Income Smoothing and Properties of Analyst Information Environment

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ABSTRACT

This paper investigates whether income smoothing affects the properties of the information environment of users of financial statements. We study the association between the extent of income smoothing and the precision of common and private information implied in analysts' forecasts. We find that income smoothing improves the precision of analysts' common and private information, and is also associated with higher forecast accuracy. Our results are consistent with arguments that managers smooth earnings to convey information to the market.

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I. INTRODUCTION

Income smoothing has been a subject of interest to accounting researchers for several decades. Buckmaster (2001) cites examples of expositions as far back as the late nineteenth century and the subject continues to draw interest (see for example, Ronen and Sadan 1981; Chaney and Lewis 1995; Francis, LaFond, Olsson and Schipper 2004; Tucker and Zarowin 2006). Notwithstanding long-standing arguments in the literature both in favor of and against income smoothing, we know from prior work that income smoothing is not an uncommon practice, managers prefer to report smooth earnings (Graham et al. 2005), analysts prefer to follow firms with smooth earnings patterns (Previts et al. 1994) and, firms with patterns of smooth and increasing earnings over time enjoy higher market valuations (Barth et al. 1999). However, it is not entirely clear why the favorable outcomes to smooth income series pertain on average. Little is known of the mechanism(s) through which smoothed earnings affect the information environment of firms, and therefore the information available to users of financial information. A recent study by Tucker and Zarowin (2006) offers some insight into this relation by showing that income smoothing makes reported earnings more informative. They find a stronger association between current stock returns and the firms' contemporaneous and future earnings when earnings are smoothed. That is, reported earnings that have been smoothed convey more information about future earnings (earnings are informative) than if they have not been smoothed.

In this paper, we adopt a different approach by directly investigating whether income smoothing affects the properties of the information environment of users of financial statements.

Specifically, we test (1) whether income smoothing is associated with the precision of common and idiosyncratic (private) information held by a group of sophisticated users (equity analysts) of financial statements, and (2) whether the precision of such information leads to more accurate forecasts. We employ measures of precision of common and private information developed by Barron et al. (1998) which exploit the observable properties of analysts' forecasts (squared forecast error and dispersion) in order to infer the precision of common and private information held by analysts. Barron et al.'s (1998) model is developed to make predictions about the information sets used by analysts (whose beliefs are used as proxies for the unobservable beliefs of investors in general). Our reliance on their model to test the effect of income smoothing on the properties of information environment faced by investors constrains our investigation to this specific group of users of financial information. Analysts are generally regarded as skilled and knowledgeable users of financial information, and whose advice about stocks have direct (or indirect) impact on the stock's performance (Loh and Mian 2006; Ertimer, Sunder and Sunder 2007). Thus the results from this study provide us with an understanding of how income smoothing affects the properties of information used by a major group of participants in the capital markets.

If income smoothing makes reported earnings more informative (Tucker and Zarowin 2006), then it follows that it will increase the precision of common information available to analysts. Common information generally refers to publicly available information such as reported earnings. However, it is less clear whether the precision of analysts' private information will likewise be higher. The precision of private information held by analysts is a function of both the quality of publicly available information signals (such as reported earnings), and the investment made by each analyst in his private information search. Reliance on a more informative common signal (reported earnings) may result in a lower investment in private information search, which will lead to a lower precision in private information. In contrast, the higher quality common signal may help the analyst better interpret private information, which may lead to an increase in precision of private information. Hence, whether income smoothing enhances or reduces the precision of analysts' private information is less clear and the net effect is an empirical issue.

Our results show that higher smoothing is associated with higher precision of both common and private information held by analysts. In additional tests, we find that higher smoothing is also associated with higher forecast accuracy. Taken together, the results indicate that income smoothing generates earnings signals that improve the precision of the information set available to analysts, which facilitates their prediction of future earnings.

Our study offers several contributions. First, it contributes to the income smoothing literature by demonstrating that income smoothing increases the quality of information held by analysts. This evidence is consistent with and validates the results from surveys of managers which indicate that managers prefer to report smooth earnings because they believe that analysts can make more accurate forecasts from such earnings patterns (Graham et al. 2005). Second, it provides a direct test of the improvement of forecast accuracy for firms that smooth earnings. Existing studies that investigate the informative role of income smoothing focus on its effect on stock returns (e.g. Tucker and Zarowin 2006). Our study contributes a different and complementary set of evidence on the information role of income smoothing by investigating its effect on the information environment faced of analysts, who are major consumers of financial information. Third, our results also shed light on a recent study by McInnis (2010) who finds no relation between the smoothness of reported earnings and the cost of equity capital. His results may be partially explained by the evidence in this study that income smoothing enhances the precision of both common and private information of the firm. As Botosan et al. (2004) point out, more precise common information reduces the cost of capital, but more precise private information increases the cost of equity capital by increasing the information asymmetry between informed and uninformed investors. These two effects may offset each other, which results in insignificant impact of income smoothing on the cost of equity capital. To the extent that a smooth reported series is indicative of higher smoothing, our results partially explain McInnis' inability to detect a significant association between smoothness of reported earnings and the cost of capital.

A caveat is in order. Our research findings are necessarily based on firms with analyst following since the Barron et al. (1998) model requires observations of earnings expectations held by users of financial statements (analysts). Our conclusions are likewise restricted to this group of firms. It is not possible for us to test the generalizability of our results to firms without analyst following. While our study has limited generalizability to all investors we note that analysts' forecasts have been used in several studies (e.g., Abarbanell et al. 1995; Barry and Jennings 1992) to deduce the characteristics of the information environment for all investors, whose expectations about the firms are unobservable.

