrasts the part of managed earnings with the total

[20] NYSE and NASDAQ modified their requirements for audit committees in December, which now require that the listing firms have outsider directors at least on the audit committees. The new requirements respond to the SEC's call for improving the effectiveness of corporate audit committee in overseeing the financial reporting process.

earnings. This definition is consistent with the price responsiveness to reported earnings. In the following corollary, we provide the properties of the quality of reported earnings.

Corollary 2 *The quality of reported earnings measured by the proportion of true earnings in total reported earnings (1) increases with reported earnings*: $\partial q/\partial r \geq 0$; (2) decreases with future earnings growth: $\partial q/\partial g \leq 0$; (3) decreases with the sensitivity of managers' compensation to stock price: $\partial q/\partial a \leq 0$ and (4) increases with the sensitivity of managers' cost to the amount of managed earnings: $\partial q/\partial c \geq 0$.

Proof See Appendix A.

In equilibrium, both the marginal benefit and the marginal cost of earnings management increase with reported earnings. But the increasing speed of marginal benefit is lower than the increasing speed of marginal cost. Every additional dollar of increased reported earning contains a smaller amount of managed earnings than the dollar before. The proportion of managed earnings in total reported earnings decreases as reported earnings increases:

$$\frac{\partial m}{\partial r} = e^{-\frac{2cb}{a}r^*} < 1 \tag{12}$$

Researchers have also used the performance adjusted discretionary accruals as the measure of earnings quality.[21] If the amount of managed earnings increases with the reported earnings as illustrated in Corollary 1, this measure would overstate the earnings quality of firms with higher performance.

Earnings quality decreases with the compensation coefficient and expected future growth, because the marginal benefit of earnings management increases with the compensation coefficient and firm's growth. Moreover, because the marginal cost of earnings management increases with the cost coefficient, earnings quality increases with the cost coefficient.

3.3. Market response to reported earnings

In the revealing equilibrium, the market could unravel the exact amount of managed earnings. For \$1 increase in true earnings, the market would increase the stock price by \$1/b; but for \$1 increase in managed earnings, the market won't change its valuation of the firm's stock. Given that the proportional of true earnings in total reported earnings increases as reported earnings rises, we would expect a more sensitive market response to reported earnings (higher price responsiveness). This is formally stated in the first part of Corollary 3. Corollary 3 also summarizes the relation between price

[21] For example: Francis, Lafond, Olsson, and Schipper (2002). They use performance adjusted discretionary accruals as one of their measures of earnings quality.

responsiveness and future earnings growth, the compensation coefficient and the cost coefficient.

Corollary 3 *The sensitivity of market response to reported earnings, measured as the first order derivative of price function with respect to reported earnings, would (1) increase in reported earnings*: $\partial^2 p/\partial r^2 > 0$ (2) increase in future earnings growth: $\partial^2 p/\partial r \partial g \geq 0$ (3) decrease in the sensitivity of managers' compensation to stock price: $\partial^2 p/\partial r \partial a \leq 0$; (4) increase in the sensitivity of managers' cost to the amount of managed earnings: $\partial^2 p/\partial r \partial c \geq 0$;

In Corollary 2, we have shown that with the rise of the cost coefficient or a dropping of manager compensation coefficient, the proportion of managed earnings in reported earnings will decrease, which causes an increase in price responsiveness to reported earnings. Price responsiveness also increases with future earnings growth. Although higher growth rate causes higher level of earnings management, the market will still be more sensitive to earnings increase of a high-growth firm, because a small amount of true earnings increase today in a high-growth firm could bring lots of true earnings in the future.

