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CROSS-SECTIONAL DETERMINANTS OF SECURITY PRICE RESPONSES TO EARNINGS INFORMATION: SEASONALITY AND FOURTH-QUARTER EFFECTS

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ABSTRACT

This dissertation seeks to provide further evidence on the relationship between security prices and accounting information. One of the primary purposes of financial accounting is to provide useful information to existing and potential investors for use in making investment decisions. The focus of this study is to ascertain whether the valuation implications of earnings vary across quarters of the reporting year and if that variation can be attributed to factors related to firms' financial reporting environments and levels of activity. More specifically, this study considers whether the differential responsiveness of prices to earnings in fourth quarters varies as a function of differential earnings management, settling-up, and auditing, and whether differential responsiveness in peak activity quarters varies as a function of the extent of seasonality and the degree to which reports of peak-quarter activity resolves uncertainty about the future relative to non-peak-quarter reports.

Previous research on cross-quarter differences in the responsiveness of prices to earnings hypothesized that fourth- and peak-quarter effects exist, but has provided conflicting and inconclusive results. This study differs from previous explorations in the following ways: (1) firm-specific estimates of differential responsiveness are employed in the analysis, (2) only companies whose peak sales quarter is not their fourth quarter are considered, and (3) firm-level measures of previously hypothesized causes of differential responsiveness are developed and tested. Fourth-quarter responsiveness is hypothesized to be lower due to increased earnings management and settling-up of interim approximations that occurs at year-end, and to be greater due to

the increased level of auditing. Peak-sales-quarter responsiveness is alternatively hypothesized to be stronger and weaker than other reporting quarters' responsiveness. As such, the extent of seasonality could be positively or negatively related to responsiveness. The extent to which peak-quarter earnings announcements resolve uncertainty about the future is, however, conjectured to be unambiguously related to increased responsiveness.

The results of the hypothesis tests are mixed. There is some evidence of decreased overall fourth-quarter responsiveness consistent with some previous research. However, that overall differential responsiveness is not demonstrated to be related to the suggested causes: earnings management, settling-up, or auditing. There is evidence of increased earnings management in fourth quarters, but the expected inverse relationship between fourth-quarter responsiveness and earnings management is not found. While substantial variation exists in the differential responsiveness of prices to earnings in the peak activity quarter, there is no overall increased or decreased responsiveness shown in the sample. This is possibly due to competing effects discussed in motivating the first two seasonal hypotheses. For the entire sample, no relationship is found between differential responsiveness and either seasonality or relative resolution of uncertainty. However, when subsamples of the most seasonal and most followed firms are analyzed, a positive relationship between uncertainty resolution and peak-quarter responsiveness, and a negative relationship between that same responsiveness and the extent of seasonality are noted.

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Chapter 1

INTRODUCTION

The objective of this study is to provide further evidence on the relation between accounting information and stock prices. More specifically, the primary purpose is to answer two questions: (1) Do the valuation implications of earnings vary across quarters of the reporting year in a systematic fashion? and (2) What are the *underlying* determinants of such cross-quarter variation?

This investigation contributes to accounting knowledge in three ways. First, it increases our understanding of how accounting earnings are valued by considering settings where valuation implications may vary. The valuation implications of accounting earnings may differ based on the perceived "quality" of the information, which may be affected by management manipulation, "settling-up" of prior approximations, external auditing, and differing activity levels. Lev (1989) suggests that research on the extent to which accounting measurements and managerial manipulations detract from the usefulness of earnings has the potential to further our understanding of how financial information is used in asset valuation. Second, the study is important for accounting research which utilizes the strength of the earnings - price relation in either assessing the usefulness of particular accounting standards, or as a measure of earnings "quality" (e.g., Bandyopadhyay, 1994). The observed relationship may be affected by the quarter of the year investigated if valuation implications vary across quarters (i.e. the measure of "quality" may be influenced by factors other than those hypothesized, such as seasonaiity). Finally, this research is important since it attempts to resolve the largely inconclusive results of previous research on the existence and determinants of cross-quarter differences in the responsiveness of prices to earnings. The research designs of previous studies did not permit adequate exploration of the hypothesized causes of cross-quarter responsiveness such as seasonality, auditing, and "settling-up."

The design of the current study differs from previous investigations in two ways. First, firm-specific regressions are employed to estimate differential responsiveness, and, second, only companies whose peak sales quarter is not their fourth quarter (end-of-fiscal-year) are incorporated in the study. Previous research has examined cross-quarter differences in earnings response coefficients (henceforth ERCs[1]) using pooled cross-sectional time-series regressions. Since extant literature suggests that the relation between earnings and prices varies cross-sectionally (e.g., Kormendi and Lipe, 1987 (KL); Easton and Zmijewski, 1989 (EZ)), better estimates of cross-quarter differences in responsiveness are made at the firm-level.[2] By estimating firm-specific measures of cross-quarter differences in price responsiveness, this study provides a means of investigating certain suggested causes of cross-quarter differences which prior authors could only speculate upon, but not test. Also, the sample selection method employed facilitates the separation of fourth-quarter and peak-sales-quarter effects since both have been hypothesized to exist (Salamon and Stober, 1994 (SS)).

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[1]An ERC is the coefficient on unexpected earnings from a regression of abnormal returns on a constant and unexpected earnings.

[2]Thomas (1993, p. 329), in discussing estimation of ERCs, notes that "...most regressions that are estimated either in cross-section or are pooled across all firms and over all years are likely to be misspecified."

Previous studies reporting differential fourth-quarter responsiveness provide conflicting results that are tenuous at best. Cornell and Landsman (1989) report that fourth-quarter ERCs are higher than those of interim quarters and ascribe the cause to annual statements being audited. However, SS, Kross and Schroeder (1990) (KS), and Mendenhall and Nichols (1988) all report attenuated fourth-quarter responsiveness for at least a subset of their sample firms. The first two sets of authors attribute the decreased responsiveness to fourth-quarter "settling-up" of approximations made in interim quarters, partly due to the integral approach to interim reporting as prescribed by GAAP.[3] Mendenhall and Nichols (1988) conjecture that interim earnings management causes higher interim quarter responsiveness to bad news announcements. However, the designs employed in these studies did not permit testing of the conjectured sources of differential responsiveness, and the authors' reporting of decreased fourth-quarter responsiveness could be due to data problems rather than to the ascribed causes. Mendenhall and Nichols (1988) and KS use Compustat earnings per share (EPS), which Philbrick and Ricks (1991) suggest may be problematic because of its inclusion of "special items" such as provisions for corporate restructurings. Further, most of the studies do not adequately control for the relative staleness of fourth-quarter forecasts which could lead to decreased responsiveness for reasons other than those posited. Previous research has suggested that the causes of differential fourth-quarter responsiveness include auditing, "settling-up" of previous approximations in the fourth quarter, and earnings management.

[3]See Accounting Principles Board Opinion 28, Paragraph 9 (1973)

Firm-specific measures of these posited determinants are developed in this study to investigate whether cross-sectional differences in fourth-quarter responsiveness can be described as a function of those determinants.

SS posit that sales seasonality may also affect the valuation implications of earnings in that peak sales quarters may have larger ERCs than other quarters. They suggest that peak-sales-quarter earnings announcements of seasonal firms are less noisy and more informative about dividend paying ability than other announcements, and that ignoring the influence of peak-quarter responsiveness could explain the conflicting findings on fourth-quarter effects. However, the results of SS with respect to peak-sales-quarter price responsiveness are inconclusive and the question of whether sales seasonality matters remains unresolved. They suggest that the extent to which ERCs in peak sales quarters are higher than other quarters should be related to the degree of sales seasonality cross-sectionally. Peak-sales-quarter earnings announcements may also differ from other quarters' announcements by the usefulness of information provided in the announcement. If peak-sales-quarter earnings announcements are more precise (contain less relative noise), then those announcements should reduce more uncertainty about future earnings and the responsiveness of prices to earnings should be greater for peak quarters.

In contrast to the above argument about seasonality, it may be the case that peak-sales-quarter earnings announcements elicit lower responsiveness than other quarterly announcements. A given earnings shock in a non-peak quarter may cause a larger price response when that shock is extrapolated to future quarters than would a peak-quarter shock since the non-peak shock would be extrapolated to peak quarters considering the larger scale of operations in future peak quarters. Algebraically this would result in price responsiveness in non-peak quarters being greater than that of peak quarters. This counter argument for decreased peak-quarter responsiveness is likewise a function of the extent of seasonality since seasonality is assumed to be related to the extent that non-peak-quarter shocks are extrapolated to future peak quarters when the market assesses the future cash flow implications of a given shock. To test for these seasonal effects, cross-sectional determinants of differential peak-quarter responsiveness explored in this study include a measure of seasonality and a relative measure of peak-quarter uncertainty resolution.

The results of the study are mixed. Consistent with some previous research, some evidence is provided that overall fourth-quarter responsiveness is lower than that of non-peak, non-fourth quarters. This result is noted after attempting to control for factors which other studies ignored, such as staleness of earnings expectations and actual EPS which are defined in a consistent manner with analyst expectations. Failure to control for these factors may have led previous researchers to conclude that fourth-quarter responsiveness was lower due to hypothesized effects when, in fact, it was due to inadequate control of other factors. There is also weak evidence of variation across firms in the differential fourth-quarter responsiveness of prices to earnings. However, that differential responsiveness cannot be explained by the three determinants suggested here and in previous research. While none of the three determinants are shown to be associated with differential fourth-quarter responsiveness, the sign of the observed relationship is as expected in the case of fourth-quarter auditing, but not the other two determinants. Management of earnings for the purpose of signalling private information which is priced by the market is an alternative explanation for the observed positive relationship.

With respect to differential peak-quarter responsiveness, no evidence of increased or decreased aggregate responsiveness is provided, though there exists substantial variation across firms. This may be due to: (1) the countervailing forces of higher responsiveness resulting from the importance of peak-quarter activity for seasonal firms offset by how the market extrapolates shocks to future periods based on whether the quarter is peak or non-peak; (2) seasonal effects being fictional; or (3) seasonal effects existing among the seasonal firms in the sample, but the test design not being powerful enough to capture those effects. The variation in peak-quarter responsiveness cannot be attributed to seasonality or the degree to which peak quarters resolve uncertainty relative to non-peak quarters with the full sample of firms. However, when only the most seasonal firms are considered, a positive relation between differential peak-quarter responsiveness and relative resolution of uncertainty is noted, as expected. Likewise, when only those firms with adequate analyst following to calculate resolution of uncertainty reasonably efficiently are considered, a negative relationship between seasonality and peak-quarter responsiveness is found. These subsample tests must be considered in light of the smaller sample sizes and the lack of robustness in the findings across the subsamples.

The remainder of the dissertation is organized as follows. Chapter 2 reviews previous research relating to ERCs generally and more specifically to fourth-quarter and seasonality effects on ERCs. Chapter 3 summarizes the research hypotheses. Chapter 4 discusses the research design, including the sample selection process, variable definitions and testing procedures. Chapter 5 reports the results of the study, and, finally, Chapter 6 summarizes the dissertation's findings and considers the implications of the analysis.

Chapter 2

LITERATURE REVIEW / RELATED EMPIRICAL EVIDENCE

2.1 ERC Literature - General

Beginning with Ball and Brown (1968), accounting researchers have examined the relationship between accounting information and firm value. This program of research has dominated published accounting research and has been described as "...the most concerted and ambitious effort in accounting history..." Lev and Ohlson (1982, p. 249). Early studies supported the notion that accounting earnings are part of the information used by investors (Ball and Brown, 1968; Beaver, 1968). This preliminary research focused on the signs of unexpected earnings and "abnormal" returns, while more recent research considers the relationship between the magnitude of unexpected earnings and returns. Beaver, et al. (1980) first proposed a linear model for the unexpected earnings/unexpected returns relation. However, despite the influence of Beaver, et al. (1980) on accounting research, the basic model includes a very restrictive assumption: the relation between prices and earnings is constant across firms.

Historically, studies investigating the relationship between earnings and returns report weak results: coefficients of determination (R^2s) of regressions of unexpected returns on unexpected quarterly earnings fall in the 2-10% range for short and long-event windows (Lev, 1989). Also, the cross-sectionally fixed ERCs are much lower than implied per theoretical models such as Miller and Rock (1985).[4] Even if

[4]Brown (1993), p. 309, summarizes how theoretical ERCs should be (1 + persistence factor) if earnings can be modelled as an ARIMA process.

earnings shocks are completely transitory (or temporary), which is unlikely, ERCs would equal one. However, while ERCs tend to be significantly greater than zero, they are usually less than one in pooled cross-sectional regressions where the unexpected earnings component is scaled by price (e.g., Swaminathan and Weintrop, 1991). Researchers have devoted effort to enhancing the power of the earnings - price relationship, including obtaining better proxies for market expectations (see Brown, 1993 for a review), and considering alternative econometric specifications of the relationship (Cheng, et al., 1992; Freeman and Tse, 1992).

Beginning with KL and EZ, accounting researchers relaxed the restrictive assumption of cross-sectionally constant ERCs. KL demonstrate, with annual earnings, that ERCs vary across firms as a positive function of the persistence[5] or permanence of earnings shocks. KL and EZ have motivated a variety of studies seeking to describe why ERCs vary across firms and across time. EZ report a positive association between ERCs and persistence and a negative association between ERCs and systematic risk. Collins and Kothari (1989) report that ERCs increase in growth and persistence, and decrease in interest rates (temporally) and risk, but they use annual, not quarterly, earnings and long event windows, so their results are not directly applicable to the current study. Lipe (1990) also employs annual earnings and long windows and reports that ERCs are positively related to the predictability and persistence of the earnings series. The implication of this stream of research as it pertains to the current study is that substantial cross-sectional variation exists in the

[5]Persistence of an economic series is described by Lipe and Kormendi (1993, p. 144) as, "...how a current shock is expected to impact the whole stream of future realizations of the series."

relationship between prices and earnings. As such, an analysis of cross-quarter differences in the responsiveness of prices to earnings is best conducted at the firm level.

The current study extends the ERC literature by explicitly considering firm-specific cross-quarter patterns in the relationship between earnings and prices. Extant research has not established that ERCs vary across quarters within firms.

2.2 Fourth-Quarter Effects

Prior research has documented reasons why the relationship between earnings shocks and security price responses related to year-end announcements could be both stronger and weaker than the same relationship for interim announcements. Fourth-quarter responses could be accentuated due to auditing of the year-end statements which purportedly decreases noise in fourth-quarter earnings (KS). Conversely, Collins, et al. (1984) demonstrate that both analyst forecast errors, and errors from two "premier" quarterly time-series models (those attributed to Brown and Rozeff, 1979 (BR) and Griffin, 1979 and Watts, 1975 (GW)) exhibit higher average mean absolute percentage errors for fourth-quarter earnings regardless of the forecast horizon. If fourth-quarter results are less predictable because empirical proxies of expectations may contain more noise, then fourth-quarter ERCs may be lower than interim ERCs. Collins, et al. (1984) suggest that seasonality, discretionary spending, and fourth-quarter "settling-up" of approximations and interperiod allocation errors may explain the decreased predictability of fourth-quarter earnings.

Earnings management may also influence the relationship between earnings shocks and price responses. Mendenhall and Nichols (1988) assert that managers have more discretion over interim earnings than annual earnings due to year-end auditing and incentives to manage earnings upward during interim periods (delay bad news). The authors suggest that a rational market will anticipate this behavior, and hence, if bad news is revealed in interim quarters, the market will interpret the news as a very negative signal. Therefore, they hypothesize that price responses to interim bad news are proportionally larger than responses to year-end bad news. They report that for expectation models other than a seasonal random walk (SRW) (i.e., Foster (1977), GW, BR, and analyst forecasts), interim bad news ERCs exceed fourth-quarter bad news ERCs.[6]

KS suggest that fourth-quarter ERCs vary as a function of firm size. They posit that fourth-quarter market responses may differ from interim responses only for small firms because large firms are subject to a more continuous audit presence and other monitoring mechanisms (e.g., by the SEC, or by capital market participants when firms seek to obtain additional capital) throughout the year. KS report that firms' fourth-quarter return responsiveness to unexpected earnings is smaller than interim responsiveness, but only for smaller firms. They ascribe this to the increased probability that smaller firms would use a "discovery" as opposed to a "restatement"

[6]However, as discussed by Palepu (1988), we would expect the same result if fourth-quarter ERCs were smaller for all types of news, and the former set of authors do not test their hypothesis in a manner permitting acceptance of one explanation to the exclusion of the other. Also, the result is not found using the SRW model which generated unexpected earnings most highly correlated with abnormal returns in their study.

approach in correcting errors from previous quarters.[7] Since firm size can proxy for many constructs discussed in the literature, KS's conclusions regarding "discovery" versus "restatement" approaches should be interpreted with caution, as they may be the result of a correlated omitted variable.