II. BACKGROUND AND RESEARCH QUESTIONS

Income Smoothing

The practice of manipulating accounting accruals in order to reduce fluctuations in a time series of reported earnings is termed "income smoothing" (Ronen and Sadan 1981). Theoretical models of income smoothing provide two contrasting views on why managers choose to smooth earnings. The first perspective considers income smoothing to be a form of opportunistic earnings management that is used to disguise a firm's actual earnings performance. Managers are motivated to misrepresent the firm's actual earnings performance in order to extend their employment tenure (Fudenberg and Tirole 1995, Dye 1988, Arya et al. 1998), and to smooth compensation over time (Lambert 1984). According to this view, reported earnings that have been smoothed are 'noisy' indicators of the true performance of a firm. Since reported earnings are an important set of public information for financial analysts, this view predicts that income smoothing will make analysts' information, particularly common information, less precise. A further implication of this form of income smoothing is that forecasts will be less accurate because reported earnings are 'noisier'.

The second perspective on income smoothing considers income smoothing as a vehicle for managers to convey their private information about future earnings to the investors (Ronen and Sadan 1981, Demski 1998), or about the quality of the manager (Chaney and Lewis 1995). Income smoothing reduces the fluctuations in reported earnings, which makes it easier for investors to infer the permanent component of future cash flows (Kirschenheiter and Melumad 2002). There is some empirical support for the informative role of income smoothing[1]. Tucker and Zarowin (2006) directly test the effect of income smoothing on the association between current stock returns and future earnings. They find that income smoothing "improves the informativeness of firms' current and past earnings about future earnings". Other studies (e.g. Subramanyam 1996 and Barth et al. 1999) provide indirect evidence on the informative role of income smoothing by assessing its effect on stock returns. Subramanyam (1996) finds that discretionary accruals convey information about a firm's prospects based on his analysis of the

[1] Defond and Park (1997) provide evidence in support of the use of income smoothing to achieve earnings targets over time. However, Elgers, Pfeiffer and Porter (2003) show that the results in Defond and Park (1997) are biased in favor of finding evidence of earnings management because to the mechanical relationship between their earnings before discretionary accruals and discretionary accruals.

relationship between discretionary accruals and stock returns. Barth et al. (1999) further show that investors attribute a higher value to firms that report smooth increasing earnings over time, and that a discontinuity in the reported earnings series results in a decrease in firm value.

One of the key reasons why managers prefer to report smooth earnings is that they believe that analysts can make more accurate forecasts from such earnings patterns (Graham et al. 2005). Analysts' earnings forecasts are an essential input to an investor's assessment of the worth of a firm (Bradshaw 2004). If income smoothing is used to create an earnings signal that is informative about a firm's future prospects (Tucker and Zarowin 2006), then we expect that income smoothing will increase the precision of analysts' common information. Predicted earnings will also be more accurate because of the increased precision of common information.

While we expect that income smoothing will have a direct effect on the precision of analysts' common information, its net effect on the precision of analysts' private information hinges on whether analysts use public and private information as complements or substitutes. If analysts use a more precise public information signal as a substitute for private information, they may reduce their private information search, which will result in a decline in the precision of private information. On the other hand, if more precise public information helps analysts better interpret private information, then a more informative earnings signal will increase the precision of analysts' private information. Thus, we do not have a clear prediction of the effect of income smoothing on the precision of the private information.

Research questions

Our first research question is whether the degree of income smoothing is associated with more precise common and private components of analysts' information set. The precision of the information is measured using the method proposed in Barron et al. (1998), which relies on the properties of analysts' forecasts to construct the level of precision. Details of Barron et al.'s method are described in the following section of the paper.

Our second research question is whether the degree of income smoothing is associated with the accuracy of analysts' forecasts. If income smoothing improves the precision of common and private information of analysts, we expect to observe a positive relationship between the accuracy of analysts' forecasts and income smoothing.[2]

III. RESEARCH DESIGN

Income Smoothing Measure

Following Tucker and Zarowin (2006), we measure the extent of income smoothing (*SMOOTH*) for a firm in a particular year by the negative correlation between the change in discretionary accruals (*DA*) and change in earnings before discretionary accruals (*EBDA*). The correlation coefficient is calculated over a five year period, which includes the four years prior to and including the year of the most recent earnings announcement. In so doing, we trade-off more precise estimates from a long time series with the survivorship bias introduced by requiring sample firms to have non-missing values for a five year period. For ease of interpretation of *SMOOTH*, we reverse the sign of the correlation coefficient so that a larger positive number for *SMOOTH* indicates more income smoothing.

[2] The positive relationship between income smoothing and stock returns reported in prior studies may be the result of increased accuracy in analysts' forecasts for firms that smooth earnings. If income smoothing enhances the predictability of future earnings, we expect that the analysts' forecasts will be more accurate for firms that smooth earnings.

The amount of *DA* and non-discretionary accruals (*NDA*) is estimated from the modified cross-sectional Jones' (1991) model. We follow the specification in Kothari, Leone and Wasley (2005) as stated in equation 1:

$$Acc = \delta_0 + \delta_1 \Delta Sales_t + \delta_2 PPE_t + \delta_3 ROA_t + \mu_t \tag{1}$$

where, *Acc* is the total accruals (COMPUSTAT item *ni* less COMPUSTAT item *oancf*); *ΔSales* is sales in period *t* minus the sales in period *t-1* (COMPUSTAT item *sales*); *PPE* is the gross level of plant, property and equipment (COMPUSTAT item *ppe*); and *ROA* is net income (COMPUSTAT item *ni*) divided by total assets (COMPUSTAT item *at*) at the beginning of the period. *Acc, ΔSales* and *PPE* are deflated by total assets (COMPUSTAT item *at*) at the beginning of the period.