The price function derived from our model is nonlinear and convex in reported earnings, consistent with empirical evidence in Burgstahler and Dichev (1997). Burgstahler and Dichev (1997) use a put option valuation model to explain the convexity. They argue that when earnings/book value is high, the firm will continue its current use of resources and earnings is more important in determining equity value; while when earnings/book value is low, the firm is more likely to exercise the option and adapt the assets to a more efficient usage, therefore book value becomes more important in determining equity value. Fischer and Verrecchia (1997) view equity as a call option. In their model, equity holders with limited liability capture all upwards potential of a positive movement in terminal value with limited downside risk, therefore their response to ''good'' news is greater to ''bad'' news. Veronesi (1999) studies a model in which risk-averse investors assess the firms' risk through past dividends pattern. He shows that investors' willingness to ''hedge'' against changes in the level of uncertainty makes them overreact to bad news in good times and under-react to good news in bad times, which makes the price of the asset more sensitive to news in good times than in bad times. Our model offers another potential explanation for the convexity of the price function: Firms with higher reported earnings also have higher earnings quality (lower percentage of managed earnings). When the market is efficient in expecting earnings management, the price responsiveness will be higher for firms with higher performance.

Our interpretation of the price responsiveness to reported earnings differs from that of Fischer and Verrecchia (2000), in which price responsiveness is used to measure earnings relevance (i.e. how much information about true earnings can be reflected in price). They assume a linear pricing function and demonstrate that when there is no uncertainty about managers' motivations, the market could back out the true earnings and the price responsiveness is a

constant. In our model, we drop the assumption of linear pricing function. We demonstrate that even when there is no uncertainty about managers' objective function and the market could fully back out the true earnings, the price responsiveness still varies with other factors, because the marginal proportion of true earnings in reported earnings varies with other factors.

4. Empirical tests

Our model provides several testable predictions about earnings management and earnings quality. Our empirical tests focus on the influence of performance or growth on the amount of managed earnings and earnings quality. Specifically we test the following two hypotheses:

Hypothesis 1 *The amount of managed earnings increases with reported earnings and expected future earnings growth;*

Hypothesis 2 *Earnings quality increases with reported earnings and decreases with expected future earnings growth.*

Prior empirical studies have provided supporting results for H1. However the existing results are consistent with both the conventional explanation (Jones models are mis-specified) and our rational expectation explanation. Our empirical tests try to distinguish these two explanations by using refined proxies for the amount for managed earnings. We carry out empirical tests on two samples with different proxies for the amount of managed earnings. The first sample contains all firm years during 1988–2001 with necessary information and the proxy for the amount of managed earnings is the estimated discretionary accruals from the KS (1995) model. KS (1995) mitigates the omitted variables, simultaneity and error-in-variable problems by (1) directly using costs of goods sold and other operating expenses as regressees; (2) employing either the standard IV method or Hansen's (1982) generalized moment of method (GMM). The authors claim that their model is more powerful and better specified than Jones models. The superiority of KS model is confirmed by Thomas and Zhang (2000), who compare KS model with other discretionary accruals detection models and find that KS provides the most precise estimations. If a positive relation between discretionary accruals from KS model and firms' performance and growth exists, it would lessen the concern of mis-specification. The second sample contains data from restatement announcements that are identified as the results of accounting irregularities between January 1, 1997 and June 30, 2002. The proxy for the amount of managed earnings is the restated amount of earnings hand-collected from the restatement announcements. Because the restated amount usually comes from investigations conducted by outside auditors, the SEC, or firms' internal auditors, it is unlikely to have the same type of measurement errors caused by

model mis-specification. If the positive relation between the restated amount and firms' performance and growth holds in the restatement sample, it would provide a strong support for our rational explanation.

Hypothesis 2 has not been tested before. Our empirical tests on Hypothesis 2 are also carried out in the two samples as described above. Since the mis-specification explanation does not predict the properties of earnings quality, any evidence consistent with Hypothesis 2 would support our rational expectation explanation.

Each proxy has advantages and disadvantages. The proxy from KS model enables us to employ a large sample, which increases the power of our tests. However we cannot rule out the possibility that the estimation of earnings management from KS (1995) model remains biased. The proxy from the restatement data is less subject to measurement error. However the sample is limited to firms that have restated before. Firms that have not been detected and those that manipulate earnings within GAAP are neglected. The restatement sample size is small and the testing power is weak. Though both proxies are imperfect, we gain more confidence if tests using two proxies provide consistent evidence.