SS test hypotheses related to fourth-quarter and seasonality effects and report that fourth-quarter ERCs are generally smaller than interim ERCs regardless of firm size when using a SRW expectation of earnings. However, SS's findings regarding overall fourth-quarter effects are non-robust when using I/B/E/S analyst forecasts as expectations.[8] SS attribute the variation in their results for large firms from KS's results to:

(1) KS's smaller sample size and different sample due to exclusion of non-calendar year-end firms and different sample period;
(2) KS's use of the GW quarterly forecasting model for earnings expectations versus SS's use of a seasonal random walk model and analyst forecasts; and,
(3) differential outlier treatment.

SS also differs from KS in that SS control for peak-quarter influences and to the extent that they can separate the effects, the fourth-quarter ERCs are expected to be lower for both small and large firms in cross-section.

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[7]KS describe the difference between the "discovery" and "restatement" approaches as follows. The "discovery" approach involves reporting fourth-quarter earnings including correction of previous mistakes, while the "restatement" approach allocates the mistakes to prior quarters and restates those earnings such that the fourth-quarter announcement contains less noise.

[8]For all types of firms grouped together, incremental fourth-quarter ERCs are significantly negative when the data are winsorized or truncated, but not with raw data. However, there is no evidence of decreased fourth-quarter ERCs for non-seasonal firms and inconclusive evidence on seasonal firms when the sample is divided based on their definition of seasonality.

Also employing a pooled, cross-sectional design, Cornell and Landsman (1989) conclude that year-end announcements may be more informative (implying higher ERCs) because only year-end statements are audited and fourth-quarter results could contain corrections of interim information. However, that paper differs from the other studies and this one in that only longer return windows are considered and their analysis includes both earnings forecast errors and analyst forecast revisions as explanatory variables.

At least two potential problems related to measures of expected and actual EPS are common to the previous investigations of fourth-quarter effects. First, studies using mechanical expectation models (SRW, BR, GW, or Foster) and unadjusted Compustat EPS[9] to build those models are suspect bases of support that fourth-quarter ERCs are systematically smaller than interim quarter ERCs. Elliott and Shaw (1988) provide evidence that special items such as write-offs and restructurings are reported most frequently in fourth quarters (63% of their sample disclosures occur in fourth quarters). Bartov (1992) provides additional evidence related to the preponderance of fourth-quarter asset sales reported above-the-line as do Philbrick and Ricks (1991) in their search for causes of differences between Value Line actual EPS and adjusted Compustat EPS before extraordinary items. Since these items are probably previously priced (56% of Elliott and Shaw (1988) sample disclosures were made prior to earnings announcements) and, hence, less value-relevant at earnings announcement, fourth-quarter ERCs should be lower without regard to the reasons

[9]Unadjusted EPS means unmodified for special items as defined by Philbrick and Ricks (1991).

cited by previous authors. Therefore, the lower reported fourth-quarter ERCs are possibly due to increased measurement error of unexpected fourth-quarter earnings resulting from using unadjusted Compustat EPS both as a direct input in the calculation of unexpected earnings and in time-series model building.[10]

A second potential problem is the relative staleness of fourth-quarter expectations. Because of the longer delay in reporting year-end earnings, forecasts of those earnings vis-a-vis interim earnings are often much older, leading to greater error in expectations, and, therefore, more downward-biased ERCs (Brown, et al., 1987). This applies to both mechanical and analyst forecasts. Both SS and Mendenhall and Nichols (1988) report longer fourth-quarter reporting lags than interim lags in their samples, though no confirming statistical tests are conducted. Of the above studies, only Mendenhall and Nichols (1988) and KS attempt to reduce measurement error due to staleness of the forecast. The studies incorporating analyst forecasts as expectations use I/B/E/S summary information, however, O'Brien (1988) suggests that better analyst proxies are available. This study uses the median of forecasts submitted within thirty trading days of the quarterly announcement date from the I/B/E/S detail tape to obtain better proxies of the market's expectation and to make the staleness of forecasts more uniform across quarters.

This research attempts to address the measurement issues that may exist in previous studies causing fourth-quarter price responsiveness to earnings

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[10]Of the above studies, both Mendenhall and Nichols (1988) and Cornell and Landsman (1989) use I/B/E/S estimates and Compustat actuals to obtain unexpected earnings. It is likely that those analyst forecasts will not correspond to Compustat actuals in the presence of special items (Philbrick and Ricks, 1991).

announcements to appear to be lower than that of interim quarters. Better unexpected earnings measures are anticipated in this study due to: (1) the matching of analyst forecasts, calculated as the median of recent analyst forecasts from the I/B/E/S detail tape, with (predominantly) analyst actuals and (2) the use of a variable to proxy for and mitigate error in the expectation due to the age of the forecast (Brown, et al., 1987).

In summary, previous research has provided mixed evidence regarding the existence and direction of fourth-quarter effects. Earlier studies hypothesized reasons why fourth-quarter responsiveness of prices to earnings differed from that of other quarters, but could not adequately test those hypotheses. This study contributes to the literature by providing evidence of firm-specific fourth-quarter responsiveness and by exploring the hypothesized causes of that differential responsiveness.

2.3 Seasonal Effects

In addition to testing for fourth-quarter effects, SS test whether firms' ERCs vary across quarters based on sales seasonality. They conjecture that shocks to sales and/or earnings that occur during quarters of peak activity may be more value-relevant or permanent than other such shocks. SS use eleven years of data in pooled, cross-sectional time-series regressions to estimate short-window ERCs with unexpected earnings calculated using a SRW model and I/B/E/S forecasts. They divide their sample along dimensions of seasonality (seasonal, non-seasonal, and mixed firms)[11] and size. The authors report that for the SRW expectation model, the coefficients measuring both incremental ERCs and intercepts of the peak sales quarter are significantly positive in the seasonal and mixed sub-samples. However, SS's results regarding peak-quarter responsiveness of prices to earnings are inconclusive. In their SRW sample, the significance of peak-quarter incremental ERCs depends on the treatment of outliers and is not shown with raw and truncated data. When SS use I/B/E/S analyst forecast errors, peak-quarter ERCs are significantly higher only using raw data. However, non-seasonal firms have significant incremental peak-quarter ERCs for two forms of data winsorization. They conclude that:

> "The result of major concern that is **not robust** across sample segments and earnings expectation alternatives is the incremental earnings response coefficient for firms during the period in which they announce earnings from their peak-sales-quarter." (SS, p. 321) (Emphasis added)

The following points distinguish this study from SS and indicate the contribution of the current study regarding seasonal effects. First, by employing a time-series design to estimate firm-specific parameters related to incremental ERCs during peak sales quarters and a directed sampling approach, this research represents a more powerful means of determining if peak-quarter effects exist. SS implicitly assume that ERCs are intertemporally and cross-sectionally constant (within regressions of seasonal and size groupings). This study's design assumes that ERCs

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[11]SS categorize firms on the basis of average sales in one quarter relative to the other three, and the number of years in which the quarter with the largest average is the peak sales quarter. Whichever quarter has the highest average is classified as the peak quarter for each firm for every year so long as it is the peak sales quarter in eight of the eleven sample years.

are constant across time, but not across firms. Various authors have suggested that ERC regressions estimated in cross-section or pooled across time and firms are probably misspecified (Thomas, 1993; Cheng, et al., 1992). This probable misspecification could have resulted in the lack of robustness that SS report regarding peak-sales-quarter responsiveness.

Second, after estimating incremental peak-quarter ERCs for specific firms, this study describes and tests cross-sectional variation therein as a function of firm-specific variables which may cause peak-quarter responsiveness to be different from that of other reporting quarters. The variables considered include a continuous measure of seasonality versus the coarse categorization employed by SS, and a proxy which measures the relative informativeness (or resolution of uncertainty) of peak-quarter earnings disclosures.

Chapter 3

HYPOTHESIS DEVELOPMENT

3.1 Hypotheses Related to Fourth-Quarter Effects

Arguments exist supporting the competing hypotheses of weaker and stronger fourth-quarter earnings - returns relations relative to interim quarters. As described more fully in the following paragraphs, fourth-quarter ERCs may be attenuated due to earnings management and "settling-up" of interim approximations. Alternatively, as suggested by Cornell and Landsman (1989) and KS, fourth-quarter ERCs may be higher than interim ERCs because the fourth-quarter earnings alone are audited. The external audit may provide investors with increased confidence in the fourth-quarter earnings number (relative to interim earnings) as a signal of future dividend paying ability. Because of these competing arguments, the first research hypothesis is two-tailed:[12]

H^{4Q}_{A1}: **The return responsiveness to fourth-quarter earnings shocks differs from the return responsiveness to interim earnings shocks.**

The variation in differential fourth-quarter ERCs across firms can be attributed to accounting-related factors specific to individual companies. Earnings management may contribute to differential market responses to reported earnings in the fourth quarter relative to other quarters. The Mendenhall and Nichols (1988) argument is predicated on the assumption that managers exercise greater discretion over interim earnings. However, if the earnings management which they describe (i.e., deferred

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[12]All hypotheses are stated in the alternate form.

interim recognition of expenses) does occur, it must reverse more than proportionally in the fourth quarter. Further, earnings management may be more prevalent in fourth quarters since managers know the results of the previous three quarters and can adjust earnings to maximize bonuses or to achieve other targets during the fourth quarter. If earnings management is, in fact, more widespread in fourth quarters, ERCs should be lower since the market would evaluate earnings shocks in the presence of earnings management to be of a less permanent and more transitory nature. Therefore, the second hypothesis is:

H^{4Q}_{A2}: There is a negative relationship between incremental fourth-quarter return responsiveness to earnings and relative fourth-quarter earnings management across firms.

The authoritative guidance provided by GAAP in the form of APB-28 *Interim Financial Reporting* suggests another reason to expect differential fourth-quarter ERCs. Two approaches explain the relationship between interim and annual reporting. The "discrete" or "independent" approach treats each interim period as an individual reporting period and applies accounting principles for annual periods to each subperiod in the same manner. The "integral" or "dependent" approach, which GAAP encourages, considers interim periods as components of the annual reporting period rather than as separate periods (Accounting Principles Board Opinion Number 28, Paragraph 9, 1973). Based on the use of the integral approach to interim reporting, fourth-quarter actuals may have more noise due to "settling-up" factors such as inventory adjustments or the allocation of income tax expenses. "Settling-up" differs from earnings management in that "settling-up" does not directly imply purposeful manipulation of reported numbers, only necessary corrections of interim estimations. To the extent that corrections of interim quarter approximations are made in the fourth quarter without restatement of interim earnings (such that fourth-quarter earnings could be separately identified), we would expect ERCs to be attenuated in the fourth quarter relative to interim quarters. Therefore, the third hypothesis is:

H^{4Q}_{A3}: **There is a negative relationship between incremental fourth-quarter return responsiveness to earnings and relative fourth-quarter "settling-up" across firms.**

The discussion above suggests that fourth-quarter ERCs may be higher due to the confirmation provided by external auditors independent of adjustments induced by the year-end accounting closing process. However, the construct of interest is the degree of auditing that takes place in the fourth quarter relative to interim quarters across firms. For firms receiving more audit scrutiny in interim periods, we expect lower differential fourth-quarter ERCs. Hence, the fourth research hypothesis is:

H^{4Q}_{A4}: **There is a positive relationship between incremental fourth-quarter return responsiveness to earnings and the relative amount of fourth-quarter auditing across firms.**

3.2 Hypotheses Related to Seasonal Effects

SS hypothesize that reports associated with peak activity quarters provide more value-relevant information because a larger portion of earnings shocks in those quarters are permanent, or because those reports resolve proportionally more uncertainty. They offer the retail sales industry as an example where quarters ending in January are proportionally more value-relevant because of the critical holiday season. A sales shock occurring during such a peak quarter may signal a change in market share in the product market and associated future economic rents. SS suggest that peak-sales-quarter disclosures contain less noise since "...uncertainty in judgments about interim accruals or deferrals relates to uncertainty about annual sales or productive volumes." (SS, p. 301) Therefore, since peak sales quarters resolve a larger proportion of uncertainty, expense accruals and deferrals contain less noise in those periods. To the extent that earnings from peak sales quarters contain more value-relevant components and less noise, we would expect those quarters' ERCs to be higher.

However, the relationship between prices and earnings may be stronger in non-peak quarters than in peak quarters, and, hence, peak-quarter ERCs may be lower than non-peak-quarter ERCs. The reason for this alternative conjecture is that for a given level of earnings-shock persistence, a shock in a non-peak quarter will result in a larger revision in future cash flows (or earnings) since that shock is extrapolated to peak quarters as a larger amount (due to scale). In contrast, an earnings shock from a peak quarter would be discounted by the extent of seasonality in the markets' assessment of the implication of that shock on future (non-peak) cash flows and earnings. As a practical example, consider how the market would assess a holiday season shock to earnings of a retailer versus a non-holiday shock. If the holiday shock is extrapolated into the future, it is likely that the size of the shock assumed for non-peak seasons is smaller due to the scale of operations. Conversely, a non-holiday season earnings shock, assumed to be equally persistent, would map to larger revisions during future peak quarters due to the scale of activity. Hence, drawing strictly on an algebraic argument, we may expect price responses (resulting from changes in expectations of future cash flows/earnings) to be greater for non-peak quarters versus peak quarters given the same earnings shock, and, therefore, smaller ERCs for peak quarters versus others. Based on these competing arguments, this study hypothesizes that peak-sales-quarter earnings announcements may provide proportionally more or less value-relevant information than other quarters and, therefore, the responsiveness of prices to earnings for peak relative to non-peak quarters is ambiguous.

H^{S}_{A1}: **The return responsiveness to peak-sales-quarter earnings shocks differs from the return responsiveness of other quarterly earnings shocks.**

Support for one tail of this hypothesis would provide evidence that SS were unable to conclusively obtain. However, stronger support could be found if price responses varied across quarters as a positive or negative function of the degree of firm sales seasonality. Hence, the second sales seasonality hypothesis is likewise tested in a two-tailed manner:

H^{S}_{A2}: **There is a relationship between incremental peak-sales-quarter return responsiveness to earnings and relative sales seasonality across firms.**

One reason that peak-sales-quarter return responsiveness may differ from other quarters' responsiveness is because peak-quarter results are more precise (contain less relative noise) in that disclosure of these results effect a larger reduction of uncertainty about future earnings. If uncertainty about future earnings is reduced more than proportionally by peak-sales-quarter earnings disclosures, then the reduction in divergence of investor beliefs should be more pronounced for these earnings announcements than other quarterly earnings announcements. Therefore, the third seasonal hypothesis tested in this study suggests that the relative degree of uncertainty reduction for peak sales quarters is positively associated with incremental peak-quarter price responsiveness.

H^{S}_{A3}: **There is a positive relationship between incremental peak-sales-quarter return responsiveness to earnings and relative peak-sales-quarter resolution of uncertainty across firms.**

Support for this hypothesis would provide evidence consistent with the notion that peak-quarter disclosures are priced differentially because they are more informationally useful (resolve proportionally more uncertainty).

In summary, this study hypothesizes overall fourth- and peak-quarter effects which could result in more or less price responsiveness to earnings. Cross-sectional determinants of differential fourth-quarter responsiveness considered are earnings management, settling-up, and auditing. Sales seasonality, itself, and the relative resolution of uncertainty effected by disclosure of peak-quarter results are hypothesized to be related to peak-quarter effects. The following chapter, Chapter 4, summarizes how these seven hypotheses are tested. Chapter 5 reports the results of those tests.

Chapter 4

RESEARCH DESIGN

This research design chapter details sample selection, tests of differential fourth- and peak-quarter responsiveness, and tests of cross-sectional determinants of differential fourth- and peak-quarter responsiveness. Section 4.1 discusses the data and characteristic requirements that firms must meet to enter this study's sample. The next section, 4.2, describes how differential fourth- and peak-quarter responsiveness is tested for and defines empirical proxies of variables contained in the ERC regressions. Reasonableness checks of variable measures used in the study are also described in this section. Section 4.3 introduces empirical proxies for the hypothesized determinants of differential fourth-quarter responsiveness and how those hypotheses are tested. Finally, Section 4.4 describes the proxies of determinants used in tests of differential peak-quarter responsiveness and the tests which mirror the fourth-quarter tests.