Equation 1 is first estimated for all firms within the same two-digit SIC code in each year. The coefficients from the regression are used to calculate the amount of *NDA* for each firm within the same two-digit SIC industry. *DA* is the residuals obtained by subtracting *NDA* from actual accruals. *EBDA* is obtained by subtracting *DA* from net income. The change in *EBDA* and the change in *DA* in the past five years are then used to compute *SMOOTH* for each firm.

Measures of the precision of common and private information

Our measures of the precision of analysts' common and private information rely on the model developed by Barron et al. (1998, hereafter BKLS). These measures have been used to examine analysts' information environment in a number of settings (Barron et al. 1998, 2002, 2005, 2008; Byard and Shaw 2003; Botosan and Plumlee 2004). In the BKLS model analysts are characterized as possessing both common information (with precision h) and private information (with precision s). The common information is identical across all the analysts, while the private information is unique and is independently normally distributed with mean zero. In formulating their forecasts, analysts weight their common and private information sets by their respective degree of precision (h or s). BKLS define the consensus (ρ) as the degree to which individual analysts' forecasts contain the same information and show that consensus can be expressed as:

$$\rho = \frac{(SE - D/N)}{(SE - D/N + D)} \tag{2}$$

where *SE* is the expected squared error in the mean forecast, *D* is the expected forecast dispersion, and *N* is the number of analysts.

Assuming analysts' private information is equally precise across analysts, BKLS show that the precision of common information (h) and private information (s) can also be expressed in terms of *SE*, *D* and *N*, in the following equations:

$$h = \frac{(SE - D/N)}{(SE - D/N + D)^2} \tag{3}$$

$$s = \frac{D}{(SE - D/N + D)^2} \tag{4}$$

These equations allow us to use observable properties of analysts' forecasts to estimate the precision of their common and public information. Specifically, we use analysts' forecasts issued immediately after annual earnings announcement to calculate the realized forecast dispersion ($\hat{D}$) and squared error in the mean forecast ($S\hat{E}$) using the following equations:

$$\hat{D} = \frac{1}{N-1}\sum_{i=1}^{N}(F_i - \overline{F})^2 \tag{5}$$

$$S\hat{E} = (A - \overline{F})^2 \tag{6}$$

where F_i is the forecast issued by analyst i, $\overline{F}$ is the mean analysts' forecast, A is the actual annual earnings, and N is the number of analysts. Following Byard and Shaw (2003), we scale both the realized dispersion ($\hat{D}$) and the squared error in the mean forecast ($S\hat{E}$) by the absolute value of actual annual earnings. To eliminate extreme values caused by the scaling variable, we delete observations with absolute value of actual earnings of less than ten cents per share. We then substitute $\hat{D}$, $S\hat{E}$ and N into equations 2, 3 and 4 to obtain the estimated analyst consensus, and the precision of both analysts' common and private information.

To obtain meaningful forecast dispersion, we require that at least two analysts update their annual earnings forecasts within the 30-day period following the announcement of the previous year's earnings. Given that the BKLS model requires the precision of information (*h* and *s*) to be non-negative, we exclude estimates where *h* or *s* is negative.

Estimation model for income smoothing and the precision of analysts' information.

To investigate our first research question on the role of income smoothing with respect to the precision of analysts' common and private information signals (*h* and *s*, respectively), we estimate the following regression model:

$$h(s) = \alpha + \beta_1 SMOOTH + \beta_2 SIZE + \beta_3 MB + \beta_4 SURPRISE + \beta_5 ANALYST + \varepsilon \qquad (7)$$

where h and s are the measures of precision of analysts' common and private information as defined in equations 3 and 4 respectively. *SMOOTH* is the measure of income smoothing, or the negative correlation between the change in discretionary accruals and the change in pre-managed earnings. For ease of interpretation of *SMOOTH*, we reverse the sign of the correlation coefficient so that a larger positive number for *SMOOTH* indicates more income smoothing. A positive coefficient on *SMOOTH* (β_1) indicates that for firms with more income smoothing, the precision of analysts' common (*h*) or private(*s*) information is higher. In contrast, a negative β_1

will suggest that income smoothing increases noise in earnings and decreases the precision of analysts' information.

We include variables to control for previously identified determinants of the properties of analysts' information environment. *SIZE* is a common proxy for the level of a firm's information available to investors. Lys and Soo (1995) show that firm size is positively related to the precision of analysts' information. We thus expect *SIZE* to have positive coefficients. We measure firm size using the natural logarithm of market capitalization (in millions of dollars). We include the market-to-book ratio (*MB*) to control for firm characteristics related to growth opportunities/intangibles. Prior research finds that growth firms attract relatively higher analyst following, indicating a higher demand for private information search for these types of firms (Barth et al. 2001). Barron et al. (2008) find that for firms with large earnings surprise, the analyst consensus decreases and the precision of their private information increases after the earnings announcements, which suggests that large earnings surprises motivate analysts to search for and incorporate more private information into their forecasts. We measure earnings surprises by *SURPRISE*, computed as the absolute value of the difference between the actual and mean forecasted earnings per share. We deflate *SURPRISE* by the absolute value of actual earnings per share. Finally, the number of analysts (*ANALYST*) is added as a control, since Barron et al. (2008) show that when more analysts update their forecasts more private information will be incorporated into the forecasts and thus reduce the consensus.