4.1. Tests on the large sample

Our large sample combines data from Compustat and I/B/E/S. Financial data for estimating discretionary accrual are obtained from Compustat during 1988–2001. We require firms to satisfy the following selection criteria: (1) The firm is not a utility firm (SIC 4400–5000) or a financial institution (SIC 6000–6999); (2) The firm has price and shares outstanding data to calculate market value at the year end; and (3) There are at least 10 observations in the same industry, defined using two-digit SIC codes. Utilities firms are excluded because they are subject to regulation and financial institutions are excluded because their financial reporting environment differs from that of industrial firms. The requirement of market value ensures that firms are listed, so managers can benefit from the increase of market price through earnings management, as we assumed in the model. The third requirement ensures that we have enough observations for estimating discretionary accruals from KS model. We obtain long-term earnings growth forecasts from I/B/E/S as the proxy for expected earnings growth rates.

After the estimation of discretionary accruals, we restrict our sample to firms with positive net income. Our reasons for the restriction are as follows. First, according to the equilibrium in our model, when reported earnings is less than 0, the manager doesn't manage earnings up and the market price has 0 sensitivity to the change of reported earnings. Second, our predictions are made within the context when economic earnings is permanent and have a constant growth rate. According to the existing empirical evidence, when reported earnings is negative, they signal little content about the economic earnings. Hayn (1995) shows that negative earnings is transient while positive earnings is more persistent. Basu (1997) finds that negative earnings is more

likely to reverse. Third, when firms perform poorly, they may want to manage earnings down to take a big bath (see Kirschenheiter & Melumad, 2002), which is inconsistent with our assumption that managers have incentives to manipulate earnings upwards. Fourth, our model assumes that stock prices are decided by reported earnings. When the earnings is negative, the market prices are more related to book value instead of earnings (Collins, Pincus, & Xie, 1999). Finally, our definition of earnings quality requires reported earnings to be positive.

We use KS model to estimate the amount of managed earnings. Specifically, we run a regression using GMM in each year and two-digit SIC code category if there are 10 observations or more in that category. The dependent variable and independent variables in previous 2 years are used as instrumental variables for GMM estimation.

$$\frac{\mathrm{ACCL}_t}{\mathrm{TA}_{t-1}} = c_0 + c_1 \frac{\mathrm{REV}_t}{\mathrm{TA}_{t-1}} \left(\frac{\mathrm{ART}_{t-1}}{\mathrm{REV}_{t-1}} \right) + c_2 \frac{\mathrm{EXP}_t}{\mathrm{TA}_{t-1}} \left(\frac{\mathrm{OCAL}_{t-1}}{\mathrm{EXP}_{t-1}} \right) + c_3 \frac{\mathrm{GPPE}_t}{\mathrm{TA}_{t-1}} \left(\frac{\mathrm{DEP}_{t-1}}{\mathrm{GPPE}_{t-1}} \right) + \varepsilon_t^{22}$$

The amount of managed earnings is the error term from the model. Earnings quality is calculated as the negative of the amount of managed earnings divided by return of assets. Note our sample includes observations with negative discretionary accruals. Though our model only predicts positive earnings management, the structure of KS model implies that the discretionary accruals (as an error term) should have mean of zero. Therefore we use discretionary accruals from KS to measure the relative degree of earnings management instead of the actual amount of managed earnings.[23] Following McNichols (2000), we use long-term earnings growth forecasts[24] from I/B/E/S as the proxy for the expected future earnings growth.

Table 1 presents descriptive statistics of our sample. We have 13,164 observations from 1991 to 2001. The median of long-term earnings growth rate is 15.08%. The median of the amount of discretionary accruals is around 1% of total assets. ROA is around 7%. The median of earnings quality is around −14%, which means the median proportion of discretionary accruals in reported earnings is around 14%. Panel B presents correlation matrix between variables. EM is negatively related to EQ, which means higher earnings management firms have lower earnings quality. Although the correlation is strong (−.569), they are not the same. EQ explicitly considers the reported

[22] See appendix for the description of variables. Thomas and Zhang (2000) use KS model in pooled sample. We use cross-sectional version of KS, similar to cross-sectional version of Jones model. Our total accruals are calculated from statement of cash flow. Using balance sheet method does not change the results.

[23] If we exclude firms with negative discretionary accruals, our results are qualitatively the same but stronger.