4.1 Sample Selection

A directed sampling procedure is used in this study in that only firms exhibiting seasonal sales patterns and whose fourth quarter is not their peak sales quarter are included. The study employs this approach because if fourth-quarter and peak-quarter effects are not identifiable and describable in this sample, the effects may not exist. Schipper (1990) contends that if the goal of a research effort is to document that some phenomenon exists, it is advantageous to use a biased sample that is especially likely to display the phenomenon. With this set of firms, I am able to separate fourth-quarter from peak-quarter effects without compromising the established variation in price responsiveness to earnings across firms. The degree to which firms' sales series meet the following definition of seasonality dictates inclusion in the sample.

The approach used in this study samples from the population of seasonal firms defined in a manner simiiar to SS (see footnote 11). All firms with quarterly net sales (#2), shares used in EPS calculation (#15), and adjustment factor (#17) data in Compustat for the first fiscal quarter of 1983 through the fourth fiscal quarter of 1993 are eligible for inclusion in the study. Sales per share (SPS) are deflated by the consumer price index (CPI) to eliminate undue weight given to later quarters resulting from general price level movements.[13] After deflation, firms whose ratio of the quarter with the largest deflated SPS to the average of the other three quarters' deflated SPS is greater than 1.1 are classified as seasonal if that peak quarter has the highest SPS for a majority (six of eleven) of sample years. This ratio of deflated peak-quarter SPS to other quarters' SPS measure is used as a proxy of relative sales seasonality as is discussed later. For inclusion in the study, a firm's peak quarter cannot be that firm's fourth quarter for the reasons described above.

Firms that meet the seasonal classification criteria are subject to the following restrictions prior to inclusion in the population from which the sample is drawn:

(1) firms that change fiscal year-ends during the sample period are excluded
(2) firms without continuous quarterly sales data on Compustat from 1983

[13]The Monthly US Consumer Price Index of the Federal Reserve Bank of Boston with an index of 1982-1984 = 100 (the base period), not seasonally adjusted, is used as the deflator in the study.

to 1993 are excluded

(3) firms with less than twenty-five quarters of unexpected earnings estimable from I/B/E/S analyst forecast data accompanied by estimable abnormal returns and prices from CRSP are excluded

(4) firms classified as public utilities (SICs 4900-4941) and banks, savings and loans, and insurance companies (SICs 6000-6411) are excluded since returns - earnings relations in these historically regulated industries are dictated by other factors.

4.2 Tests of Differential Fourth- and Peak-Quarter Responsiveness

The following regression model (equation (1)) relating abnormal returns to unexpected earnings is used to test H^{4Q}_{A1} and H^{S}_{A1}. Firm specific parameters for incremental fourth- and peak-quarter ERCs are estimated using ordinary least squares regressions (OLS) with firm-level time-series data.

$$CAR_{iq} = \alpha_{1i} + \alpha_{2i}4QD_{iq} + \alpha_{3i}SD_{iq} + \gamma_{1i}\,UE_{iq} + \gamma_{2i}\,4QD_{iq}\,UE_{iq} + \gamma_{3i}\,SD_{iq}\,UE_{iq} + \gamma_{4i}\,RME_{iq} + \epsilon_{iq} \quad (1)$$

Where

	CAR_{iq}	=	cumulative abnormal returns for firm i during event period q
	UE_{iq}	=	quarter q unexpected earnings for firm i
	$4QD_{iq}$	=	indicator variable[14] = 1 if q is a fourth quarter, 0 otherwise
	SD_{iq}	=	indicator variable = 1 if q is a peak sales quarter, 0 otherwise
	RME_{iq}	=	cumulative returns for firm i from the quarter q forecast date to the event period

In this regression, γ_{1i} is the firm-specific ERC for quarters other than the peak sales or fourth-quarter, and γ_{2i} and γ_{3i} represent firm-specific incremental fourth- and peak-quarter ERCs, respectively. The empirical proxies for the variables included in equation (1) are described in the following paragraphs.

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[14] The differential intercepts for peak- and fourth-quarter observations are included for statistical reasons as well as for comparison with prior research. SS make a case for higher peak-quarter intercepts, and report that they exist among their seasonal sub-sample in pooled cross-sectional regressions.

Cumulative Abnormal Returns (CAR_{iq}) - Risk-adjusted abnormal returns are accumulated over a two-day event period using the market model as a proxy for expected returns.[15] Equation (2) summarizes the market model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \quad (2)$$

Where R_{it} = continuously compounded return for firm i's common stock, day t,
R_{mt} = continuously compounded return on the CRSP Value-Weighted Index for day t,
α_i = intercept coefficient for firm i,
β_i = slope coefficient for firm i
ϵ_{it} = normally-distributed error term

Abnormal returns are accumulated over the date of and trading day preceding the quarterly earnings announcement date reported in Compustat (or I/B/E/S if no actual date is reported in Compustat).[16] Using estimates a_i and b_i of α_i and β_i, respectively,

[15]Market-model parameters are estimated using OLS over the period t = -104 through t = -5 relative to the announcement date (one-hundred-trading-day estimation period) excluding the prior earnings announcement period(s) that fall within that hundred-day estimation period.

[16]Multiple reasonableness checks were conducted to ensure the integrity of the earnings announcement dates. Compustat announcement dates were used except when missing, in which case I/B/E/S announcement dates were adopted. If both were absent, announcement days were hand collected from the Wall Street Journal Index (WSJI) augmented by other sources. Reasonableness checks of announcement dates were conducted using the following criteria for investigating existing dates:

(1) If the earnings announcement date was more than four trading days in absolute terms from both the previous and subsequent years' same-quarter announcement, the date was output for investigation. 1993 announcement dates were investigated based only on their relationship to previous announcement dates. This resulted in 59 date changes.

(2) Based on the idea that returns of a large magnitude preceding the earnings announcement may be indicative of an information release that may have included the earnings announcement, I investigated RME_{iq} variable observations (see below for definition) that were greater than .10 or less than -.10. Of the 395 announcement dates investigated based on this second criteria, only six required modification.

(3) Based on the established positive and significant relation between abnormal returns and unexpected earnings reported in the literature, firms: (a) whose standardized γ (ERC for non-peak, non-fourth quarters) was negative; or (b) whose adjusted R^2 from estimation of equation (1) above was negative; were subject to a third reasonableness check. For consistency, ten firms with "good" models, those

fitted residuals (u_{it}s) for days (-1,0) are calculated and summed to serve as estimates of risk-adjusted abnormal returns. CAR_{iq} are summarized in equation (3):[17]

$$CAR_{iq} = \sum_{t=-1}^{0} u_{it} \tag{3}$$

Where u_{it} = market model residuals estimated from equation (2)
t = trading day relative to the earnings announcement date

Unexpected Earnings (UE_{iq}) - The measures of unexpected earnings primarily used in this study are analyst forecast errors derived from differences between I/B/E/S actual and I/B/E/S forecasts of EPS for a given quarter. However, during the course of conducting the study, it was noted that severe data problems exist in the I/B/E/S actual EPS data files, particularly in sample periods prior to 1989. The problems noted were related to adjustment factors for actuals being inconsistent with forecast adjustment factors, Compustat adjustment factors, and CRSP adjustment factors. Also, in some instances, I/B/E/S actual EPS inclusive of non-recurring items, which are presumably excluded from analyst forecasts, were reported. Because of these problems, a heuristic had to be developed to investigate and correct I/B/E/S actuals to the extent possible from available sources.

To determine how to address this issue, an initial analysis was conducted

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with positive base-case ERCs and positive adjusted R^2s, were randomly selected for the same review. This earnings announcement date check involved review of all earnings announcements dates for each of the thirty-six firms (twenty-six firms with "bad" models, and ten with "good" models) in the WSJI. Announcement dates were only changed if they were outside the then current event period (defined as above). In total, forty-eight dates were changed for firms with "bad" models, while nine dates were changed of firms with "good" models, resulting in 57 date changes.

[17]Due to extreme returns to securities during the stock market crash of 1987 which are likely to be unrelated to earnings announcements during that period, observations were eliminated if the announcement date was between October 16 and 23, 1987, inclusive. This resulted in the removal of seventeen observations from sample firms' series.

comparing I/B/E/S and Compustat actuals with Value Line actuals to ascertain which were closest to Value Line. There was no discernable pattern though it did appear that Compustat was more closely aligned with Value Line in earlier years. Consequently, the procedure adopted here was to first apply the appropriate adjustment factor (for stock splits and stock dividends) to the I/B/E/S actual data based on observation of the Compustat adjustment factors and I/B/E/S adjustment file. Next, the I/B/E/S actual was used if the ratio of I/B/E/S actual to Compustat actual EPS (adjusted for stock splits and stock dividends) was between .95 and 1.0526 (the reciprocal of .95). If the ratio was outside of those parameters, the procedure followed was to use Value Line actuals, if available, augmented by the WSJI and New York Times Index when the firm was not covered by Value Line.[18] Hence, I/B/E/S actuals were not used exclusively because the scaling and other problems with earlier observations would have added noise and inconsistency to the analysis. Philbrick and Ricks (1991) report that forecast errors calculated using actual EPS from Value Line yield the highest correlations with abnormal returns independent of forecast source relative to I/B/E/S actuals and Compustat actuals adjusted or unadjusted for special items. However, the results of Philbrick and Ricks (1991) are not directly applicable to this study since that paper used the I/B/E/S summary tape, was from an earlier time period, and alluded to other types of problems with I/B/E/S actuals.

A second reasonableness check investigated the most extreme unexpected

[18]Four firms in the sample were not covered by Value Line consistently.

earnings (price-scaled forecast errors greater than 5% and less than -5%) based on the assumption that the most extreme observations are the most likely to be problematic. The same investigation and correction procedure was subsequently followed in that Value Line actual EPS were referenced in those instances and input as the actual amount. In cases where either I/B/E/S or Compustat actual EPS differed appreciably from Value Line, further analysis was conducted of quarterly and annual financial statements as well as company news releases. Fifty-five changes were made to actual EPS as a result of this second reasonableness check.

In support of using analyst forecasts as the earnings expectation employed in the study, O'Brien (1988) reports that, for short forecast horizons, the mean or median forecast from among recent analyst forecasts is more accurate than the most current individual forecast or the median or mean of less current forecasts. Brown and Kim (1991) report similar results with respect to association tests (i.e., timely composites are superior to the mean of all outstanding forecasts on the market association dimension). As such, the median of analyst forecasts made within thirty trading days prior to the earnings announcement event period (-31,-2) from the I/B/E/S detail tape proxies for the analyst forecast of quarterly EPS. The median of recent individual forecasts has the virtue of providing a time-dated estimate which readily permits controlling for errors in forecasted earnings due to age of the forecast. The analyst forecast errors are scaled by the market price per share immediately prior to the event period to which the forecast pertains (Christie, 1987).

Control for Error in Earnings Expectations in Short Window Regressions (RME_{iq}) - Brown et al. (1987) suggest that by adding a variable correlated with the measurement error in an independent variable to the right side of a regression equation, we may be able to mitigate downward bias in coefficients caused by the errors-in-variables problem. They use stock returns for one hundred days prior to the abnormal return period as the independent variable based on the idea that the error in the earnings expectation caused by its staleness is correlated with returns in the intervening period. Since the analyst forecast expectation used is the median of the most recent individual analyst forecasts, the returns accumulated between the median date of the analyst forecasts used in determining that median and the announcement period serves as the control variable in this study. Hence, RME_{iq} is calculated as:[19]

$$RME_{iq} = \sum_{t=MD}^{-2} R_{it} \tag{4}$$

Where R_{it} = continuously compounded return for firm i's common stock, day t,
MD = median date of analyst forecast dates used in the determining the median forecast

In testing H^{4Q}_{A1} and H^{S}_{A1}, the t-statistics of γ_{2i}s and γ_{3i}s (standardized coefficients) serve as independent standardized observations of differential fourth-quarter and peak-sales-quarter responsiveness across firms and parametric t-tests are conducted to ascertain whether the mean of the distribution of t-statistics is significantly different from zero. This aggregation of firm-level relationships is

[19]As with abnormal returns, if RME_{iq} variables were calculated using returns from the market crash of 1987, they would not serve their intended function which is to mitigate error from the earnings expectation. As such, observations that included in the calculation of RME returns from October 16 to 23, 1987 were excluded. This resulted in the elimination of thirty-four such observations.

preferred to using t-tests of parameter estimates in pooled, cross-sectional regressions because of the aforementioned variation in ERCs across firms. Tests of incremental fourth- and peak-quarter responsiveness are two-tailed.

Hypotheses H^{4Q}_{A1} and H^{S}_{A1} were also tested using modified chi-square tests of the distribution of t-statistics to ascertain whether there is a differential relationship between returns and unexpected earnings for fourth and peak quarters. The standardized coefficients are assumed to be distributed as Student's t with mean zero and variance equal to one under a null of no differential responsiveness because not all firm-level equations were estimated with more than thirty observations. With a longer time-series, the t-statistics of the γ_{2_i}s and γ_{3_i}s would be distributed normally with mean zero and variance equal to one under a null of no differential responsiveness for fourth and peak quarters. The null of no differential responsiveness is tested by computing a test statistic equal to the sum of the squared t-statistics. After a slight adjustment for the Student's t versus normal distributional assumption, the sum of independent squared t-statistics is distributed chi-square with i (the number of different firms/regressions) degrees of freedom under the null. This test does not establish direction, only differential responsiveness as implied by the hypothesis.

4.3 Tests Related to Cross-Sectional Determinants of Differential Fourth-Quarter Responsiveness

The hypothesized determinants of differential fourth-quarter price responsiveness to unexpected earnings are summarized in Table 1, which details the construct of interest, hypothesized sign, and empirical proxy. Tests of hypotheses

H^{4Q}_{A2} through H^{4Q}_{A4} require operational definitions of those constructs and this section provides a description of how each variable is proxied.

TABLE 1
Summary of Hypotheses Related to Fourth-Quarter Effects

Hypothesis	Hypothesized Determinant of Differential Fourth-Quarter Responsiveness	Exp. Sign	Empirical Proxy
H^{4Q}_{A2}	Relative Earnings Management	-	$REM_i = \frac{VAR(TA_{4q,i}/SALES_{4q,i})}{\sum_{q=1}^{3}(VAR(TA_{q,i}/SALES_{q,i}))/3}$
H^{4Q}_{A3}	Relative "Settling-Up"	-	$RSU_i = \sum_{y=1}^{N} \lvert COGS\%_{4q,i} - COGS\%_{Iq,i} \rvert / N$
H^{4Q}_{A4}	Relative Auditing	-	$R4QA_i = \frac{\text{Intrm Qtrs w/ Timely Rev}_i}{\text{Total Interim Qtrs}_i}$

Dependent Variable - Relative Fourth-Quarter Price Responsiveness ($4QRES_i$) - The construct of interest is the relative price-responsiveness to fourth-quarter versus interim earnings announcements for each firm. A standardized measure of relative responsiveness is preferred to using raw incremental fourth-quarter ERCs (γ_{2i}s from equation (1)). Employing a measure of relative responsiveness conditioned on the standard error of the estimate indicates the firm-specific importance of the differential response which is essential in subsequent tests. As such, the t-statistic of γ_{2i} from equation (1) proxies for the relative fourth-quarter responsiveness within a firm and is named $4QRES_i$.