To reduce measurement errors in the estimates of the precision of analyst' common and private information, we adopt the procedure in Barron et al. (2002) by averaging the measures of analysts' information precision and the control variables over each of the five-year periods, beginning with 1988. These five-year periods correspond to the same five-year periods used to estimate our measure of income smoothing. Our estimates of the measures of precision are highly skewed, as are some of the explanatory variables. It is also possible that there is a non-linear relation between the measures of precision and the other explanatory variables. Thus, following prior research (Barron et al. 2002, Byard and Shaw 2003), we rank all the variables by period and use rank regressions to perform the multivariate analysis.

IV. SAMPLE AND DATA

We obtain accounting information from Compustat to compute our measures of income smoothing and the control variables. We require sample firms to have sufficient data to estimate discretionary accruals from the performance-adjusted (modified) Jones model, and to have five years' data on changes in *DA* and *EBDA* to estimate *SMOOTH*. Our analysis focuses on non-financial and non-regulated firms. Firms with the two-digit SIC codes, 40-49 (regulated firms) and 60-69 (financial firms), are thus excluded from the sample.

To measure the precision of analysts' information environment, we obtain individual analysts' forecasts of annual earnings from the IBES unadjusted detail file. Following prior studies, we select forecast revisions that are issued immediately after the annual earnings announcements dates. Specifically, we require that at least two individual analysts revise their annual earnings forecasts for year *t* within 30 days after the announcement of annual earnings of year *t*–1. These analysts should also have issued a forecast of year *t* annual earnings within 60 days before the annual earnings announcement of year *t*–1.[3] Barron et al. (2002) argue that there are several advantages of this restrictive sample. First, analysts who update their forecasts immediately after the earnings announcement are more likely to use their own information and less likely to

[3] In rare cases when analysts issue multiple forecasts in these two windows, we select the last forecast before the annual earnings announcement and the first forecast after the annual earnings announcement.

"herd". Herding among analysts leads to underestimation of forecast dispersions and introduces measurement errors to our estimates of analysts' information precision. Second, these forecasts of year *t* annual earnings are issued early in the financial year, thus are more likely to reflect changes in analysts' perception of core earnings rather than manager's earnings guidance that emerge later of the year. Third, this selection procedure excludes stale forecasts which can introduce noise in our estimates of analysts' information precision. It also controls for the forecast horizon since forecasts tend to be more accurate when issued closer to the end of the fiscal year. Following Byard and Shaw (2003), we require that the absolute value of actual earnings per share, as reported in IBES, to be no less than ten cents, in order to avoid extreme values when we use absolute value of actual earnings as the scaling variable in the calculation of precision of analysts' information. Since the theoretical value of precision of analysts' information cannot be negative, we exclude observations with negative h or s.

Our sample starts in 1988 when cash flow statement items became available in COMPUSTAT. The sample period spans from 1988 to 2007 and consists of four non-overlapping five-year periods. We follow Barron et al. (2002) and average all the variables excluding income smoothing within each of the five-year periods. The final sample has 2,876 observations and 1,976 distinct firms.

Table 1 reports descriptive statistics for the sample used to estimate equation 7. The measure of income smoothing has a mean of 0.67 and a median of 0.857, which suggests that discretionary accruals and pre-managed earnings are highly correlated. These numbers are comparable to those reported in Tucker and Zarowin (2006). The average firm in our sample is large, with a mean market capitalization of about $1.8 billion, and has a relatively high market-to-book ratio. This is consistent with prior findings that analysts are more active in forecasting earnings for larger and higher growth firms. On average, four analysts update their earnings forecasts immediately after earnings announcements. Both of our measures of the precision of analyst information (h and s) exhibit considerable variation across the sample.

V. EMPIRICAL RESULTS

In Table 2 we present Spearman rank correlation coefficients between the variables in the sample. First, we notice a significant and positive association between income smoothing and the precision of analysts' both common and private information. This evidence lends preliminary support to the argument that income smoothing conveys information about future prospects to the market instead of misrepresenting a firm's performance. Income smoothing is also positively related to firm size and negatively related to earnings surprise, consistent with the notion that large firms are more likely to smooth their earnings, and that income smoothing results in smaller earnings surprises. The negative association between income smoothing and the number of analysts revising their earnings forecasts is consistent with two explanations with opposite causality: (1) high analyst monitoring reduces managers' incentives and/or ability to smooth earnings and/or (2) high income smoothing permits more accurate forecasting, which reduces the need to revise forecasts.

The correlation between the precision of analysts' common and private information is positive, implying that analysts' common information may complement, rather than substitute for, their private information. Consistent with the notion that firm size proxies for the quality of the firm's information environment, we find that firm size is positively related to the precision of analysts' common and private information. The positive association between the market-to-book ratio and each of the precision measures of analysts' private and common information may reflect the fact that investors and analysts are more interested in glamour firms and invest more resources to search for information for these firms.[4] Large earnings surprises are associated with less precise information, consistent with poor information environment for firms with large earnings surprises. The number of analysts revising earnings forecasts is positively related to the precision of analysts' private information, suggesting that more private information is incorporated into earnings forecasts when a larger number of analysts cover the firm. The correlation between the number of analysts following and the precision of analysts' common information is positive but insignificant, implying that the amount of public or common information does not increase significantly with the number of analysts following the firm. In general, these correlations are consistent with our expectations, and confirm that it is necessary to include these control variables in the multivariate analyses.

Association between income smoothing and the precision of analysts' information

In multivariate analyses, we perform seemingly unrelated regressions after considering the fact that analysts' private and common information are estimated from the same analysts' forecasts and for the same firm. The positive correlation between the precision of common and private information also indicates that a common set of variables may affect both private and common information of a firm. Seemingly unrelated regressions take into account the correlation between the two models of the precision of common and private information, and are thus more appropriate for our purpose. Another advantage of seeming unrelated regressions is that they allow us to compare the coefficients across two models and make inferences with respect to the

[4] This conjecture is supported by the positive and significant association between market-to-book ratio and the number of analysts who revise earnings forecasts.

contribution of income smoothing to the precision of analysts' common information relative to the contribution to the precision of analysts' private information.