[24] We use the median of long-term growth forecasts in the last month of each fiscal year.

Table 1 Descriptive statistics of the large sample

Year	No. of sample firms	EM earnings management	EQ earnings quality	ROA returns on assets	LG long-term growth forecast
Panel A. Description of variables by year					
1991	868	.01	−.19	.07	14.44
1992	863	.01	−.14	.07	14.75
1993	938	.01	−.08	.07	15.00
1994	1060	.00	−.04	.08	15.00
1995	1131	.01	−.07	.08	15.00
1996	1312	.01	−.10	.08	15.00
1997	1442	.01	−.13	.08	16.04
1998	1413	.01	−.14	.08	16.50
1999	1546	.01	−.12	.07	15.90
2000	1472	.02	−.21	.08	16.46
2001	1119	.02	−.30	.06	15.63
Whole sample	13,164	.01	−.14	.07	15.08

Panel B. Correlation between variables

	EQ	ROA	LG
EM	−.569	.059	.089
	(<.001)	(<.001)	(<.001)
EQ		.064	−.026
		(<.001)	(.003)
ROA			.291
			(<.001)

The samples consist of 13,164 firm year observations with sufficient data to estimate discretionary accruals using a cross-sectional version of KS (1995) model. The sample period cover 12 years from 1991 through 2001. Utility firms (SIC: 4400–4999) and financial firms (6000–6999) are excluded. The sample only includes firm years with positive net income. EM is the amount of managed earnings estimated from the KS (1995) model. EQ is earnings quality, defined as the negative of the proportion of managed earnings in net income. ROA is net income divided by total asset at the beginning of fiscal year. LG is analysts' forecasts of long-term earnings growth rates from I/B/E/S. Panel A presents median of each variable by year. Panel B presents the correlation between variables. We have winsorized the sample at 1 and 99% for each of the variables

earnings, and contrasts the managed earnings with the whole reported earnings. The correlations between EM and ROA or LG are both significantly positive, which is consistent with our hypotheses. The correlation between EQ and ROA is significantly positive and the correlation between EQ and LG is significantly negative, which is also consistent with our hypotheses.

Table 2 presents the results from regression of the level of earnings management or earnings quality on ROA and long-term growth. Hypotheses 1 and 2 predict that the amount of managed earnings should be positively related to ROA and future earnings growth while earnings quality should be positively related to ROA and negatively related to earnings growth. We find positive and significant ($P<.001$) coefficients on both ROA and earnings growth in regression (1), where the amount of managed earnings is the dependent variable. We also find a positive and significant ($P<.001$) coefficient on ROA and a negative and significant ($P<.001$) coefficient on long-term earnings growth in regression (2), where earnings quality is the

Table 2 The regression of EM or EQ on performance and growth-large sample

Independent variable	EM		EQ	
	Coeff.	*P*-value	Coeff.	*P*-value
Intercept	−.340	.049	−.271	<.001
ROA	3.994	<.001	3.297	<.001
LG	.079	<.001	−.019	<.001
Number of observations	13,164		13,164	
R-square	.89%		.61%	

The samples consist of 13,164 firm year observations with sufficient data to estimate a cross-sectional version of KS (1995) model. The sample period cover 12 years from 1991 till 2001. Utility firms (SIC: 4400–4999) and financial firms (6000–6999) are excluded. The sample only includes firm years with positive net income. EM is the amount of managed earnings estimated from the KS (1995) model. EQ is earnings quality, defined as the negative of the proportion of managed earnings in net income. ROA is net income divided by total asset at the beginning of fiscal year. LG is analysts' estimation of long-term earnings growth rates from I/B/E/S. We have winsorized the sample at 1 and 99% for each of the variables. For the regression (1) coefficients are presented as 100 times the original amount

dependent variable.[25] The results support both Hypothesis 1 and Hypothesis 2. As a robust check, we also run rank regressions and the results are qualitatively the same.