Relative Earnings Management (REM_i) - The problem with formulating a variable which measures the amount of earnings management that takes place in the fourth quarter relative to other quarters is that models usually employed to estimate earnings management require an estimation period when earnings are presumed not to be managed (e.g., Healy, 1985; DeAngelo, 1986; Jones, 1991). This study assumes that discretionary accruals are related to total accruals and assesses the variation in fourth-quarter accruals relative to interim accruals. Hence, the assumptions are: (1) that the time-series of accruals scaled by net sales follows a seasonal random walk absent earnings management, and (2) the more that accruals depart from this expectation across the sample period, the more prevalent the incidence of earnings management. Relative earnings management (REM_i) is therefore proxied as:

$$REM_i = \frac{VAR(TA_{4q,i} \,/\, SALES_{4q,i})}{\sum_{q=1}^{3} (VAR(TA_{q,i} \,/\, SALES_{q,i}))/3} \qquad (5)$$

Where $TA_{q,i}$ = total accruals[20] for firm i for quarter q or the

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[20]Total accruals are calculated in a manner similar to Jones (1991) as follows (where # refers to Compustat data item number):

$TA_{iq} = -DEP_{iq}$ (#5) + ΔCA_{iq} (#40) - $\Delta CSH\&EQ_{iq}$ (#36) - ΔCL_{iq} (#49) + ΔSTD_{iq} (#45)

Where DEP_{iq} = depreciation and amortization expense for firm i during quarter q

ΔCA_{iq} = change in balance of total current assets from quarter q-1 to q for firm i

$\Delta CSH\&EQ_{iq}$ = change in balance of cash and cash equivalents from qtr q-1 to q for firm i

ΔCL_{iq} = change in balance of total current liabilities from qtr q-1 to q for firm i

ΔSTD_{iq} = change in balance of debt in current liabilities from qtr q-1 to q for firm i

In periods after 1987 when the above measure is unavailable, the following measure is used:

$TA_{iq} = NETINC_{iq}$ (#8) - $OPCF_{iq}$ (#108) for the first fiscal quarter, and

$TA_{iq} = NETINC_{iq}$ (#8) - ($OPCF_{iq}$ (#108) - $OPCF_{iq-1}$ (#108)) for quarters 2 to 4

Where $NETINC_{iq}$ = net income for firm i during quarter q

$OPCF_{iq}$ = operating cash flows for firm i cumulatively to quarter q from the statement of cash flows.

In instances where only the annual depreciation measure was available, depreciation expense was fourth quarter (4q)

$Sales_{q,i}$ = net sales for firm i, during quarter q

Special items are removed from total accruals to avoid ascribing to earnings management the effect of the same potential data problems alluded to previously.[21] [22]

Relative "Settling-Up" (RSU$_i$) - Fourth-quarter "settling-up" relates to corrections of previous cost estimates in the fourth quarter made without any restatement which would permit separate identification of earnings for the last quarter. Many estimates relate to the interim valuation of inventory, as discussed in APB-28, and therefore cost of goods sold is expected to be the income statement line-item most affected by "settling-up." Kinney and McDaniel (1989) report that corrections or restatements in their sample are more prevalent in cost of sales than in any other account. If unreported corrections of previous estimates are correlated with disclosed corrections, then analysis of cost of goods sold across quarters of the year provides information regarding "settling-up." Therefore, the following variable measuring the variation of fourth-quarter cost of goods sold as a percentage of sales relative to interim quarters

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assumed to occur uniformly across quarters. Similarly, when only the year-end balances of the current maturities of long-term debt are available, the decrease or increase in that account was spread evenly across the quarters in calculating accruals. If the data to adequately calculate total accruals was unobtainable, that quarterly observation was dropped from the variance calculation.

[21]Considerable time and expense was incurred in collecting information about special items and making corresponding corrections. The majority of corrections related to corporate restructurings which usually resulted in changes in current liabilities (e.g., accrued restructuring costs) and/or current assets (e.g., assets held for sale) for many subsequent periods. The effect of changes in these assets on accrual calculations were reversed to the extent that information was available, consistent with the purpose of the study. As with current maturities in long-term debt, when the current liability or asset related to restructuring(s) were only disclosed annually, it was assumed that changes in those balances occurred uniformly throughout the year.

[22]Reasonableness checks were also conducted on the accrual/sales measures, and some adjustments were made to firms that changed reporting formats (e.g., the initial inclusion of financing subsidiaries in the balance sheets) causing extreme accrual measures.

serves as the proxy for "settling-up":

$$RSU_i = \frac{\sum_{y=1}^{N} |COGS\%_{4q,i} - COGS\%_{Iq,i}|}{N} \tag{6}$$

Where $COGS\%_{4q,i}$ = Cost of goods sold as a percentage of sales for the fourth quarter in year y for firm i

$COGS\%_{Iq,i}$ = Cost of goods sold as a percentage of sales for interim quarters averaged across interim quarters in year y for firm i

Relative Auditing ($R4QA_i$) - This study requires a proxy that reflects the relative degree of auditing in the fourth quarter vis-a-vis interim quarters. While interim financial reports are typically not audited, they are sometimes reviewed prior to release.[23] Ettredge, et al. (1994) explore the reasons that auditees purchase timely reviews from an agency cost perspective. Their analysis suggests three levels of the extent of interim auditing and, hence, the relative amount of interim versus fourth-quarter auditing across firms. The highest level of interim auditing is for firms purchasing timely reviews and reporting that review with an attachment from the auditor to Form 10-Q filed with the SEC. An intermediate level of interim auditing is provided when companies purchase the timely review, but do not disclose the review via attachment to Form 10-Q.[24] The lowest level of interim auditing and, therefore, highest level of relative fourth-quarter auditing occurs when there is no timely review. Data for this proxy was obtained from corporate 10-Q filings. This study uses the

[23]A timely (quarterly) review does not include evaluation of the internal control structure or tests of details of account balances per SAS 36, 66, and 71.

[24]Ettredge, et al. (1994) ascertain this via a survey instrument regarding external and internal accountant involvement with quarterly data and contend that sophisticated external users could be made aware of the review without the auditor's letter.

percentage of interim quarters receiving timely reviews as illustrated by auditors' letters as an *inverse* measure of the relative degree of fourth-quarter auditing.

$$R4QA_i = \frac{\text{Interim Quarters Receiving Timely Reviews}_i}{\text{Total Interim Quarters}_i} \quad (7)$$

In collecting this data, it was noted that firms either had interim reviews for the entire sample period or never did, and hence $R4QA_i$ became a dichotomous variable, assigned a value of one or zero.

Firm Size (SZE_i) - Though not hypothesized in this study as a cross-sectional determinant of incremental fourth-quarter responsiveness, firm size is included as a control variable in the analysis. Firm size may be correlated with other suggested determinants, but can also proxy for various other constructs. Firm size was measured as the sample firms' average market value from ten year-ends (1984 - 1993).[25]

Hypothesis Testing - Fourth-Quarter Determinants

This study uses the variable definitions described above and assesses Hypotheses H^{4Q}_{A2} to H^{4Q}_{A4} by estimating Spearman partial rank correlations between $4QRES_i$ and each of the above three variables after controlling for the other two and firm size. Therefore, the tests of cross-sectional determinants of differential fourth-quarter responsiveness are summarized in Table 2 as:

[25]The average across the ten most recent years was selected over eleven years, including 1983 year-ends, since a few firms did not have price and/or shares outstanding information from 1983.

TABLE 2
Tests of Hypotheses Related to Fourth-Quarter Effects

Hypothesis	Determinant	Test
H^{4Q}_{A2}	Relative Earnings Management	Rank Corr($4QRES_i$,REM_i | RSU_i,$R4QA_i$,SZE_i)
H^{4Q}_{A3}	Relative "Settling-Up"	Rank Corr($4QRES_i$,RSU_i | REM_i,$R4QA_i$,SZE_i)
H^{4Q}_{A4}	Relative Auditing	Rank Corr($4QRES_i$,$R4QA_i$ | REM_i,RSU_i,SZE_i)

4.4 Tests Related to Cross-Sectional Determinants of Differential Peak-Quarter Responsiveness

The hypothesized determinants of differential peak-quarter price responsiveness to earnings information are summarized in Table 3. To test these hypotheses, variables are needed that measure relative peak-sales-quarter price responsiveness, seasonality, and relative resolution of uncertainty, which are described in this section. Using these variable definitions, the same non-parametric partial correlation tests assessing fourth-quarter determinants will be used to test Hypotheses H^S_{A2} and H^S_{A3} as detailed in Table 4. Identification of the peak quarter is a necessary prerequisite to conducting the following tests. This is accomplished in a manner similar to that employed by SS in that the peak quarter is that quarter with the highest average sales per share and whose sales per share is larger than the other three quarters for a majority of the sample years.

TABLE 3
Summary of Hypotheses Related to Peak-Sales-Quarter Effects

Hypothesis	Hypothesized Determinant of Differential Peak-Quarter Responsiveness	Expected Sign	Empirical Proxy
H^S_{A2}	Relative Seasonality	?	$RSS_i = \frac{\text{Average SPS in peak qtr}}{\text{Average SPS in other qtrs}}$
H^S_{A3}	Relative Resolution of Uncertainty	+	Median $RRU_{i,y} = \frac{VAR(AF_{yr+1}^B)/VAR(AF_{yr+1}^A)}{\text{Ave. measure for non-peak qtrs}}$

TABLE 4
Tests of Hypotheses Related to Peak-Quarter Effects

Hypothesis	Determinant	Test
H^S_{A2}	Relative Sales Seasonality	Rank Corr($SRES_i$,RSS_i | RRU_i,SZE_i)
H^S_{A3}	Relative Resolution of Uncertainty	Rank Corr($SRES_i$,RRU_i | RSS_i,SZE_i)

Dependent Variable - Relative Peak-Sales-Quarter Price Responsiveness ($SRES_i$) - The t-statistic of γ_{3i} (the standardized coefficient measuring incremental peak-quarter responsiveness from equation (1)) is used as a measure of firm-specific relative peak responsiveness and the variable is named $SRES_i$.

Relative Sales Seasonality (RSS_i) - Relative sales seasonality is measured as the deflated average net sales per share for the peak quarter relative to the other quarters. Therefore, RSS_i is calculated as the average deflated net sales per share for the peak quarter divided by the average of the other three:

$$RSS_i = \frac{(\sum_{y=1983}^{1993} Deflated\ SPS_{i,pq}) / 11}{(\sum_{y=1983}^{1993} Deflated\ SPS_{i,npq}) / 33} \quad (8)$$

Where Deflated SPS = $\frac{\text{Net Sales}_{iq} / \text{Adjusted Shares Outstanding}_{iq}}{CPI_q}$

pq = peak quarter

npq = non-peak quarter

Relative Resolution of Uncertainty (RRU_i) - The study requires a proxy measuring the degree of uncertainty resolution effected by peak-sales-quarter relative to non-peak-sales-quarter earnings announcements. Brown and Han (1992) suggest that the change in dispersion of analyst forecasts following earnings announcements proxies for information usefulness. Alternative characterizations of information usefulness include the extent to which uncertainty about future earnings is resolved by a given disclosure, or the amount of signal versus noise contained in the information. This study incorporates the relative change in dispersion of analyst forecasts resulting from peak-quarter earnings announcements versus those of other quarters as a relative measure of uncertainty resolution. Therefore, the following variable measures the relative informational usefulness of peak-sales-quarter earnings announcements for a given year (y):

$$RRU_{i,y} = \frac{VAR(AF_{yr+1}{}^{B})/VAR(AF_{yr+1}{}^{A})}{\text{Median of same measure for non-peak quarters}} \quad (9)$$

Where $AF_{yr+1}{}^{B}$ = Analysts' forecasts of the following fiscal year (yr+1) EPS made before the quarter q earnings announcement for firm i

$AF_{yr+1}{}^{A}$ = Analysts' forecasts of the following fiscal year (yr+1) EPS made after the quarter q earnings announcement for firm i

RRU_i = median $RRU_{i,y}$ value from y = 1983 to 1993 (9a)

This variable is calculated using analyst forecasts in trading days (-40 to -1) relative to the quarter q earnings announcement for AF_{yr+1}^{B} and (+1 to +40) for AF_{yr+1}^{A} from the I/B/E/S detail tape.[26] The measure of uncertainty reduction for the peak quarter in a given year is divided by the median non-peak quarter for that same reporting year. The median value of yearly observations of this ratio serves as the firm-specific measure of RRU_i. The numerator and denominator observations should be greater than one, but if peak quarters are more informationally useful, then the proxy itself will be greater than one.

This chapter discussed the sample selection process, empirical proxies of variables used in the study, and the manner in which hypotheses are tested. The next chapter reports information regarding the sample itself, and distributions and correlations of and among the variable measures described here. It also reports the results of the hypothesis tests described in this chapter.

[26]Brown and Han (1992) report the intuitively appealing result that divergence of beliefs about year ahead earnings decreases after current year earnings announcements using the detail tape and suggest that the unexpected increased divergence finding of Morse, et al., (1991) is probably the result of using I/B/E/S summary data which obscures the effect.

Chapter 5

DATA ANALYSIS

This chapter is organized as follows. First, information regarding how the sample was determined is discussed and details about sample firms are provided in Section 5.1. Section 5.2 discusses the distribution of forecast error measures across types of quarter, forecast staleness (across quarters), and the relationship of these with previous research. Results of hypothesis tests, descriptive detail, and supplemental analysis relating previous research on differential fourth- and peak-quarter responsiveness to this study are described in Section 5.3. Sections 5.4 and 5.5 report results of hypothesis tests of cross-sectional determinants of fourth and peak quarters, respectively, as well as sensitivity and supplemental analyses related to those tests.

5.1 Sample Information

Table 5 summarizes how the sample was reduced to seventy firms for fourth-quarter tests and sixty-seven for seasonal tests from a possible 1,510 non-utility, non-financial institution firms which did not change year-ends, but had complete data to calculate sales seasonality. Of 1,510, 972, or 64.37%, were not seasonal by the definition employed, and another 335, or 22.19%, were seasonal, but the fourth quarter was the peak quarter. Of the remaining 203, 116 did not have twenty-five unexpected earnings observations from which to estimate firm-specific ERC regressions. Of the remaining eighty-seven (87), it was noted in the course of conducting the study that eighteen had reporting quarters of unequal lengths. That is, these firms appeared to be seasonal, but because their "peak" quarter was sixteen weeks long versus twelve weeks for the other three reporting quarters during at least part of the sample period, further analysis was conducted to determine whether those firms were seasonal in the same manner as others in the sample.[27] To accomplish this, the peak quarters' SPS of those firms were multiplied by 13/16 and non-peak quarters' SPS were multiplied by 13/12 for the sample years impacted to equate the quarters in terms of time. After this adjustment, all but one of the eighteen firms, Adolph Coors, were eliminated because they either no longer met the seasonal definition, or were seasonal, but the peak and fourth quarter coincided.[28] Therefore, the final sample consists of seventy firms for fourth-quarter tests. Three more firms were eliminated from the peak-quarter tests because there was inadequate analyst following to calculate the RRU variable (described in the last chapter). Hence, the peak-quarter tests were conducted using sixty-seven firms with variable measures available.

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[27]Anecdotal evidence in fact suggests that sixteen-week quarters may occur during slow activity periods based on a conversation with one eliminated firm's shareholder relations department.

[28]Based on this adjustment, Adolph Coors' peak quarter changed within the three interim quarters.

TABLE 5
Summary of Sample Selection Process

Firms with eleven years of continuous sales, shares, and adjustment factor data from which to calculate a sales per share (SPS) series on the Compustat Quarterly Industrial Tape, whose primary SIC code is not 4900-4941 (Utilities) or 6000-6411 (Banks, Savings and Loans, or Insurance Companies), and which did not change fiscal year-ends during the sample period	1,510
Firms which are not seasonal per the definition employed	(972)
Firms which are seasonal, but the peak quarter is the fourth quarter	(335)
Seemingly seasonal firms whose peak is not their fourth quarter based on the definition from Compustat data	203
Firms without twenty-five unexpected earnings observations complete with returns and price data (including two without returns data on CRSP)	(116)
Initial Sample	87
Firms which appear to be seasonal, but in fact have sixteen week reporting quarters, and after normalization are either non-seasonal or the fourth quarter became the peak quarter	(17)
Final Sample for Fourth-Quarter tests	70
Firms without adequate analyst following to calculate resolution of uncertainty and are therefore excluded from peak-quarter tests	(3)
Final Sample for Peak-Quarter tests	67

Table 6 summarizes the distribution of firms across primary Standard Industrial Classification (SIC) codes as categorized by Compustat and CRSP. As one would expect, the firms tend to operate in seasonal industries such as farm equipment, agriculture and food products, building construction and related products, clothing manufacturing, airlines, and motor vehicles and parts suppliers. These companies' year-ends also occur in off-peak periods, e.g., airlines are busy during vacation (summer) periods, but have calendar year-ends; clothing manufacturers tend to make sales to retailers prior to the holiday season (and have calendar or January year-ends); and the construction and related industries are busiest during temperate weather, but tend to have calendar year-ends. Generally, this sample is not characteristic of the population of firms that operate and compete in U.S. capital markets. However, the sample uniquely permits the firm-specific investigation motivated by an interest in separately investigating peak- and fourth-quarter effects and their suggested determinants.