Table 3 presents the results from regressions of the precision of analysts' information (*h* and *s*) on income smoothing and our control variables. We note that in both models, *SMOOTH* has a positive and statistically significant coefficient. The positive association between income smoothing and the precision of analysts' common information supports the argument that income smoothing provides useful information to the market, and improves the precision of analysts' common information. This evidence is consistent with Tucker and Zarowin (2006) who find a stronger association between current stock prices and future earnings for firms with higher income smoothing measures. The evidence that income smoothing is positively related to (and therefore, enhances) the precision of analysts' private information suggests that managers convey private information through smoothing earnings. It is also consistent with the view that more precise *common* information as a result of income smoothing allows analysts to develop more precise *private* information about the firm (Byard and Shaw 2003).

Controls variables have significant coefficients with expected signs, except for analyst following. The precision of analysts' common and private information is positively related to firm size and to the book-to-market ratio, but negatively related to earnings surprise. The evidence suggests that analysts' forecasts tend to reflect more precise information for larger firms, glamour stocks and firms with smaller earnings surprises. The number of analysts revising earnings forecasts appears to be positively related to the precision of analysts' private information, which suggests that earnings forecasts incorporates more precise private information when there a larger analyst following. The negative association between the number of analysts and the precision of analysts' common information is unexpected, which may be the result of the high correlation between firm size and analysts following.

The seemingly unrelated regression technique allows us to compare the coefficients of income smoothing in the two models. In the model where the dependent variable is the precision of analysts' common information, income smoothing has a coefficient of 0.128 (t-stat = 7.60). In the other model where the precision of analysts' private information is the dependent variable, the coefficient of income smoothing is 0.066 (t-stat = 3.70). Wald test shows that null hypothesis that these two coefficients equal is rejected at the 1% level (Wald statistic = 21.20, p-value < 0.001). This evidence suggests that while income smoothing enhances the precision of both analysts' common and private information, its effect on the precision of common information is much stronger.

To shed further light on the differential effect of income smoothing on the precision of analysts' public and private information, we examine the association between income smoothing and analyst consensus as defined in Equation 2. Barron et al. (1998) show that analyst consensus can be interpreted as the proportion of common information contained in analysts' forecasts, and that analyst consensus increases with the precision of common information relative to the precision of private information.[5] If income smoothing has a larger impact on common information than on private information, we should expect a positive association between income smoothing and analyst consensus. In Table 4, we test this prediction by regressing analyst consensus on income smoothing and the control variables. Consistent with our expectation, income smoothing has a positive and statistically significant coefficient, suggesting that income smoothing increases analyst consensus by enhancing the relative precision of analysts' common information.

[5] Specifically, Barron et al. (1998) show that, ρ equals h divided by the sum of h and s.

We conclude this sub-section with a robustness test. In the above tests, we follow Tucker and Zarowin (2006) and measure the extent of income smoothing (*SMOOTH*) for a firm in particular year by the negative correlation between the change in discretionary accruals and change in earnings before discretionary accruals. To ensure that our results are not sensitive to this specific measure, we redo our main test using three alternative measures of income smoothing, based on the measures used in Leuz et al. (2003). The first measure is *SMOOTHOCF*, which is the correlation between the change in cash flows and the change in total accruals. The second measure is *SMOOTHOCFDA*, which the correlation between the change in cash flows and the change in discretionary accruals. The last measure is *SMOOTHOICFO*, which is the ratio of the standard deviation of operating income and the standard deviation of cash flow from operations.

Table 5 reports that results from seemingly unrelated regressions using these three measures of income smoothing. We find that all the three measures are positively related to the precision and analysts' common and private information, after controlling for firm size, market-to-book ratio, earnings surprises and the number of analysts revising earnings forecasts. Further, all the three measures show a stronger association with the precision of common information than with the precision of private information. The results show that the positive association between income smoothing and the precision of analysts' common and private information is robust to alternative measures of income smoothing.

Association between income smoothing and analysts' forecast accuracy

If income smoothing enhances the precision of analysts' common and private information, we expect to find that analysts will make more accurate earnings forecasts for firms with high income smoothing. To test this hypothesis, we estimate the following regression model:

$$ACCY_{i,t} = \beta_0 + \beta_1 SMOOTH_{i,t-1} + \beta_2 SIZE_{i,t-1} + \beta_3 ANALYST_{i,t-1} + \beta_4 LOSS_{i,t-1} + \beta_5 LEV_{i,t-1} + \beta_6 MB_{i,t-1} + \varepsilon_{i,t} \tag{8}$$

where, for firm *i* in fiscal period *t*, $ACCY_{i,t}$ is the accuracy in analysts' earnings forecasts, defined as the negative absolute value of analysts' forecast error, deflated by share price at the beginning of the year. That is,

$$ACCY_{i,t} \quad = \quad (-1)\times\left|\frac{(A_{i,t} - \bar{F}_{i,t})}{Prc_{i,t}}\times 100\right| \tag{9}$$

where $\bar{F}$ is the mean analysts' forecast, *A* is the actual annual earnings, and *Prc* is the share price. We reverse the sign of the absolute forecast errors so that larger values of *ACCY* indicate more accurate analysts' forecasts. Because the price-deflated forecast errors tend to be very small if evaluated as a ratio, we convert them to percentages by multiplying the forecast errors by 100. This specification enables us to evaluate the coefficients of the independent variables as a percentage change in forecast error. We require the firm to be covered by at least two analysts as reported in the IBES details file. In order to eliminate the influence of extreme values, we removed observations of *ACCY* that fall within the bottom 1% of its distribution (recall that *ACCY* is a negative number, hence, at the 100% percentile, *ACCY* is equal to zero).