4.2. Tests on the restatement sample

Our restatement sample combines data from firms' restatement announcements, Compustat and I/B/E/S. Data on restatements is constructed based on the General Accounting Office (GAO)'s report: ''Financial Statement Restatements: Trends, Market Impacts, Regulatory Response, and Remaining Challenges.'' The GAO report includes a listing of 919 restatements that are identified as the results of accounting irregularities between January 1, 1997 and June 30, 2002. The types of accounting irregularities include so-called ''aggressive'' accounting practices, intentional and unintentional misuses of facts applied to financial statements, oversight or mis-interpretation of accounting rules, and fraud (see GAO-03-138 for detail description of definition and procedures). Prior studies have used the occurrence of this type of restatements as the evidence that firms committed earnings management.[26] In our paper, we use the restated amount (reported earnings announced initially—reported earnings restated) as the proxy for the amount of managed earnings.

The GAO database includes company name, ticker symbol, the date of the announcement, the entity that prompted the restatement, and the reason(s) for the restatement. However, it does not report the amount of restatements and

[25] For tests of earnings quality, we also use the cross-sectional version of Jones model (as the way used in Becker et al., 1998; DeFond & Jiambalvo, 1994; Subramanyam, 1996). We reach the same conclusions.

[26] For instance, see Agarwal and Chadha (2003), Beasley (1996), Desai, Hogan, and Wilkins (2004), Farber (2005), Richardson, Tuna, and Wu (2002), and Srinivasan (2005).

Table 3 Descriptive statistics of the restatement sample

	Firm-years affected	Announcements
Panel A: Data loss during the sample collection		
Number of firms from GAO's report		919
Firms not in CRSP		245
No restatement amounts found		390
Restatement unrelated to annual report		166
	228	118
The effects on earnings not identified	69	
The reported earnings is not positive or not available in Compustat	49	
The restated amount is positive	19	
Final sample	91	(67 firms)

Panel B: Descriptive statistics of variables

Variable	*N*	Mean	Median	SD	Min	Max
EM_Restated	91	.014	.006	.022	.001	.102
EQ_Restated	91	−.407	−.161	.632	−.001	−2.918
ROA	91	.059	.046	.055	.002	.255
LG	91	18.610	18.083	7.096	2.500	40.000

Panel C. Correlation between variables

	EQ_Restated	ROA	LG
EM_Restated	−.425 (<.001)	.209 (.047)	.111 (.297)
EQ_Restated		.275 (.008)	.044 (.677)
ROA			.214 (.042)

The sample consists of firm-years affected by restatement announcements identified between 1997 and 2002 as results of previous ''aggressive accounting'' practice. Based on GAO's report, we hand collect the available restated fiscal year and restated amount of earnings from the firms' restatement announcements on Lexis–Nexis. We require each observation to have a clearly specified amount of restated annual net income, positive reported earnings and negative earnings restatements (firms had managed earnings upwards.) Our final restatement sample consists of 91 firms years (67 firms). EM_Restated is defined as the restated amounts (reported earnings announced initially—reported earnings restated) divided by previous total assets, EQ_Restated is defined as the negative of the proportion of restated amount in initially stated net income, ROA is net income divided by total assets, LG is analysts' estimation of long-term earnings growth rates from I/B/E/S. To mitigate the problem of losing observations, we replace LG as industry median LG if the firm specific LG is not available. Panel A shows the reasons for data loss during the sample collection. Panel B shows the basic statistics for variables and Panel C presents the correlation matrix of our variables. All variables have been winsorized at top and bottom 3%

the financial periods on which the restatements affect. We search Lexis–Nexis for each restatement announcement included in GAO's report,[27] and identify the restated amount and the affected fiscal periods. We then merge the restatement data with Compustat to get necessary financial information.

[27] Using the Lexis–Nexis ''Guided News Search'' command and the ''News Wire'' database, we performed a keyword search using ''restate,'' ''restated,'' in the full text and the key word in the company's name in the headline. We further require the date of the news to be within 3 days around the announcement date from GAO's report.

During the data collection process, we notice that many firms do not have a definite amount of restatement; some restatements affect only quarterly data; some restatements affect revenues and/or expenses but not earnings.