At the end of the sample period, fifty-five sample firms' securities were traded on the New York Stock Exchange (NYSE), two on the American Stock Exchange (ASE), and thirteen over-the-counter (OTC). During the sample period, there was a movement toward NYSE from the ASE ar OTC. This predominance of NYSE firms is probably representative of firms which would meet all of the sales (Compustat), analyst following (I/B/E/S) and return (CRSP) data requirements across the sample period. Descriptively, the market value of sample firms at their fiscal 1993 year-end (as defined by Compustat) ranged from $33M to over $32B. The mean market value was approximately $2.05B, while the median was just over $810M. The first quartile was $242M and the third quartile was $2.09B.

TABLE 6
Sample Distribution by Industry

2-Digit SIC Code	Description of Industry	# of Firms per Compustat	# of Firms per CRSP
01	Agriculture Production - Crops	1	1
10	Metal Mining	-	1
13	Oil and Gas Extraction	4	4
14	Mining, Quarry Non-Metal Materials	1	1
15	Building Construction - General Contractor	1	1
20	Food and Kindred Products	6	5
22	Textile Mill Products	-	1
23	Apparel and Other Finished Products	6	5
24	Lumber and Wood Products	1	1
27	Printing and Publishing	4	4
28	Chemical and Allied Products	4	5
29	Petroleum Refining	2	3
30	Rubber and Miscellaneous Products	1	1
31	Footwear	1	2
32	Cement	2	3
33	Primary Metal Industries (Castings)	1	-
34	Fabricated Metals	3	4
35	Engines, Farm Equipment and Lawn Tractors	3	3
36	Electronic Lighting	1	1
37	Motor Vehicles, Parts and Motor Homes	5	4
39	Miscellaneous Manufacturing Industries	3	1
40	Railroads	1	1
44	Water Transportation	1	-
45	Airlines	3	3
50	Durable Goods - Wholesale	3	3
51	Nondurable Goods - Wholesale	2	1
52	Building Materials, Hardware, Lumber - Retail	3	2
53	General Merchandising Stores	2	2
54	Convenience Stores	1	-
56	Apparel and Accessory Stores	-	1
57	Furniture Stores	1	-
58	Eating Places	-	1
59	Drug Stores	2	3
73	Computer Processing and Equipment Rentals	1	2
78	Motion Picture Theaters	-	1

5.2 Forecast Error Measures, Forecast Staleness, and Previous Research

Table 7, panels A and B, documents a consistent finding from previous research (e.g., Collins, et al, 1984): that fourth-quarter EPS are less predictable than other fiscal quarters (forecast errors are larger than for other quarters of the fiscal year). Panel A indicates descriptively that the standard deviation of forecast errors is larger for fourth-quarter observations (.0337) than for peak (.0152) or non-peak, non-fourth quarters (hereafter referred to as "other" quarters) (.0211). Another finding consistent with previous research shown on Panel A is analyst optimism in forecasting EPS (Fried and Givoly, 1982; O'Brien, 1988). The mean scaled forecast error is less than zero for each type of quarter forecasted (-.0058, -.0002, and -.0003 for fourth, peak, and "other" quarters, respectively). However, peak-quarter forecast errors are not significantly different from zero based on two-tailed parametric ($t = -.2383$, $p = .812$) or non-parametric ($p = .944$) tests. This may imply that analysts are less optimistic, or unbiased in their forecasts of peak-quarter EPS for seasonal firms, or that they are biased as suggested in previous research, but do not take scale into account in formulating forecasts for peak quarters. I do not attempt to answer this particular issue in this study. Panel B also descriptively demonstrates the decreased predictability of fourth-quarter EPS in that the mean (median) absolute forecast error for fourth-quarter forecasts, .0114 (.0030), is larger than that of peak, .0070 (.0026), or "other", .0069 (.0024), quarters.

TABLE 7
Scaled and Scaled Absolute Forecast Errors by Type of Quarter

Panel A: Scaled Forecast Errors by Type of Quarter[a]

Type of Quarter	n	Mean (Std Dev.)	Min	25%	Median	75%	Max	t : Mean = 0 (p-value)	Signed Rank: Median = 0 (p-value)
Fourth	612	-.0058 (.0337)	-.3705	-.0064	-.0005	.0013	.3897	-4.2530 (<.001)	-28032 (<.001)
Peak	581	-.0002 (.0152)	-.1255	-.0027	.0000	.0025	.1248	-.2383 (.812)	-263 (.944)
"Other"	1147	-.0003 (.0211)	-.5486	-.0043	-.0001	.0016	.1120	-5.1978 (<.001)	-56961 (<.001)

Panel B: Scaled Absolute Forecast Errors by Type of Quarter[b]

Type of Quarter	n	Mean (Std Dev.)	Min	25%	Median	75%	Max
Fourth	612	.0114 (.0322)	.0000	.0008	.0030	.0090	.3897
Peak	581	.0070 (.0135)	.0000	.0008	.0026	.0076	.1255
"Other"	1147	.0069 (.0202)	.0000	.0008	.0024	.0075	.5486

[a] Scaled Forecast Errors = (Actual EPS - Median Analyst Forecast) / Price (t = -2)
[b] Scaled Absolute Forecast Errors = Absolute Value [(Actual EPS - Median Analyst Forecast)] / Price (t = -2)]

The forecast errors reported here are comparable to those reported by Mendenhall and Nichols (1989), but smaller than those reported by SS and KS. For example, SS report that the standard deviation in price-scaled forecast errors from a SRW model for fourth, peak, and interim quarters that range from .061 to .088, .050 to .064, and .041 to .061, respectively. As noted on Table 7, the standard deviation in price-scaled forecast errors in this study are .0337, .0152, and .0211, for fourth, peak, and "other" quarters, respectively. These standard deviations are sizably smaller, and may be a function of better forecasts (I/B/E/S analyst forecasts versus SRW model). KS report mean absolute (price-scaled) forecast errors of .031 and .029 for interim and fourth-quarters, respectively, based on their GW expectation models. The mean absolute price-scaled forecast errors reported here are .0114, .0070, and .0069 for fourth, peak, and "other" quarters, respectively, again indicative of a superior forecast model. Mendenhall and Nichols (1989) report similar mean absolute forecast errors of .0064 and .0076 for interim and fourth-quarters, respectively.

Table 7 is intended to be descriptive in nature, and while two sample t-tests comparing means of fourth- and peak-quarter scaled forecast errors, and fourth- and "other" quarter scaled forecast errors (not tabled, but from Panel A) indicate that the means are significantly different ($t = -3.6954$, $p < .001$, $t = -1.9555$, $p = .025$, one-tail, respectively), these tests should be considered with caution. First, since these measures are signed, there are offsetting positive forecast errors in each quarter class of observation which render mean comparisons useless in assessing relative forecast accuracy across types of quarters. Second, there exists some evidence of serial correlation in forecast errors (Ali, Klien, and Rosenfeld, 1992) implying that forecast error observations are not independent draws from a normal population. Hence, tests that assume independence are inappropriate in this context.

In an effort to provide more than descriptive detail about predictability across types of quarters, the following regression was run regressing absolute scaled forecast errors on seventy dummy variables (one for each firm) and a peak and "other" quarter dummy variable. Hence, the unique firm-specific factors are blocked and the relative forecast accuracy of peak and "other" quarters relative to fourth quarters is assessed.

$$ABS(SCLDUE_{iq}) = \alpha_1 F_{1q} + \alpha_2 F_{2q} + \ldots + \alpha_{70} F_{70q} + \beta_1 PQDMY_{iq} + \beta_2 OQDMY_{iq} + \epsilon_{iq} \qquad (10)$$

Where:

$SCLDUE_{iq}$	=	Quarter q Price-Scaled Unexpected EPS for firm i
F_{iq}	=	Dummy Variable = 1 if observation is for firm i, zero otherwise (i = 1, ... , 70)
$PQDMY_{iq}$	=	Dummy Variable = 1 if quarter q is a peak quarter for firm i
$OQDMY_{iq}$	=	Dummy Variable = 1 if quarter q is a non-peak, non-fourth "other" quarter for firm i

The results as they relate to type of quarter are summarized on Table 8. From this regression, we can conclude that fourth-quarter forecast accuracy, after controlling for firm effects, is significantly worse than peak ($t = 3.242$, $p = .001$, two-tailed) or "other" ($t = 3.972$, $p < .001$, two-tailed) quarter forecast accuracy. Though not tabled, peak and "other" quarter accuracy is apparently comparable ($t = .218$, $p = .828$). Demonstrating that fourth-quarter forecast accuracy is lower than that of other quarters provides no evidence with respect to the cause of that decreased accuracy which is considered more directly in this study by assessing the relative amounts of earnings management, settling-up, and auditing that takes place in fourth quarters.

TABLE 8
Results of Fixed-Effects Regression of Absolute Forecast Errors on Firms and Types of Quarters

Regression	Peak-Quarter t-stat (p-value)	"Other" Quarter t-stat (p-value)	Adjusted R^2 (F-stat)
Equation 10: Relative to Fourth Quarters	-3.242 (.001)	-3.972 (<.001)	.2728 (13.193)

Another factor that has been suggested as causing decreased responsiveness of prices to fourth-quarter earnings is the relative staleness of fourth-quarter expectations to those of interim quarters. Table 9, Panel A describes the distribution of forecast lags across type (fourth, peak, or "other") of quarter. Forecast lag is defined here as the difference in trading days between the median date of forecasts incorporated in determining the median analyst forecast and the start of the event period (day -1 relative to the announcement date). Since analyst forecasts comprising the median are constrained by the study to be within thirty days of the beginning of the event date, the distributions are generally expected to be comparable. However, fourth-quarter reporting lags appear to be slightly longer than at least "other" quarters in both a parametric and non-parametric sense. The mean (median) forecast lag for fourth, peak, and "other" quarters are 14.2598 (14), 14.0826 (14), and 13.6295 (13), respectively.

TABLE 9
Forecast Lags Across Type of Quarter
Panel A: Distribution of Forecast Lags Across Type of Quarter

Type of Quarter	n	Mean (Std Dev.) Forecast Lag[a]	Distribution Min	25%	50%	75%	Max
Fourth	612	14.2598 (6.5528)	1	9	14	19	30
Peak	581	14.0826 (6.8980)	1	8	14	19	30
"Other"	1147	13.6295 (6.9127)	1	8	13	19	30

Panel B: Results of Fixed-Effect Regression of Forecast Lags on Firms and Types of Quarters

Regression	Peak-Quarter t-stat (p-value)	"Other" Quarter t-stat (p-value)	Adjusted R^2 (F-stat)
Relative to Fourth Quarters	-0.413 (.679)	-1.939 (.053)	.8130 (142.315)

[a] Forecast lags are defined as the difference in trading days between the median date of analyst forecasts comprising the median and the beginning of the event period (usually day -1 relative to the earnings announcement date in Compustat).

An analysis identical to that summarized in Table 8 was conducted on forecast lags and is reported on Panel B of Table 9. That is, a similar fixed-effects regression like Equation 10 was run with forecast lag as the dependent variable, again blocking firm effects. From this regression it appears that the forecast lags for fourth quarters are indeed significantly longer (t = -1.939, p = .053, two-tailed) than for "other" (non-fourth, non-peak) quarters. However, the null hypothesis that the reporting lags of fourth and peak quarters are the same cannot be rejected ($t = -0.413$, $p = .679$, two-tailed).

Note that the mean difference between fourth and "other" quarters is less than one trading day, so the economic significance of this difference in terms of added noise in earnings expectations may not be great. Further, while the mitigating effect of including the RME variable in the ERC regressions to address the issue of forecast staleness is unobservable, it must be considered in reaching a conclusion regarding the relationship between increased forecast lag and noise in the expectations used in the model. Overall, it appears that the intention to have reasonably comparable forecast lags across type of quarter was plausibly achieved despite the statistically significant difference in the staleness of fourth- and "other" quarter forecasts as proxied in these tests.

5.3 Hypothesis Tests of Overall Differential Responsiveness of Returns to Earnings in Fourth and Peak Quarters

As a preliminary to discussing the overall results, Table 10 provides information about the distribution of standardized coefficients (t-statistics of firm-level parameter estimates) from the seventy firm-specific ERC regressions (Equation (1)). As expected, the distribution of t-statistics related to base-case and incremental fourth- and peak-quarter intercepts indicates that, in general, these standardized parameters are not far from zero. For example, only eleven of seventy non-peak, non-fourth ("other") quarter intercepts are significantly different from zero in either direction at the $p = .10$ level. Though not tabled, the hypothesis that the mean base-case standardized intercept is different from zero cannot be rejected at conventionally

TABLE 10
Distribution of Standardized Coefficients and Model Fit Across Sample Firms' ERC Regressions
n = 70

$$\text{EQ (1)}\quad CAR_{iq} = \alpha_{1i} + \alpha_{2i}4QD_{iq} + \alpha_{3i}SD_{iq} + \gamma_{1i}UE_{iq} + \gamma_{2i}4QD_{iq}UE_{iq} + \gamma_{3i}SD_{iq}UE_{iq} + \gamma_{4i}RME_{iq} + \epsilon_{iq}$$

			Distribution					Cum # of Significant Parameters					
								Negative			Positive		
Stdzed Parameter	Mean	Std Dev	Min	25%	50%	75%	Max	.01	.05	.10	.10	.05	.01
α_{1i} - Intercept	.2197	1.1807	-2.04	-.76	.09	1.01	3.35	0	1	2	9	4	3
α_{2i} - Incremental Intercept 4Q	-.1083	1.1077	-3.85	-.74	-.16	.76	2.90	1	2	4	1	1	1
α_{3i} - Incremental Intercept PQ	-.0447	1.0802	-2.95	-.86	.08	.69	2.37	1	3	5	3	1	0
γ_{1i} - ERC	1.0759	1.4522	-2.15	.10	.89	2.12	5.01	0	1	2	22	20	9
γ_{2i} - Incremental ERC 4Q	-.2341	1.1325	-3.00	-1.02	-.08	.44	2.26	1	5	7	3	2	0
γ_{3i} - Incremental ERC PQ	-.0033	1.4332	-3.24	-.81	.07	.93	5.45	2	6	8	7	2	2
γ_{4i} - RME	-.8107	1.3436	-5.03	-1.44	-.82	.09	1.75	5	10	13	1	0	0
Adjusted R^2	.1222	.1670	-.162	.017	.096	.231	.486	N/A			26	19	10

Where
CAR_{iq} = cumulative abnormal returns for firm i during event period q
UE_{iq} = quarter q unexpected earnings for firm i
$4QD_{iq}$ = indicator variable = 1 if q is a fourth-quarter, 0 otherwise
SD_{iq} = indicator variable = 1 if q is a peak quarter, 0 otherwise
RME_{iq} = cumulative returns for firm i from the quarter q forecast date to the event period

accepted levels (p = .124).[29] Similar conclusions apply to the distribution of standardized incremental fourth-quarter intercepts. While both the mean and median measures across firms are negative (-.1083 and -.16, respectively), a t-test indicates that we cannot reject the hypothesis that the mean standardized incremental fourth-quarter intercept is different from zero (p = .416).

The distribution of standardized α_{3_i}'s (incremental peak-quarter intercepts) yields an interesting overall conclusion that is inconsistent with previous research. SS report that incremental peak-quarter intercepts are significantly positive for seasonal firms only (not mixed or non-seasonals) in their pooled, cross-sectional regressions and attribute this to peak-quarter results resolving proportionately more uncertainty about future prospects. While relative resolution of uncertainty is considered more directly later, among the seasonal firms whose peak is not the fourth quarter investigated in this study, the mean standardized incremental intercept is *negative*, though the median is positive, and five firms have standardized incremental peak-quarter intercepts that are at least marginally significantly negative, while only three are at least marginally significantly positive. An untabled hypothesis test indicates that we cannot reject the null hypothesis that the mean standardized incremental peak-quarter intercept equals zero (p = .7302). Hence, these results are inconsistent with those reported by SS with respect to seasonal firms, and may be attributed to the more powerful design employed in this study (including firm-specific regressions, better analyst forecast proxies and actuals, inclusion of the RME variable, and sample

[29]All tests related to standardized intercepts are two-tailed since no formal hypotheses are motivated regarding these parameters in this study.

selection).

A finding consistent with previous research is the predominant positive relationship between abnormal returns and unexpected earnings. Both the mean and median standardized base-case ERC (1.0759 and .89, respectively) across firm regressions are sizably above zero. The hypothesis that the mean standardized base-case coefficient is greater than zero is strongly supported. The t-test that the mean standardized base-case ERC is equal to or less than zero is strongly rejected ($t = 6.1985$, $p < .001$). Further, twenty-two of seventy sample firms, almost one-third, have ERCs (for quarters other than the peak or fourth) which are greater than zero at the .10 level. These base-case standardized ERCs range from -2.15 to 5.01, and over 80% are positive, as expected.