We include several control variables that have been shown in prior studies (e.g. Behn, Choi and Kang 2008) to affect forecast accuracy. They include, firm size (*SIZE*), number of analyst following (*ANALYST*), a dummy variable for loss-making firms (*LOSS*), leverage ratio (*LEV*) and market-to-book ratio (*MB*). To be consistent with the tests conducted in the section on precision of analysts' information, we average the dependent variable and control variables in equation 8 over the same five year period used to estimate *SMOOTH*. The average values obtained for each sub-period are then pooled and regression analysis conducted using these average values. In the regression analysis, we include dummy variables to represent each sub-period in order to control for possible year-effects. We have 1,340 observations for analysis.

Table 6 reports results from the regression of analysts' forecast accuracy on income smoothing measure. The coefficient for *SMOOTH* is expected to be positive. The coefficient of *SMOOTH* in Table 6 is positive and statistically significant at the 5% level, which suggests that analysts' forecasts are, on average, more accurate for firms with higher income smoothing. An increase in income smoothing is associated with 0.89% increase in average forecast accuracy over a five year period. Thus our evidence on forecast accuracy provides further support of our hypothesis that income smoothing enhances the precision of analysts' information, which allows analysts to make more accurate forecasts. The signs of the coefficients for the control variables are also consistent with the predicted signs (based on prior literature), except for the number of analysts following a firm, which is significantly negative. This same negative relation was observed for the precision of information results in Table 3. Forecast accuracy is positively related to firm size and market-to-book ratio, and negatively related to leverage ratio and loss dummy. An examination of the correlation coefficient for *SIZE* and *ANALYST* shows a high correlation between the two variables (0.59), which may account for the negative sign for the coefficient for *ANALYST*. We perform the regression for equation 8 again by including only one of the correlated dependent variable (respectively, *SIZE* and *ANALYST*) instead of both variables. Our results (untabulated) show that the omission of either variable does not significantly affect the coefficient of *SMOOTH*. The coefficient for *ANALYST* is not significant when *SIZE* is omitted from the regression, which suggests that the effect of *SIZE* dominates that of *ANALYST*.

Sensitivity Analysis

Our sample selection requires that analysts issue forecasts of annual earnings of year t within 60 days prior to the announcement of year t – 1 earnings and revise their forecasts within 30 days immediately after the earnings announcements. This selection criterion ensures that the forecasts in our sample reflect analysts' up-to-date information and reduces measurement errors associated with analyst herding and stale forecasts. However, it results in a significantly smaller sample. In a sensitivity test, we relax this data requirement and use all the earnings forecasts (both revisions and initiations) issued within 30 days immediately after the earnings announcement. Using this larger sample we obtain very similar results, which suggest that our results are not sensitive to this sample selection procedure.

Following Byard and Shaw (2003), we estimate the precision of analysts' common and private information using the methodology developed by Barron et al. (1998). This methodology, however, is based on the assumption that analysts' private information is equally precise. Gu (2004) relaxes this assumption and develops a model to estimate h and s without assuming that s is equal across analysts. We follow Gu (2004) and re-estimate h and s using either analysts' forecast revisions or all the analysts' forecasts issued immediately after the annual earnings announcements. We obtain similar results using these new estimates of the precision of analysts' common and private information.

It is possible that income smoothing and the precision of analysts' information may vary systematically across industries. To control for the industry effect, we rank all the variables within industry and time period while we define an industry by two-digit Standard Industry Code (SIC). We obtain similar results from multivariate analyses using the new rankings of the variables. In another sensitivity test, we follow Tucker and Zarowin (2006) to use percentile rankings of variables within industry and time period. A variable's percentile ranking is its rankings within industry and time period scaled by the number of firms within the industry during the time period. Using percentile rankings in regressions ensures variables have the same mean across industries, equivalent to having industry dummies in the model. Our main results are not sensitive to this transformation of the data.

VI. CONCLUDING REMARKS

We set out to test whether income smoothing impacts the information environment of a group of sophisticated users of financial statements. We do this by investigating the association between income smoothing and the precision of common and private information implied in analysts' forecasts. We report that income smoothing improves the precision of analysts' common and private information. We further investigate whether income smoothing (by virtue of being associated with increased precision) is also associated with higher forecast accuracy, and find that an increase in income smoothing leads more accurate earnings forecasts for analysts.

Our results are consistent with theoretical arguments that managers smooth earnings in order to convey information to the market, and with the evidence in Tucker and Zarowin (2006), which shows that current stock prices of high income smoothing firms incorporate more information about future earnings. We contribute a further dimension to our understanding of this informative role of income smoothing by focusing directly on the impact of smoothing on the information environment faced by sophisticated users of financial statements. We present evidence consistent with income smoothing improving analysts' information environment, which leads to more accurate forecasts. Together with Tucker and Zarowin (2006), our results suggest that income smoothing improves the information environment of investors.

This study also sheds light on a recent study by McInnis (2010) which fails to find a relationship between the smoothness of reported earnings (as opposed to the extent of smoothing) and the cost of equity capital. Our evidence shows that income smoothing enhances the precision of both common and private information of the firm. If more precise common information reduces the cost of capital, but more precise private information increases the cost of equity capital by increasing the information asymmetry between informed and uninformed investors (Botosan et al. 2004), then the net outcome could be insignificant. To the extent that a smooth reported earnings series is indicative of higher smoothing, our results may help explain McInnis' inability to detect a significant association between smoothness of reported earnings and the cost of capital.