Reasons for reduction of observations during the collection process are presented in Panel A of Table 3. We also require observations to have positive reported earnings and earnings decreasing restatements (firms had managed earnings upwards). The final sample includes 91 firm years with 67 different firms. We note that there are only 19 cases of earnings increasing restatement, in contrast to 91 cases with earnings decreasing restatement. This suggests that most of firms are managing earnings upwards, which is consistent with our assumption.

For the restatement sample, the proxy for the amount of managed earnings (EM_Restated) is defined as restated amount deflated by the beginning total assets, and earnings quality (EQ_Restated) is defined as negative of restated amount divided by initially reported earnings. We still use ROA as the proxy for firm performance and long-term earnings growth forecasts from I/B/E/S as the proxy for the future growth. To mitigate the problem of losing more observations, we use the 2-digit industry median of long-term earnings growth forecasts if firms' specific forecasts are not available. Panel B of Table 3 presents descriptive statistics for the restatement sample. We notice that the performance of the restated firms have lower performance (median of ROA = .046) compared to the previous sample (median of ROA = .070), inconsistent with our hypothesis that earnings management increases with performance. The earnings growth is higher in restated sample (median of LG = 18.08) than in the previous sample (median of LG = 15.08), consistent with our hypothesis that earnings management increase with earnings growth. However we do not conduct rigorous tests to compare restated firms with non-restated firms. Richardson et al. (2002) find that restated firms are not different from non-restated firms in earnings performance, but average growth rate of restated firms are higher.

In Table 4, we regress EM_Restated and EQ_Restated respectively on performance and growth. The results are mixed. The amount of managed earnings is positively related to performance and earnings quality is also positively related to performance. Both are significant at 5% level. This is consistent with our predictions and tests' results on the large sample. However, we do not find significant relations between firms' growth and earnings management or earnings quality. As a robustness check, we also use market-to-book ratios (M/B) to measure the expected earnings growth. The coefficients on M/B are not significant either.

4.3. Discussions of empirical results

Taken as a whole, our prediction that performance is positively related to earnings management or earnings quality is supported by results from both samples. However, our prediction that growth is positively related to earnings management and negatively related to earnings quality is only supported by

Table 4 The regressions of EM or EQ on performance and growth-restatement sample

Independent variable	EM_Restate		EQ_Restate	
	Coeff.	*P*-value	Coeff.	*P*-value
Intercept	.012	.348	−.631	.081
ROA	.086	.047	3.126	.010
LG	−.001	.825	.002	.910
Number of observations	91		91	
R-square	2.25%		5.50%	

The sample consists of firm-years affected by restatement announcements identified between 1997 and 2002 as results of previous ''aggressive accounting'' practice. Based on GAO's report, we hand collect the available restated fiscal year and restated amount of earnings from the firms' restatement announcements on Lexis–Nexis. We require each observation to have a clearly specified amount of restated annual net income, positive reported earnings and negative earnings restatements (firms had managed earnings upwards.) Our final restatement sample consists of 91 firms years (67 firms). EM_Restated is defined as the restated amounts (reported earnings announced initially—reported earnings restated) divided by previous total assets, EQ_Restated is defined as the negative of the proportion of restated amount in initially stated net income, ROA is net income divided by total assets. LG is analysts' estimation of long-term earnings growth rates from I/B/E/S. To mitigate the problem of losing observations, we replace LG as industry median LG if the firm specific LG is not available. All variables have been winsorized at top and bottom 3%

tests results on the large sample but not by results on the restatement sample. A possible reason for the insignificance is the low test power caused by the small restatement sample.

The evidence that discretionary accruals are positively related to performance and growth is consistent with Dechow et al. (1995) and McNichols (2000). The conventional explanations for this relationship are mis-specification of Jones model. Our model suggests that the relationship may be results from rational activities of the market and managers. Our empirical results using measurement from KS model or restated amount are consistent with our theory. Though we cannot exclude the possibility that KS model is also biased, the measurement using restated amount should be free of the same kind of measurement bias. Our model suggests another explanation for the relationship between earnings management, performance and growth.[28]

Our study has implications for empirical studies in earnings management. To measure the amount of managed earnings, some researchers directly use performance or growth as the regressees or use performance matched control sample to filter out the performance effects. Our model suggests that performance and growth are important factors affecting the amount of managed earnings. Fully filtering out the discretionary accrual associated with performance or growth will not only reduce the test power but also biases