The distributions of incremental fourth- and peak-quarter standardized coefficients are discussed in more detail below, as these measures serve as inputs into hypothesis tests H^{4Q}_{A1} and H^{S}_{A1}, but some descriptive detail is presented here. The incremental fourth-quarter standardized ERCs are negative across a majority of the sample firms. The mean (median) standardized coefficient is -.2341 (-.08) and seven of seventy coefficients are significantly negative at the .10 level (two-tailed). In contrast, only two firms' incremental fourth-quarter ERCs are significantly positive at the .05 level and three are at the .10 level.

Observation of the distribution of peak-quarter incremental standardized ERCs yields more inconsistences with previous research. Notably, SS report "some evidence" of increased responsiveness to peak-quarter earnings announcements. The distribution of standardized coefficients here does not corroborate that conclusion. The mean standardized coefficient is negative (-.0033), while the median (.07) is not appreciably far from zero. Eight of seventy (over 11%) incremental peak-quarter ERCs are significantly less than zero at the .10 level while only two are significantly positive at the .05 level and seven are significantly positive at the .10 level. Again, this may be indicative of differences in the research design employed in this study versus SS.

Analysis of the standardized coefficients on the RME variable provides reasonable assurance that the measure included to remove the error in unexpected earnings due to staleness in earnings expectations serves its purpose. The mean and median t-statistics of γ_{4i} are -.8107 and -.82, respectively, and the mean is significantly less than zero at less than the .001 level (two-tailed). Further, thirteen of seventy (almost 19%) of the individual firm coefficients are significantly negative at the .10 level, while only one is significantly positive at the .10 level.

In terms of model fit across the firm-level regressions, the average (median) adjusted coefficient of determination (adjusted R^2) is .1222 (.096). Over 75% of the adjusted R^2s for individual firms are positive and twenty-six of seventy (about 37%) firm-level Equation (1) estimated models yield F-statistics which are significant at the .10 level.

To provide more visual detail about fourth- and peak-quarter effects, Figures 1 and 2 are histograms of the distributions of standardized incremental coefficients across firms for fourth and peak quarters, respectively. The figures report the observed distributions of t-statistics and the corresponding number that would be observed if the distribution were normal with a mean of zero and variance of one (i.e., no differential relationship between abnormal returns and unexpected earnings for those quarters versus non-fourth, non-peak "other" quarters). From Figure 1, there appears to be a general shift in the distribution to the left relative to what would be expected from a standard normal distribution. Based solely on visual comparison without any formal testing, the shift to the left implies decreased responsiveness for fourth-quarter earnings announcements across firms.

In contrast to the fourth-quarter distribution, Figure 2 offers no discernible shift in the observed distribution of differential peak-quarter standardized coefficients. Figure 2 indicates that the observed distribution exhibits more firm observations on the tails of the distribution than would be anticipated if the distribution were standard normal. It appears that some of these seasonal firms have much greater return responsiveness to peak-quarter earnings announcements while others exhibit sizably lower return responsiveness. Tests to confirm these visual interpretations from the histograms are reported in the next few pages following the figures.

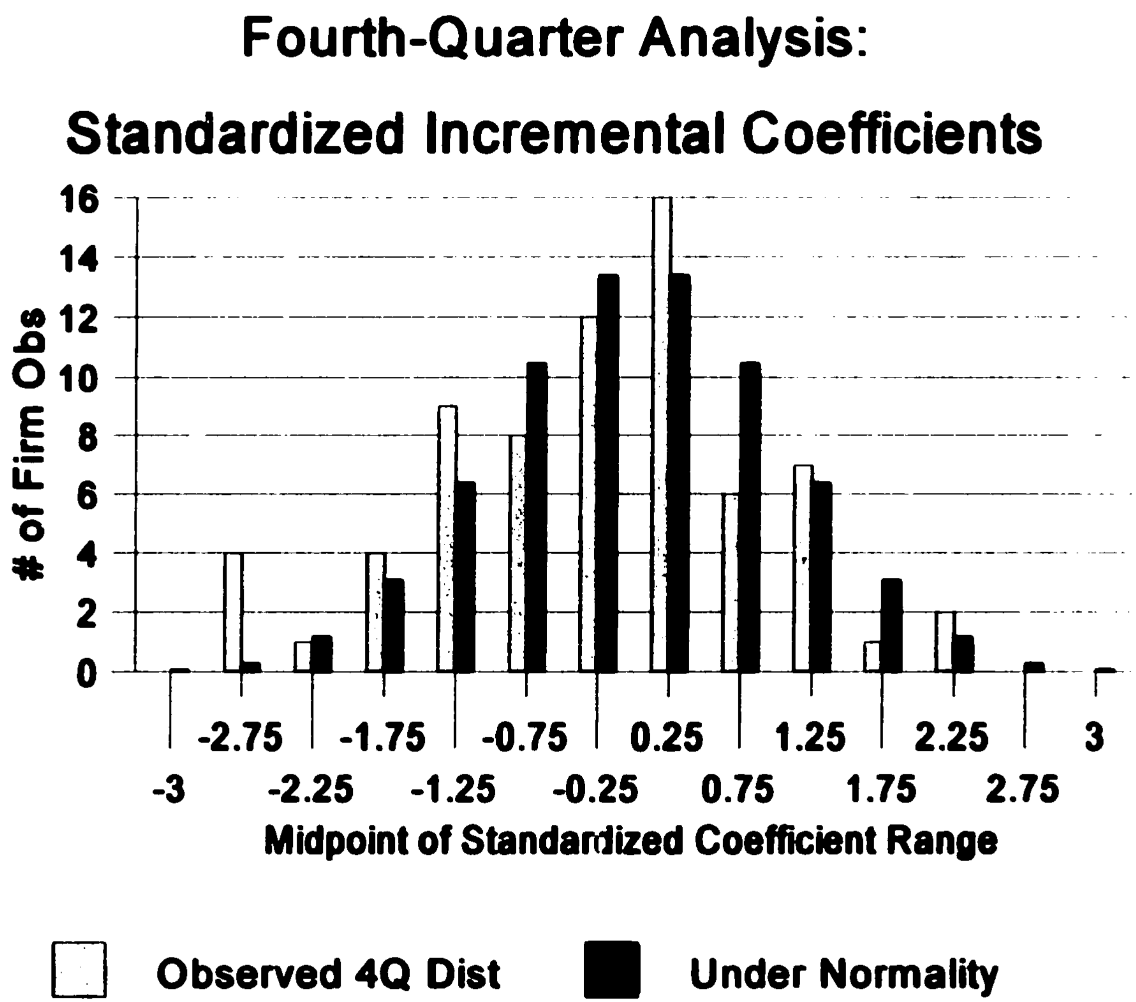
Fourth-Quarter Analysis:
Standardized Incremental Coefficients
# of Firm Obs
16
14
12
10
8
6
4
2
0
-2.75
-1.75
-0.75
0.25
1.25
2.25
3
-3
-2.25
-1.25
-0.25
0.75
1.75
2.75
Midpoint of Standardized Coefficient Range
Observed 4Q Dist
Under Normality

FIGURE 1

Peak-Quarter Analysis:
Standardized Incremental Coefficients

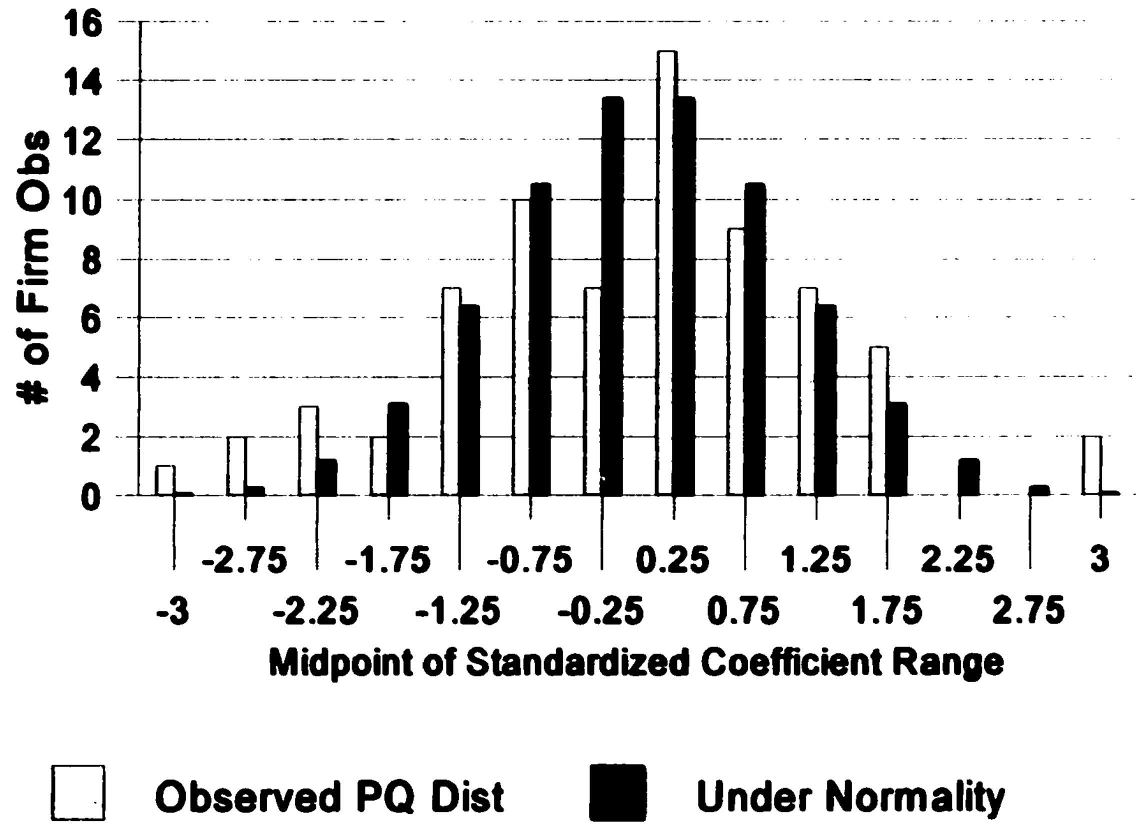

FIGURE 2

Tests of Differential Fourth-Quarter Responsiveness

Two tests are conducted to determine whether there is an overall differential relationship across firms between prices and earnings in fourth quarters relative to non-fourth, non-peak ("other") quarters. Table 11 summarizes these tests. First, a parametric t-test (two-tailed) is conducted to determine whether the mean standardized incremental ERC for fourth quarters is different from zero (implying that fourth-quarter relationships between unexpected earnings and abnormal returns differ from those of "other" quarters). We can marginally reject the null hypothesis of no differential relationship in favor of a decreased responsiveness ($t = -1.730$, $p = .088$).

TABLE 11
Tests of Differential Fourth-Quarter Responsiveness
n = 70

Test	Test Statistic	p-value
t-test: Mean $4QRES_i = 0$	-1.730 (t-stat)	.088
χ^2 Test: $4QRES_i \sim N(0,1)$	85.660 (G')	.099
Where $4QRES_i$ = t-statistic of γ_{2i} from Equation (1)		

A second test, discussed in the last chapter, is a χ^2 test of the sum of squared standardized coefficients (t-statistics). A slight adjustment was made to the test statistic to account for the $4QRES_i$ distribution being Student's t versus standard normal due to the number of observations used in estimating the ERC regressions.[30]

[30]Per Box (1953), when the distribution is assumed to be standard normal, the χ^2 statistic (e.g., G) is multiplied by a "correction factor" of 1.0 (no change) and the test statistic is distributed χ^2 with m (in this case the number of standardized coefficients) degrees of freedom. If the distribution of standardized coefficients is assumed to be Student's t with v degrees of freedom, the test statistic (G')

This is essentially a joint test of whether the distribution is normal and if the mean equals zero. It does not establish direction, only differential responsiveness. The observed test statistic (G') is 85.660 (p = .099, for 70 degrees of freedom), which indicates very marginal rejection of the hypothesis that the distribution of standardized coefficients is standard normal, implying that there is some evidence of differential responsiveness in fourth quarters.

The marginal rejection of the hypothesis that the mean standardized coefficient is not different from zero provides some evidence that, after attempting to correct for potentially unaddressed problems in other studies, there appears to be an overall decreased responsiveness to earnings announcements in fourth quarters. The design deployed here separates peak from fourth quarters to assess the effects independently.

Tests of Differential Peak-Quarter Responsiveness

This study was motivated in part by inconclusive evidence regarding the differential responsiveness of seasonal firms' returns to peak-quarter earnings announcements. Arguments were offered here supporting both increased and decreased responsiveness, so these tests are two-tailed. Table 12 summarizes the results using the same two tests conducted on sixty-seven firms for which proxies for the determinants of differential peak-quarter responsiveness are available. The t-test

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is approximately χ^2 with the following adjustment:

$$G' = G * (v-4) / (v-2)$$

with a corresponding, but negligible impact on the degrees of freedom. For this study, the degrees of freedom assumed for the Student's t (v) was the median degrees of freedom from the seventy firm-level regressions (28). The median degrees of freedom from the firm-level regressions is equal to the median observations less the number of parameters estimated (six) minus one.

of the hypothesis that the mean differential peak-quarter standardized ERC is different from zero cannot be rejected ($t = -.2037$, $p = .839$). Hence, the conjecture that the average incremental responsiveness of peak quarters is greater than or less than that of non-peak, non-fourth quarters is not supported. This could be due to the offsetting effects discussed in motivating the hypothesis, because there actually is no effect in either direction, or because peak-quarter responsiveness is greater or less than "other" quarters, but the test design used in this study was not powerful enough to reveal a difference.

The second test of differential responsiveness which is independent of directional implications is the χ^2 test discussed previously. This test indicates that we can reject the hypothesis that the distribution of standardized coefficients is not different from a standard normal distribution ($G' = 127.935$, $p < .001$), which is consistent with the visual interpretation of Figure 2. As above, a minor adjustment was made to the test statistic to account for the number of observations used in estimating the $SRES_i$ variables (see footnote 30). While not providing evidence of increased or decreased responsiveness, this test does indicate a substantial amount of cross-sectional variation in the differential responsiveness of peak-quarter returns to earnings which is needed for the subsequent tests of cross-sectional determinants.

TABLE 12 Tests of Differential Peak-Quarter Responsiveness n = 67		
Test	Test Statistic	p-value
t-test: Mean $SRES_i = 0$	-0.2037 (t-stat)	.839
χ^2 Test: $SRES_i \sim N(0,1)$	127.935 (G')	<.001
Where $SRES_i$ = t-statistic of γ_{3i} from Equation (1)		

Comparison with Previous Research - Pooled Cross-Sectional Regressions

While not advocated as the appropriate manner to assess overall effects, the following equations were estimated using data from the full seventy-firm sample:

$$CAR_{iq} = \alpha_1 + \alpha_2 4QD_{iq} + \alpha_3 SD_{iq} + \gamma_1 UE_{iq} + \gamma_2 4QD_{iq} UE_{iq} + \gamma_3 SD_{iq} UE_{iq} + \gamma_4 RME_{iq} + \epsilon_{iq} \quad (11)$$

$$CAR_{iq} = \alpha_1 + \alpha_2 4QD_{iq} + \alpha_3 SD_{iq} + \gamma_1 UE_{iq} + \gamma_2 4QD_{iq} UE_{iq} + \gamma_3 SD_{iq} UE_{iq} + \epsilon_{iq} \quad (12)$$

Where All variables have the same definitions as in the firm-specific regressions (see Equation (1))

Equation (11) is more consistent with the Mendenhall and Nichols (1988) approach than SS's approach in that a control for the error in the earnings expectation due to the staleness in the forecast (RME) is included in the model. Equation (12) represents a replication of SS's design. Table 13 summarizes the results of these pooled cross-sectional regressions.