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Table 1
Descriptive Statistics

This table reports descriptive statistics for a sample of 2,876 firm-year observations over the four non-overlapping five-year periods from 1988 to 2007. SMOOTH is the negative correlation coefficient between the change in discretionary accruals and change in earnings before discretionary accruals, estimated using annual accounting data from COMPUSTAT over each of the five-year period. *SIZE* is the natural log of market capitalization. *MB* is the market-to-book ratio. *SURPRISE* is the absolute value of the difference between analyst consensus (median) forecasts and actual earnings per share, deflated by the absolute value of actual earnings per share. *ANALYST* is the number of analysts following the firm. *h* and *s* are measures of precision of analysts' common and private information respectively. *SIZE*, *MB*, *SURPRISE*, *ANALYST*, *h* and *s* are averaged over each of the five-year period.

Variable	Mean	Standard Deviation	Q1	Median	Q3
SMOOTH	0.670	0.442	0.594	0.857	0.957
SIZE	7.485	1.639	6.321	7.363	8.513
MB	3.689	3.106	1.677	2.615	4.171
SURPRISE	0.170	1.067	0.015	0.035	0.091
ANALYST	3.974	2.534	2.000	3.000	4.750
h	176.005	653.022	4.375	20.956	91.444
s	183.366	1511.920	0.227	3.224	25.750

Table 2
Correlation Coefficients

This table presents Spearman correlation coefficients between variables for a sample of 2,876 firm-year observations over the four non-overlapping five-year periods from 1988 to 2007. *SMOOTH* is the negative correlation coefficient between change in discretionary accruals and change in earnings before discretionary accruals, estimated using annual accounting data from COMPUSTAT over each of the five-year period. *SIZE* is the natural log of market capitalization. *MB* is the market-to-book ratio. *SURPRISE* is the absolute value of the difference between analyst consensus (median) forecasts and actual earnings per share, deflated by the absolute value of actual earnings per share. *ANALYST* is the number of analysts following the firm. *h* and *s* are measures of precision of analysts' common and private information respectively. *SIZE*, *MB*, *SURPRISE*, *ANALYST*, *h* and *s* are averaged over each of the five-year period. The *p*-values associated with the correlation coefficients are reported in the line below each coefficient.

	SMOOTH	*SIZE*	*MB*	*SUPR*	*N*	*h*
SIZE	0.096					
	<.001					
MB	-0.022	0.331				
	0.229	<.001				
SURPRISE	-0.177	-0.224	-0.174			
	<.001	<.001	<.001			
ANALYST	-0.046	0.402	0.137	-0.030		
	0.013	<.001	<.001	0.107		
h	0.212	0.261	0.303	-0.370	0.029	
	<.001	<.001	<.001	<.001	0.114	
s	0.132	0.301	0.247	-0.233	0.128	0.740
	<.001	<.001	<.001	<.001	<.001	<.001

Table 3
Seemingly Unrelated Regressions of Analysts' Information Precision

This table reports results from seemingly unrelated (rank) regressions of analysts' information precision. The sample consists of 2,876 firm-year observations over the four non-overlapping five-year periods from 1988 to 2007. *SMOOTH* is the negative correlation coefficient between change in discretionary accruals and change in earnings before discretionary accruals, estimated using annual accounting data from COMPUSTAT over each of the five-year period. *SIZE* is the natural log of market capitalization. *MB* is the market-to-book ratio. *SURPRISE* is the absolute value of the difference between analyst consensus (median) forecasts and actual earnings per share, deflated by the absolute value of actual earnings per share. *ANALYST* is the number of analysts following the firm. *h* and *s* are measures of precision of analysts' common and private information respectively. *SIZE*, *MB*, *SURPRISE*, *ANALYST*, *h* and *s* are averaged over each of the five-year period. All the variables are ranked within the five-year period. The models are estimated using seemingly unrelated regressions with dummy variable indicating each of last three five-year periods included. *, ** and *** indicate the coefficients are significant at 10%, 5% and 1% level respectively.

	h			*s*	
	Coefficient	*t*-stat		Coefficient	*t*-stat
SMOOTH	0.128***	7.60		0.066***	3.70
SIZE	0.127***	6.71		0.181***	9.04
MB	0.201***	11.69		0.155***	8.54
SURPRISE	-0.300***	-17.34		-0.158***	-8.64
ANALYST	-0.049***	-2.73		0.035*	1.86
Year dummies	Yes			Yes	
No of observations	2876			2876	
Adj. R^2	41.60%			34.83%	
Test equality of *SMOOTH* coefficients			$F = 21.20$	$p < 0.001$	

Table 4
Effect of Income Smoothing on Analyst Consensus

This table reports results from OLS rank regressions of analyst consensus on income smoothing. The sample consists of 2,876 firm-year observations over the four non-overlapping five-year periods from 1988 to 2007. Dependent variable is the measure of analyst consensus (ρ) estimated from actual analysts' forecasts. *SMOOTH* is the measure of income smoothing, computed as the negative correlation coefficient between change in discretionary accruals and change in earnings before discretionary accruals, estimated using annual accounting data from COMPUSTAT over each of the five-year period. *SIZE* is the natural log of market capitalization. *MB* is the market-to-book ratio. *SURPRISE* is the absolute value of the difference between analyst consensus (median) forecasts and actual earnings per share, deflated by the absolute value of actual earnings per share. *ANALYST* is the number of analysts following the firm. *SIZE*, *MB*, *SURPRISE*, *ANALYST* and I are averaged over each of the five-year period. All the variables are ranked within the five-year period. The models are estimated with dummy variable indicating each of last three five-year periods included. Standard errors are adjusted for the year clustering effect. *, ** and *** indicate the coefficients are significant at 10%, 5% and 1% level respectively.