[28] Beaver, McNichols, and Nelson (2003) examine the relation between discretionary loss reserve accruals and the distribution of reported earnings for a sample of property-casualty insurers. They find that the least profitable firms understate reserves relative to the most profitable firms, which contradicts our prediction and findings.

downwards the amount of managed earnings for firms with better performance or higher growth.[29] Our model suggests whether performance or growth should be controlled depends on research objectives. If the research objective is to measure the level of earnings management and link it to market efficiency or compare earnings management level among individual firms within a sample (e.g. all IPO firms), eliminating the effect of performance or growth may result in a biased measure. If the research objective is to test whether some events (e.g. IPO or SEO) trigger higher level of earnings management, controlling firms' performance and growth would be necessary. In this case, even if as we predict, firms' performance and growth affect the amount of managed earnings, not controlling them would cause the omitted variable problem when the occurrence of events is correlated with firms' performance or growth. In event studies, the emphasis is on the relation between earnings management and the occurrence of the event, not on the accurate measure of earnings management level. This point is clearly stated in Dechow et al. (1995). Our model also suggests that the relationship between the magnitude of earnings management and firm's performance and growth are not linear. Therefore controlling performance and growth in an OLS regression may result in biased estimation of discretionary accrual due to model mis-specification. Performance and growth matched control sample would probably do a better job if data allows (see Kothari et al., 2005).

5. Conclusions

Using a simple reporting model, we demonstrate that firms with higher performance or expected earnings growth over-report earnings by a larger amount because price responsiveness in equilibrium increases with earnings performance or growth. Our model suggests another explanation for the documented relationship between discretionary accruals and performance and growth. We further suggest that fully filtering out the discretionary accruals associated with performance or growth would bias the estimate for the amount of managed earnings. We define earnings quality as the proportion of true economic earnings in reported earnings. Under our definition, firms with higher earnings quality have higher price responsiveness. We predict that earnings quality is positively related to reported earnings and negatively related to expected growth. Our model also offers an alternative explanation to the phenomenon that the price is convex in reported earnings. In our setting, firms with higher reported earnings have higher earnings quality therefore receive higher price responsiveness. Our empirical tests, using two proxies for the amount of managed earnings, confirm our predictions

[29] Kothari et al. (2005) also notice the reduced power of performance matching. See their discussion at Page 170. However, our model suggests the performance matching may also produce biases results conditional on different performance or growth.

concerning firms' performance. However, we get mixed empirical results for predictions concerning expected future earnings growth.

Future research can build on our study to further understand the relationship between earnings management and firms' performance and expected growth. Our simple theoretical model could not address the inter-temporal nature of earnings management. Future research could generalize our model to a multi-period setting. In our model, earnings reporting only affect investors' perception of performance level. It would be more interesting it also affects investors' perception of earnings growth. Our empirical tests are limited by the difficulty in finding an appropriate proxy (readily available and free of bias) for the amount of managed earnings. A large sample size with such a proxy would provide more convincing evidence on the relationship between earnings management and firm's performance and future earnings growth.

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Appendix A: Proofs

Proof of Proposition 1 Using Eqs. 1–4, we get the differential equation:

$$ap_r^{*\prime} + 2cbp^* - 2cr = 0 \tag{A.1}$$

where $r \geq 0$, and $b = d - g/1 + d$. The general solution for Eq. A.1 is:

$$p^*(r) = Ge^{-\frac{2cb}{a}r} + \frac{r}{b} - \frac{a}{2cb^2} \tag{A.2}$$

Using the initial condition $p(r = 0) = 0$, we get $G = a/2cb^2$. We plug G back into Eq. A.2, and get:

$$p^*(r) = \frac{a}{2cb^2}e^{-\frac{2cb}{a}r} + \frac{r}{b} - \frac{a}{2cb^2} \tag{A.3}$$

Eq. A.3 gives the equilibrium pricing function when reported earnings is positive.