The inferences that one would draw from conducting the analysis in this manner differ drastically from those described above. While the ERC for non-peak, non-fourth quarters is significant and positive, consistent with the firm-level analysis

TABLE 13
Summary of Pooled Cross-Sectional Regressions
Presented for Comparative Purposes
n = 2,340

EQ (11) $CAR_{iq} = \alpha_1 + \alpha_2 4QD_{iq} + \alpha_3 SD_{iq} + \gamma_1 UE_{iq} + \gamma_2 4QD_{iq} UE_{iq} + \gamma_3 SD_{iq} UE_{iq} + \gamma_4 RME_{iq} + \epsilon_{iq}$

EQ (12) $CAR_{iq} = \alpha_1 + \alpha_2 4QD_{iq} + \alpha_3 SD_{iq} + \gamma_1 UE_{iq} + \gamma_2 4QD_{iq} UE_{iq} + \gamma_3 SD_{iq} UE_{iq} + \epsilon_{iq}$

Parameter Estimates (t-statistics)

Model	α_1	α_2	α_3	γ_1	γ_2	γ_3	γ_4	Adjusted R^2 (F-stat)
EQ (11)	.0005 (.370)	-.0011 (-.505)	.0015 (.672)	.2175 (3.522) ***	-.1053 (-1.294)	.2883 (2.137) *	-.06373 (-5.392) ***	.024 (10.458) ***
EQ (12)	.0001 (.112)	-.0017 (-.777)	.0017 (.735)	.1900 (3.069) ***	-.0703 (-.861)	.2975 (2.192) *	-	.012 (6.656) ***

*** significant at .01 level (one-tailed)
** significant at .01 level (two-tailed)
* significant at .05 level (two-tailed)

Note: Variable definitions are reported on the bottom of Table 10 and previous research estimating the equation both with and without the RME variable, there is not strong evidence of differential fourth-quarter responsiveness from this analysis (though the sign is negative, consistent with the aggregated firm-level analysis and some previous research). Results of these regressions are consistent with the SS analysis using raw data in that they support the notion that peak-quarter responsiveness of returns to earnings is greater than that of non-peak, non-fourth "other" quarters. However, one difference is that SS report significantly positive differential intercepts for peak quarters in their sub-sample of seasonal firms. The adjusted R^2 from estimation of Equation (14) is low, but greater than that of SS when they used seasonal firms and I/B/E/S forecasts without winsorization (their Table 10, p. 324) (.012 versus .004).[31] Including the RME variable in the Equation (13) regression serves to strengthen the model fit, but does not change any inferences.

The principal conclusions of SS pertaining to I/B/E/S analyst forecasts result from the use of scaled unexpected EPS observations that are subject to winsorizing the upper (lower) one percent to the value of the observation at the 99th (1st) percentile.[32] I conducted a similar analysis (untabled) with the set of seasonal firms employed in this study and would reach similar conclusions with the exception of not finding incremental peak-quarter intercepts that are greater than zero. With the winsorized observations, base-case ERCs are significantly positive and incremental

[31]These same regressions were run with data from the thirty-nine firms in the sample with sales seasonality measures greater than 1.15 (which is almost identical to SS definition of seasonals, n = 1,267) and the inferences are the same.

[32]SS contend that it is important to examine how treatment of outliers affects results since outliers can drive results in motivating this winsorization.

fourth-quarter ERCs are negative, while peak-quarter differential ERCs do not differ significantly from zero. The results differ in comparison with SS's Table 8, p. 319 in a few important ways: (1) (as above) while SS report significantly positive peak-quarter intercepts, the incremental peak-quarter intercept coefficient is not significant in this analysis (p = .7096); (2) this regression's parameter estimate of the base-case ERC is sizably larger than in SS, while the parameter estimate of the differential fourth-quarter ERC is much smaller than in SS. A 95% confidence interval around base-case ERCs is (.4593, .9056) with a parameter estimate of .6824 versus (.1744, .2862) for SS around a parameter estimate of .2303. Likewise, a 95% confidence band around incremental fourth-quarter ERCs estimated here is (-.6377, .0019) versus SS's (-.2039, -.0445); (3) the adjusted R^2 of the regression reported here is .026 versus .017 in SS (a 53% improvement).

Because of weaknesses associated with constraining relationships between prices and earnings and across quarters to be the same for all firms, Table 13 serves no purpose with respect to hypothesis testing. However, it is interesting to note that one of central conclusions of SS, that peak-quarter intercepts are significantly different from those of other quarters is not replicated in this potentially more careful analysis. These regressions differ from SS only in that risk-adjusted, as opposed to size or market-adjusted, returns are used, certain types of firms are excluded from this analysis (including utilities, banks, firms whose peak is their fourth quarter, and most firms with peak quarters of sixteen week length), and the actual EPS used is primarily from I/B/E/S (with some adjustments from Value Line) versus Compustat.

5.4 Hypothesis Tests of Cross-Sectional Determinants of Fourth-Quarter Responsiveness

In this section, descriptive statistics related to proxies of differential fourth-quarter responsiveness are reported along with rank correlations among the suggested explanatory variables and the dependent variable (4QRES). Table 14 reports distributions of fourth-quarter determinant-variable measures. At the end of this section, results of hypothesis tests related to fourth-quarter determinants are reported.

TABLE 14
Distribution of Fourth-Quarter Determinant Measures
n = 70

Variable	Mean (Std Dev)	Min	25%	Median	75%	Max
REM	2.3553 (3.6323)	.1106	.8732	1.5011	2.3532	27.6605
RSU	.0351 (.0267)	.0068	.0192	.0293	.0438	.1631
R4QA	.0714 (.2594)	0	0	0	0	1

The distribution of relative earnings management (REM) across firms is difficult to interpret as the variable is measured as a ratio of variances, and could range from zero to infinity. REM ranges from .1106 to 27.6605 across firms in the sample with a mean of 2.3553 and a more meaningful median of 1.5011. In developing the hypothesis related to earnings management, I suggested that more earnings management would take place in fourth quarters than in interim quarters based on the propositions that managers were more fully informed regarding proximity to annual profit targets and that, to the extent that interim earnings management prevailed, we would expect it to reverse at year-end. To assess whether there is more earnings management in fourth quarters than interim quarters, as proxied in this study, I conducted a distributional assumption-free sign test of the distribution of REM minus one (since an REM measure of less than one indicates that the average interim variance in total accruals exceeds the variance in fourth-quarter total accruals). The results of this test (not tabled) indicate that the hypothesis of equal earnings management in fourth and interim quarters, as proxied here, can be rejected ($M = 16$, $p < .001$, one-tailed). This result is consistent with the conjecture that more earnings management takes place in fourth quarters than in interim quarters. It is important to note that the REM measures calculated in this study exclude special items to the extent that information exists to remove those effects. Hence, this evidence is unlikely to be an artifact of the restructurings and asset sales alluded to in Elliott and Shaw (1988) and Bartov (1993), which both studies note are more prevalent in fourth quarters.

The distribution of relative settling-up (RSU) measures is bounded below at zero since it is the average absolute difference across sample years between cost of sales as a percentage of net sales in fourth quarters and the average cost-of-sales percentage in interim quarters. The RSU variable measures across the seventy firms range from .0068 to .1631 with a mean of .0351 and a median of .0293.

Relative fourth-quarter auditing (R4QA) was proxied for in this study as the number of interim quarters that received timely reviews (determined by whether auditors included timely review letters in firm 10-Qs) divided by the total number of interim reporting quarters in the sample period. It was noted during the course of the study that, at least for this sample of firms, the choice was discrete: firms either choose to engage auditors to conduct timely reviews and included an auditor's letter in the 10-Q for the entire period, or never did so. As such, R4QA was either one or zero across sample firms. Only five sample firms included auditor reports of interim reviews in their 10-Qs: Butler Manufacturing, Commerce Clearing House, Cooper Tire, Ford, and Lowe's. Due to the overall lack of variation in this suggested fourth-quarter determinant, power is substantially reduced for the subsequent tests.

Table 15 summarizes univariate Spearman rank correlations between and among measures of relative fourth-quarter responsiveness (4QRES) and the suggested determinants and the control variable, firm size (SZE).

TABLE 15
Spearman Rank Correlation Coefficients (p-values, two-tailed)
- Fourth-Quarter Responsiveness and Cross-Sectional Determinants
n = 70

Variable	$4QRES_i$	REM_i	RSU_i	$R4QA_i$	SZE_i
$4QRES_i$	1.0000 (.000)	.1304 (.282)	.0536 (.660)	-.1002 (.409)	-.0362 (.766)
REM_i	-	1.0000 (.000)	-.0077 (.950)	.0124 (.919)	-.0581 (.633)
RSU_i	-	-	1.0000 (.000)	-.1386 (.252)	-.0791 (.515)
$R4QA_i$	-	-	-	1.0000 (.000)	.1386 (.252)
SZE_i	-	-	-	-	1.0000 (.000)

The univariate correlations indicate that the hypothesis of no relationship among the variables cannot be rejected. Of the three suggested determinants (relative earnings management (REM), relative settling-up (RSU), and relative fourth-quarter auditing (R4QA)), only R4QA has the anticipated negative sign (relatively more fourth-quarter auditing results in larger incremental fourth-quarter ERCs), though it is not surprisingly insignificant given the diminished power due to lack of variation in the measure. Neither REM, nor RSU are negatively correlated with 4QRES as was expected, though neither correlation is significant. Based on the Spearman correlations, it does not appear that the determinants are highly correlated either (the highest rank correlation is -.1386, between RSU and R4QA, p = .252).

Finally, no support is offered here for KS's conjecture that only smaller firms' relationships between returns and earnings in fourth quarters are attenuated relative to interim quarters. Though size is not included as an explanatory variable, these simple correlations do not support the conjecture that differential fourth-quarter responsiveness is related to firm size.

Table 16 summarizes the results of the formal hypothesis tests of the cross-sectional determinants of differential fourth-quarter responsiveness. The Spearman partial rank correlations (denoted R') indicate that none of the three null hypotheses can be rejected. Again, the multivariate tests indicate that only one of the suggested determinants (R4QA) attains the suggested sign. The sample rank correlations between REM and RSU and differential fourth-quarter responsiveness (4QRES) are positive. The lack of significant relationships for the suggested determinants of deferential fourth-quarter responsiveness could be due to a number of factors which are briefly discussed in the following paragraphs.

TABLE 16
Tests of Cross-Sectional Determinants of Fourth-Quarter Responsiveness
Spearman Partial Rank Correlation Coefficients
n = 70

Alternative Hypothesis	R^s	p-value (one-tailed)
H^{4Q}_{A2}: $R^s(4QRES_i, REM_i \mid RSU_i, R4QA_i, SZE_i) < 0$	.1317	.856
H^{4Q}_{A3}: $R^s(4QRES_i, RSU_i \mid REM_i, R4QA_i, SZE_i) < 0$	.0406	.628
H^{4Q}_{A4}: $R^s(4QRES_i, R4QA_i \mid REM_i, RSU_i, SZE_i) < 0$	-.0938	.225

It is possible that increased earnings management and settling-up in fourth quarters does, in fact, cause decreased responsiveness of returns to earnings, but that the proxies employed in this study do not capture these constructs, or are measured with sizable error. Another possibility related to earnings management is that rather than causing more noise in the reported earnings, as suggested here, earnings management is used by managers to signal future prospects. Subramanyam (1995) examines the pricing of annual discretionary accruals using a cross-sectional variation of the Jones (1991) estimation technique and reports that the market attaches value to discretionary accounting choices. Subramanyam (1995) argues that this pricing of discretionary accruals is consistent with two explanations: (1) managers behave opportunistically to manipulate income, and though it adds noise to reported earnings, the market misprices it (an inefficiency story), and (2) the market is efficient and the discretionary accruals convey private information that is appropriately priced by the market. Supplemental tests indicate support for the latter explanation. While this signalling argument is not tested in the quarterly setting of this study, it may represent an alternative explanation that is at least consistent with the observed sign of the relationship between 4QRES and REM reported here.

The lack of significance in the relationship between differential responsiveness and the relative amount of auditing that takes place in fourth versus interim quarters shown here (R' = -.0937, p = .225, one-tailed) is not surprising given the small number of firms that report interim reviews, and lack of variation in the measure. Another possibility is that firms in the sample did engage auditors to conduct interim reviews, but the interim review was not disclosed via the 10-Qs. In this case the R4QA variable would be mismeasured. Hence, it may be the case that auditing effects exist, but this study was not designed to capture the effects described above.

Overall, the results are not supportive of the hypotheses developed in Chapter 3. There appears to be no discernable relationship between differential fourth-quarter responsiveness, which was assessed in this study to be lower than that of "other" quarters in an overall sense, and the suggested causes of differential responsiveness explored in this study. Based on the proxies developed in the last chapter, I find no significant relationship between 4QRES and REM, RSU, or R4QA. There is support for the conjecture that earnings management, as measured here, is more prevalent in fourth than in interim quarters in an aggregate sense. However, that increased earnings management is not related to decreased responsiveness as suggested by previous studies and argued here.

5.5 Hypothesis Tests of Cross-Sectional Determinants of Peak-Quarter Responsiveness

Prior to discussing hypothesis tests related to determinants of differential peak-quarter responsiveness, distributions of the proxies of suggested determinants are summarized. Table 17 provides information about the distribution of peak-quarter determinant variable measures. Note that the relative sales seasonality (RSS) measure, which dictates whether firms enter the sample, ranges from a minimum of 1.1017 to a maximum of 6.0964.[33] The mean (standard deviation) and median RSS measures are 1.3218 (.6435) and 1.1662, respectively.

TABLE 17
Distribution of Seasonal Determinant Measures
n = 67

Variable	Mean (Std Dev)	Min	25%	Median	75%	Max
RSS	1.3218 (.6435)	1.1017	1.1237	1.1662	1.2490	6.0964
RRU	2.9822 (5.8613)	.1047	.7520	1.0759	2.0272	41.2713

The distribution of relative resolution of uncertainty (RRU) measures across firms is less useful in terms of description because it is measured as a ratio of variances, and therefore could range from zero to infinity. The rank correlation measures used in the subsequent analysis are insensitive to this non-normal distribution. The RRU variable ranges from .1047 to 41.2713, with a mean of 2.9822 and a median of 1.0759.[34] To assess whether, in fact, the median firm

[33]This extreme value indicates that deflated sales per share for the peak quarter are over six times the size of the average other quarters' deflated sales per share. The company in question is Pioneer Hi-Bred, a seed manufacturer whose business is highly agriculturally seasonal. The next largest seasonality measure (2.5750) belongs to Terra Industries, a mining concern.

[34]There were six instances where the variance of analyst forecasts after the earnings announcement was zero, and hence that firm-quarter RRU observation would be infinite. To address this, I winsorized these six measures at the subject firm's next highest quarterly observation, whether peak or

experienced increased resolution of uncertainty, as proxied here, for peak quarters relative to non-peak quarters, a non-parametric sign test of the distribution of the RRU measure less one (since an RRU measure of less than one indicates decreased resolution of uncertainty for peak quarters) was conducted. The results (not tabled) indicate that the null hypothesis that peak-quarter resolution of uncertainty is no greater than that of non-peak quarters can be marginally rejected (M = 6.5, p = .071, one-tailed).[35]

Spearman rank correlations between the measure of relative peak-quarter responsiveness (SRES, the firm-specific t-statistic of the differential peak-quarter ERC), relative sales seasonality (RSS), relative resolution of uncertainty (RRU), and firm size are reported on Table 18. Based on this univariate analysis, it appears that no discernable relationships exist between differential peak-quarter responsiveness and either sales seasonality or relative resolution of uncertainty resulting from peak-quarter earnings announcements versus non-peak earnings announcements. However, firm size and relative measures of both seasonality and resolution of uncertainty are highly negatively correlated. This is plausible for both. Larger firms tend to have more diversified product offerings, resulting in less concentrated sales in any particular season. With respect to resolution of uncertainty, it stands to reason that the information environment for larger firms is more complete than that of smaller

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non-peak.

[35]Ten firms had less than three yearly observations comprising the RRU variable, and elimination of these firms resulted in non-rejection (M = 3.5, p = .214) of the null hypothesis that resolution of uncertainty in peak quarters is less than or equal to resolution of uncertainty in other quarters, as proxied in the study.

firms (Bhushan, 1989; Atiase, 1985). It is probably reasonable to conjecture that resolution of uncertainty is smaller in any quarter for larger firms (because earnings announcements comprise proportionally less of the total set of information on which analysts would base forecasts of future periods' earnings). Coupled with the aforementioned relationship (that larger firms tend to be less seasonal), it is less likely that peak-quarter results will impact analyst forecasts as much as those results would for smaller firms.