	Coefficient	*t*-stat
SMOOTH	0.044**	2.03
SIZE	-0.144***	-5.84
MB	-0.063***	-2.76
SURPRISE	-0.072***	-3.18
ANALYST	-0.097***	-4.18
Year dummies	Yes	
No of observations	2,876	
Adj. R^2	28.46%	

Table 5
Robustness Test: Alternative Measures of Income Smoothing

This table reports results from seemingly unrelated (rank) regressions of analysts' information precision. The sample consists of 2,876 firm-year observations over the four non-overlapping five-year periods from 1988 to 2007. In panel A, *SMOOTHOCF* is the correlation between change in cash flows and change in total accruals. In panel B, *SMOOTHOCFDA is* the correlation between change in cash flows and change in discretionary accruals, and in panel C, *SMOOTHOICFO* is the ratio of standard deviation of operating income and standard deviation of cash flow from operations.All accounting data used to compute these smoothing measures are obtained from COMPUSTAT for each of the five-year period. *SIZE* is the natural log of market capitalization. *MB* is the market-to-book ratio. *SURPRISE* is the absolute value of the difference between analyst consensus (median) forecasts and actual earnings per share, deflated by the absolute value of actual earnings per share. *ANALYST* is the number of analysts following the firm. *h* and *s* are measures of precision of analysts' common and private information respectively. *SIZE*, *MB*, *SURPRISE*, *ANALYST*, *h* and *s* are averaged over each of the five-year period. All the variables are ranked within the five-year period. The models are estimated using seemingly unrelated regressions with dummy variable indicating each of last three five-year periods included. *, ** and *** indicate the coefficients are significant at 10%, 5% and 1% level.

Panel A: Income Smoothing measured by *SMOOTHOCF*

	Coefficient	*t*-stat	Coefficient	*t*-stat
SMOOTH	0.139***	8.24	0.059***	3.29
SIZE	0.126***	6.69	0.182***	9.11
MB	0.205***	11.89	0.156***	8.56
SURPRISE	-0.299***	-17.36	-0.159***	-8.74
ANALYST	-0.049***	-2.70	0.035*	1.82
Year dummies	Yes		Yes	
No of observations	2876		2876	
Adj. R^2	41.80%		34.76%	
Test equality of *SMOOTHOCF* coefficients		Wald statistic = 35.31	$p < 0.001$	

Panel B: Income Smoothing measured by *SMOOTHOCFDA*

	Coefficient	*t*-stat	Coefficie nt	*t*-stat
SMOOTH	0.049***	2.96	0.031*	1.78
SIZE	0.150***	7.89	0.193***	9.68
MB	0.192***	11.09	0.151***	8.28
SURPRISE	-0.319***	-18.52	-0.167***	-9.26
ANALYST	-0.061***	-3.34	0.030	1.56
Year dummies	Yes		Yes	
No of observations	2876		2876	
Adj. R^2	40.60%		34.59%	
Test equality of *SMOOTHOCFDA* coefficients		Wald statistic = 1.87	$p = 0.171$	

Panel C: Income Smoothing measured by *SMOOTHOICFO*

	Coefficient	*t*-stat		Coefficient	*t*-stat
SMOOTH	0.134***	8.17		0.107***	6.19
SIZE	0.146***	7.77		0.190***	9.65
MB	0.195***	11.33		0.152***	8.42
SURPRISE	-0.319***	-18.71		-0.167***	-9.29
ANALYST	-0.052***	-2.90		0.036*	1.91
Year dummies	Yes			Yes	
No of observations	2876			2876	
Adj. R^2	41.78%			35.38%	
Test equality of *SMOOTHOICFO* coefficients		Wald statistic = 4.21		p = 0.040	

Table 6
Effect of Income Smoothing on Analysts' Forecast Accuracy

This table reports results from OLS regressions of analysts' forecast accuracy on income smoothing. The sample consists of 1,674 firm-year observations over the four non-overlapping five-year periods from 1988 to 2007. The dependent variable is forecast accuracy (*ACCY*), which is estimated from $(-1) \times \left| \frac{(AEarn_{i,t} - FEarn_{i,t})}{Prc_{i,t}} \times 100 \right|$. *SMOOTH* is the measure of income smoothing, computed as the negative correlation coefficient between change in discretionary accruals and change in earnings before discretionary accruals, estimated using annual accounting data from COMPUSTAT over each of the five-year period. *SIZE* is market capitalization. *MB* is the market-to-book ratio. *ANALYST* is the number of analysts following the firm. *LOSS* is coded as 1 if a loss is forecasted for the forecast period, and zero otherwise. *LEV* is the ratio of total debt to total assets at the beginning of the fiscal period. *SIZE*, *MB*, *ANALYST*, *LOSS* and *LEV* are averaged over each of the five-year period. The natural logarithm is applied to *SIZE*, *MB*, and *ANALYST*, after the averaging procedure. Because of the averaging procedure, *LOSS* is a continuous variable. Standard errors are adjusted for the year clustering effect. *, ** and *** indicate the coefficients are significant at 10%, 5% and 1% level respectively for a one-tailed test.

	Coefficient	*t*-stat
Intercept	-6.848	-7.98***
SMOOTH	0.891	2.76**
SIZE	0.725	4.98***
MB	0.715	8.24***
ANALYST	-0.717	-3.90***
LOSS	-2.874	-4.10***
LEV	-1.505	-2.16*
No of observations	1674	
Adj R^2	19.08%	