Plugging (A.3) back to the objective function of the manager, we could show that the utility of the manager is concave in r when $r \geq 0$; i.e.,

$$2c\left(e^{-\frac{2cb}{a}r}-1\right)\leq 0$$

For any $r \geq 0$. Therefore, the first order condition is sufficient for a global maximum.

Proof of $\frac{\partial m}{\partial \alpha}=1-\left(1+\frac{r}{\alpha}\right)e^{-\frac{r}{\alpha}}\geq 0$where $\alpha=a/2cb$. Let $g(r)=\frac{\partial m}{\partial \alpha}$, then $g(r=0)=0$. And $g'(r)=\frac{r}{\alpha}e^{-\frac{r}{\alpha}}$. When $r>0, g'(r)>0$. So for all $r \geq 0, \frac{\partial m}{\partial \alpha} \geq 0$.

Proof of Corollary 2 Notice that the sign of $\frac{\partial q}{\partial \alpha}$ would be the same as the sign of $\frac{\partial m}{\partial \alpha}$ when $r \geq 0$, where $\alpha=\frac{a}{2cb}$, and $b=\frac{d-g}{1+d}$. Given $\frac{\partial m}{\partial \alpha} \geq 0$, it is obvious that when $r \geq 0, \frac{\partial q}{\partial \alpha} \geq 0$. Now we prove that $\frac{\partial q}{\partial r} \geq 0$: Take derivative of Eq. 11, we get:

$$\frac{\partial q}{\partial r}=\frac{a}{2cbr^2}e^{-\frac{2cbr}{a}}\times A$$

where

$$A=\left(e^{\frac{2cbr}{a}}-\frac{2cbr}{a}-1\right)$$

Because $\frac{a}{2cbr^2}e^{-\frac{2cbr}{a}}>0$, $\frac{\partial q}{\partial r}$ has the same sign as A. Because when $r=0$, $A=0$. And when $r>0$, $\frac{\partial A}{\partial r}>0$, we get $A \geq 0$, when $r \geq 0$. For the above reasoning, $\frac{\partial q}{\partial r} \geq 0$.

Proof of Corollary 3 From Eq. A.3, we get:

$$\frac{\partial^2 p}{\partial r^2}=\frac{2c}{a}e^{-\frac{2cb}{a}r},\quad \frac{\partial^2 p}{\partial r \partial a}=-\frac{2cr}{a^3}e^{-\frac{2cb}{a}r},\quad \frac{\partial^2 p}{\partial r \partial c}=\frac{2r}{a}e^{-\frac{2cb}{a}r}$$

Obviously, $\frac{\partial^2 p}{\partial r^2}>0$. And when $r \geq 0$, $\frac{\partial^2 p}{\partial r \partial a} \geq 0$ and $\frac{\partial^2 p}{\partial r \partial c} \geq 0$ From Eq. A.3, we get:

$$\frac{\partial^2 p}{\partial r \partial b}=\frac{2c}{ab}e^{-\frac{2cbr}{a}}\times B$$

where

$$B=\left(r-\frac{a}{2bc}e^{\frac{2cbr}{a}}+\frac{a}{2bc}\right)$$

Since $\frac{2c}{ab}e^{-\frac{2cbr}{a}}>0$, $\frac{\partial^2 p}{\partial r \partial b}$ has the same sign as B. Because when $r=0$, $B=0$, and when $r>0$, $\frac{\partial B}{\partial r}<0$. We get $B \leq 0$, when $r \geq 0$. For the above reason, $\frac{\partial^2 p}{\partial r \partial b} \leq 0$ and $\frac{\partial^2 p}{\partial r \partial g} \geq 0$.

Appendix B

ACCL = Net Income (#172)-Operating Cash flow (#308)
ART = Accounts receivable (#2) less Tax receivables (#161)
EXP = expenses = Revenue (#12)- Operating income before depreciation (#13)
DEP = Depreciation from Income Statement (#14)
OCAL = other current assets and liabilities = Current assets (#4)-ART-Cash (#1)- Income tax refund (#161)-(Current liabilities (#5)- Income taxes payable (#71)
GPPE = gross plant, property and equipment (#7)
TA = Total assets (#6)
REV = Revenues (#12)

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