TABLE 18
Spearman Rank Correlation Coefficients (p-values, two-tailed)
- Peak-Quarter Responsiveness and Cross-Sectional Determinants
n = 67

Variable	$SRES_i$	RSS_i	RRU_i	SZE_i
$SRES_i$	1.0000 (.000)	-.1218 (.326)	.1088 (.381)	.0963 (.438)
RSS_i	-	1.0000 (.000)	.0680 (.584)	-.3012 (.013)
RRU_i	-	-	1.0000 (.000)	-.3494 (.004)
SZE_i	-	-	-	1.0000 (.000)

Sensitivity analysis was conducted to ascertain whether the lack of univariate relationship between SRES and both RSS and RRU was due to inclusion of firms that were marginally seasonal, and whose RRU proxy was generated with less than three (of a possible eleven) yearly observations of peak- and non-peak-quarter measures in the same fiscal year. The implications from this analysis (untabled) are less clear.

When only firms whose relative sales seasonality (RSS) measure is greater than 1.15 are included in the analysis (n = 36), the univariate rank correlation between the standardized differential peak-quarter ERC (SRES) and relative resolution of uncertainty (RRU) is .4396 (significant at the .004 level, one-tailed). However, the rank correlation between SRES and relative sales seasonality (RSS) is not significant (R = .1822, p = .287, two-tailed). When only firms with more than two yearly RRU observations comprising the median RRU measure are considered (n = 57), the rank correlation between SRES and RSS is negative and significant (-.2851, p = .032, two-tailed). However, the rank correlation between SRES and RRU is not significant (.1172, p = .193, one-tailed). In this second sub-sample, size is significantly negatively correlated with both RRU and RSS, as in the original analysis.

Finally, excluding firms with few RRU yearly observations and firms with sales seasonality measures of less than 1.15 (n = 30), the only significant univariate relationship is between SRES and RRU (R = .3237, p = .041, one-tailed). This may indicate that for the most seasonal firms which have relative resolution of uncertainty proxies estimated most efficiently (with the most observations, and most likely to be widely followed by analysts), there is a positive relationship between differential peak-quarter responsiveness and the relative amount of uncertainty resolved by peak-quarter announcements.

Table 19 summarizes results of the multivariate tests of cross-sectional determinants of differential peak-quarter responsiveness. The Spearman partial rank correlations (denoted R') based on the full sample indicate that neither null hypothesis can be rejected at conventional levels. However, the correlation between SRES and RRU after controlling for RSS and SZE is reasonably close (R' = .1495, p = .117, one-tailed). As above, the robustness of this non-relationship was assessed by conducting the analysis (untabled) on: (1) firms with more yearly RRU observations to generate an overall RRU_i measure, (2) the most seasonal firms, and (3) firms common after imposing both restrictions.

TABLE 19
Tests of Cross-Sectional Determinants of Peak-Quarter Responsiveness
Spearman Partial Rank Correlation Coefficients
n = 67

Alternative Hypothesis	R'	p-value
H^S_{A2}: $R'(SRES_i, RSS_i \mid RRU_i, SZE_i) \neq 0$	-.0926	.463 (two-tailed)
H^S_{A3}: $R'(SRES_i, RRU_i \mid RSS_i, SZE_i) > 0$	.1495	.117 (one-tailed)

Consistent with the univariate information, when firms with less than three yearly observations comprising the median RRU measure are eliminated, the relationship between SRES and RSS, controlling for RRU and SZE is significant and negative (R' = -.2599, p = .055, two-tailed). Likewise, when the least seasonal of the firms are eliminated (those with RSS_i measures of less than 1.15), the correlation between SRES and RRU, controlling for RSS and SZE is significant and positive (R' = .4073, p = .009, one-tailed). Finally, when power is substantially reduced by excluding firms that have either few observations to estimate an RRU variable or are less seasonal (n = 30), only the relationship between SRES and RRU is marginally significant ($R'(SRES, RRU \mid RSS, SZE) = .2842$, p = .071, one-tailed).

Overall, the results with respect to tests of cross-sectional determinants of peak-quarter responsiveness are best characterized as mixed. The tests conducted with the full sample do not support rejection of either hypothesis. However, when firms which have few observations to generate a proxy measuring the degree to which peak-quarter earnings announcements resolve more uncertainty about firms' future prospects are eliminated, a negative relationship between peak-quarter responsiveness and sales seasonality is noted. This is consistent with the argument presented here regarding the pricing implications of peak versus non-peak-quarter earnings shocks and inconsistent with SS's argument regarding the degree of seasonality and accruals and deferrals being measured more precisely in peak quarters and peak-quarter shocks being more permanent.[36] However, that relationship is not robust among the most seasonal firms.

The positive relationship between peak-quarter responsiveness and relative resolution of uncertainty among the most seasonal firms is consistent with SS's conjectures about resolving uncertainty and intuition. Since price reactions are in theory representative of changes in expectations about future cash flows, and the

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[36]Though not hypothesized in this dissertation, Spearman partial rank correlations between standardized differential peak-quarter *intercepts* and both seasonality (RSS) and resolution of uncertainty (RRU) were conducted, controlling for size and either RRU or RSS, respectively. SS argue for an intercept shift independent of the sign of the unexpected earnings due to resolution of uncertainty effected by peak-quarter announcements of seasonal firms and report that differential peak-quarter intercepts are significant (and positive) only for seasonal firms both in SRW and I/B/E/S forecast samples. As such, these tests were conducted in a one-tailed manner. The results of this analysis are inconclusive. The partial correlation between standardized differential peak-quarter intercept coefficients (PQINT) and RRU was not significant and of the opposite sign (-.0246, p = .577), while R^s(PQINT,RSS|RRU,SZE) = .2042, is significant at the .051 level. This may be interpreted as supporting SS's conjecture since extent of seasonality is associated with the degree of intercept shift, however the argument is based on reducing uncertainty and with the proxy for RRU developed here, a negative relationship is noted. Further, conflicting evidence is reported above regarding overall conclusions about differential peak-quarter intercepts for this set of seasonal firms.

measure of uncertainty resolution can be interpreted as a measure of the change in certainty regarding future cash flow expectations, it is not surprising that they are correlated.

Chapter 6

CONCLUSION

This dissertation explores cross-quarter differences in the responsiveness of prices to earnings and suggested causes of those cross-quarter differences. It is intended to contribute to the accounting literature in at least three ways. First, the study attempts to provide a better understanding of how accounting earnings are valued by considering accounting-related and other issues which may impact the relationship between prices and earnings. Specifically, I consider whether earnings management, settling-up, and auditing are related to cross-quarter differences in the responsiveness of prices to earnings. Seasonality is likewise addressed as a potential determinant both as a direct influence and via the ability of peak-quarter information to resolve uncertainty about a firm's future prospects. Second, studies often reference the observed strength of the price - earnings relation across types of firms or time to make assertions about the usefulness of particular standards or as a measure of earnings "quality." If valuation implications vary across reporting quarters, then assessments of "quality" and usefulness are better informed by considering such cross-quarter differences. Third, the results of previous studies which employ pooled, cross-sectional research designs are inconclusive with respect to overall effects and are inadequate in terms of exploring hypothesized causes of cross-quarter differences. This study attempts to address these issues by considering the problem and conducting the analysis at the firm-level, and subsequently aggregating information.

The design used here differs substantially from those of previous investigations into cross-quarter differences in the responsiveness of prices to earnings. Firm-specific regressions are used to estimate differential responsiveness across quarters. A substantial amount of research supports the notion that ERCs vary across firms. As such, it is compelling to also assess cross-quarter differences at the firm-level. I am aware of no other study using firm-level detail to explore this issue. Since both fourth- and peak-quarter effects are conjectured to exist and because firm-level ERC regressions are employed in the study, the sample is selected to facilitate assessment and estimation of the effects. Seasonal firms whose peak is not their fourth quarter comprise the sample in this dissertation because if seasonal effects do exist, they are most likely to manifest themselves in this group and, because a firm-level design was adopted to explore these effects, econometric identification dictates that peak and fourth quarters be separate.

Hypotheses are developed in the study supporting both weaker and stronger fourth-quarter effects. The price - earnings relation is conjectured to be weaker due to earnings management which is posited to be more prevalent in fourth quarters and to cause more noise in actual earnings such that the market's assessment of actual earnings may vary from reported earnings more so in fourth than other reporting quarters leading to less price responsiveness to earnings announcements. It is important to note that this study attempts to remove the effects of "special items" such as restructurings and gains or losses on asset sales from actual and forecasted EPS, and the earnings management proxy. It is obvious that the market should price these items differentially and some empirical evidence confirms this. However, no previous study of cross-quarter differences attempts to eliminate these "special item" effects as explanations of differential responsiveness. These special items may represent another form of earnings management, the impact of which on cross-quarter responsiveness may be considered by future research.

Settling-up of interim approximations as prescribed by APB-28 represents another potential source of increased noise in fourth-quarter actuals and is argued to cause the price - earnings relation to be attenuated in fourth quarters. Conversely, since fourth-quarter earnings releases are subject to increased audit scrutiny, they may be interpreted by the market as a more credible signal of "true" earnings and priced accordingly such that fourth-quarter responsiveness is stronger.

The responsiveness of prices to earnings in peak quarters is also conjectured to be alternatively stronger, or weaker, than other quarters. Peak-quarter responsiveness may be stronger because a larger portion of the earnings shock is permanent, or because peak-quarter announcements resolve more uncertainty about the future (because they contain less proportional noise). Peak-quarter shocks may be more permanent because they indicate proportionally more about product market share and associated rents into the future. If this is the case, then there should be a positive relationship between differential resolution of uncertainty in peak quarters and the price - earnings relation across firms, which is hypothesized and tested.

In contrast to the above arguments for increased responsiveness due to increased permanence and decreased noise in peak-quarter earnings shocks, for a given level of persistence and noise, a peak-quarter shock has smaller price implications than that of a non-peak quarter due solely to extrapolation of scale effects. Therefore, overall peak-quarter effects are conjectured to be higher or lower and seasonality, which measures the extent to which a peak quarter differs from other quarters, is likewise hypothesized to be positively or negatively associated with differential responsiveness.

Fourth-Quarter Results

After attempting to address such issues as forecast staleness and selection of appropriate actual EPS, there appears to be decreased price responsiveness to fourth-quarter earnings announcements across the seventy sample firms. This is consistent with some previous research which used different research designs and potentially noisier proxies for fourth-quarter expectations. In addition to an overall effect, weak evidence of differential fourth-quarter responsiveness in cross-section is reported based on the modified chi-square test conducted on the sum of squared standardized coefficients. This potentially provides stronger evidence of fourth-quarter seasonality in the price-earnings relation because firm-level estimates are incorporated and because more careful attention was paid to incorporating earnings expectations that were representative of the market than in previous studies. These results suggest that event studies that consider only year-end announcements in their design may understate (on average) the overall relationship between prices and earnings and that individual firms' responsiveness to other quarterly announcements can differ drastically from those at year-end. For example, studies that attempt to control for the impact of unexpected earnings in pricing an annual report footnote disclosure would possibly reach other conclusions if alternative quarters were considered.

This overall conclusion is subject to a number of caveats. Though an attempt was made to control for the relative staleness of expectations across quarter types, fourth-quarter forecast lags were slightly over one-half day longer, on average, than non-fourth-, non-peak-quarter forecast lags. This increased staleness could cause fourth-quarter responsiveness to appear to be lower when, in fact, it is the same as other quarters. However, inclusion of the RME variable in the firm-level regressions was intended to mitigate this problem. Fourth-quarter EPS are also shown to be less predictable in an aggregate sense, as measured by price-scaled absolute forecast errors after controlling for firm effects, and consistent with previous research. This decreased predictability could be due to: (1) error in the actual or expected EPS resulting from not fully correcting for special items as intended, or using less timely forecasts, respectively, or (2) added noise caused by earnings management and settling-up considered in this study. Unfortunately, it is impossible to completely differentiate between these two explanations. Also, rejection of the hypothesis of no differential responsiveness for fourth versus other reporting quarters in favor of decreased responsiveness was made at a marginal level.

The results of hypothesis tests of cross-sectional determinants of fourth-quarter responsiveness do not support the conjectured relationships discussed above. In fact, the signs of the relationships between both earnings management and settling-up and differential fourth-quarter responsiveness are positive, opposite to the conjectured direction. While evidence is found that earnings management is more prevalent in fourth than interim quarters across the entire sample, that overall increased earnings management is not related to the aforementioned decreased price-responsiveness in cross-section. An alternative explanation, posited more generally by Subramanyam (1995), is that managers use discretionary accruals to signal future prospects to the market. That argument implies that increased earnings management leading to greater price responsiveness, which is consistent with the sign of the relationship observed in this study. Another alternative explanation for the non-results with earnings management and settling-up is that the underlying conjectured relationship is valid, but the constructs are inadequately proxied.

The observed relation between auditing and fourth-quarter responsiveness is in the direction conjectured, but not in a statistically significant sense. This is not surprising given the infrequence of firms engaging auditors to conduct interim reviews, as proxied by inclusion of an interim review letter in 10-Q filings. Only five of seventy sample firms reported interim reviews. Also, there was little variation in the measure of relative fourth-quarter auditing in cross-section since the five firms always received interim reviews and the remainder never did, resulting in the variable assuming a value of one or zero. Hence, it may be the case that auditing effects exist, but that the design of this study was not powerful enough to provide convincing evidence thereof. Future research may provide more evidence in this regard.

Peak-Quarter Effects

Aggregating across the sixty-seven sample firms, there was no discernable difference between the responsiveness of peak quarters and non-peak, non-fourth quarters based the tests conducted here. This could be due to the offsetting effects conjectured, i.e., less relative noise in peak-quarter earnings, more permanent shocks, and smaller price implications for a given level of persistence and noise. Alternatively, peak-quarter effects may not exist across firms, and fourth-quarter effects can be reexamined using all types of industrial firms since seasonal effects could be ignored. There is, however, substantial variation in individual firms' peak-quarter responsiveness as shown by the chi-square test of the sum of squared standardized coefficients.

Tests of the cross-sectional relationship between differential peak-quarter responsiveness and both relative seasonality and relative resolution of uncertainty using the full sample of sixty-seven firms do not support the conjectured influences of those determinants. Some evidence of an aggregate increased level of resolution of uncertainty in peak quarters is found in the full sample, but that finding is not robust in the subset of sample firms that have more observations to estimate the RRU proxy. The non-significant relationship between peak-quarter responsiveness and extent of seasonality is consistent with the overall effect described above. It is possible that offsetting effects caused this relationship to achieve an indiscernible sign.

Sensitivity analysis conducted on subsets of the sample of seasonal firms yielded some interesting findings. Notably, when only the most seasonal firms in the sample are considered, there is a significantly positive relationship between peak-quarter responsiveness and resolution of uncertainty, after controlling for both seasonality and size, as conjectured. Also, when firms with less analyst following as indicated by fewer yearly resolution-of-uncertainty observations are eliminated, a significantly negative relation between differential peak-quarter responsiveness and seasonality, after controlling for resolution of uncertainty and size, is noted. However, the results of these sub-sample tests should be interpreted with caution as they are not exhibited in the full sample.

Summary

In conclusion, this dissertation sought to provide further evidence about the price - earnings relationship. To some degree that was accomplished. Consistent with some previous research, some marginal evidence of a weakened relation in fourth quarters was noted. This study is suggested to provide stronger evidence of the empirical finding since its design is more powerful than those of previous studies. Earnings management, as proxied, was demonstrated to be more prevalent in fourth quarters, as suggested. However, neither earnings management, nor settling-up could explain the decreased responsiveness. Increased fourth-quarter auditing, or, alternatively decreased interim auditing, appeared to be very weakly related to increased price responsiveness to fourth-quarter earnings. In sum, while fourth-quarter responsiveness appears to be dampened in aggregate and variable in cross-section, that variable responsiveness is not attributable to the causes suggested in this study and the issue of what determines differential fourth-quarter responsiveness remains unresolved.

Differential peak-quarter responsiveness was not demonstrated across the full sample of seasonal firms included in this dissertation. Likewise, though there is e''idence of increased resolution of uncertainty effected by peak-quarter earnings announcements, neither seasonality, nor relative resolution of uncertainty is shown to be related to differential peak-quarter responsiveness in cross section. Some evidence of a positive relation between peak-quarter responsiveness and resolution of uncertainty and a negative relation between peak-quarter responsiveness and seasonality is noted in sensitivity analysis, but those findings are not robust. The conclusion of this study regarding peak-quarter effects is that while they may exist at the firm-level, since overall effects do not exist in this set of seasonal firms, it is unlikely that they exist in an aggregate sense. One extension of this study may be to consider other forms of seasonality discussed in the literature.

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