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The Impact of SFAS No. 131 on Information and Monitoring

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ABSTRACT

We investigate the effect of the Financial Accounting Standards Board's (FASB) new segment reporting standard on the information and monitoring environment. We compare hand-collected, restated SFAS 131 segment data for the final SFAS 14 fiscal year with the historical SFAS 14 data. We find that SFAS 131 increased the number of reported segments and provided more disaggregated information. Analysts and the market had access to a portion of the new segment information before it was made public, but analyst and market expectations were still altered by the mandated release of the new data. By increasing information disaggregation, the new standard induced firms to reveal previously "hidden" information about their diversification strategies. The newly revealed information affected market valuations and lead to changes in firm behavior consistent with improved monitoring following adoption of SFAS 131.

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1. Introduction

There is an ongoing debate about how the information provided under the new segment reporting standard, SFAS 131, compares with what was available under the old standard, SFAS 14.[1] Although advocates of the new standard claim it provides more relevant and disaggregated information to users, critics argue it reduces the comparability and reliability of segment information. Using a hand-collected database that contains restated SFAS 131 segment data for the final SFAS 14 fiscal year, we compare the segment information generated under the two reporting regimes for the same firm at the same time. We exploit these data to provide empirical evidence on the impact of SFAS 131 on the information and monitoring environment.

Disaggregated data are extremely important to financial statement users. Epstein and Palepu [1999] report that in a survey of 140 star sell-side analysts, a majority considered segment performance data (followed by the three financial statements) as the most useful data for their investment decisions. Over the past two decades, however, there has been considerable controversy over how disaggregated data should be reported and classified. Under SFAS 14, enterprises were required to classify line-of-business segment information using the *industry approach*. A major concern with SFAS 14 was that discretion in the definition of "industry" allowed many enterprises to report much less segment information to external users than what was reported internally (Ernst & Young [1998]).

Under SFAS 14, analysts consistently requested that financial statement data be disaggregated to a much greater degree (Pacter [1993]). In 1997, after extensive lobbying by analyst groups, the Financial Accounting Standards Board (FASB) issued SFAS 131. The new standard's *management approach* requires that disaggregated information be presented based on how management internally evaluates the operating performance of its business units. One of the stated objectives of the new standard is to provide more disaggregated information (FASB [1996]). For example, IBM, one of the firms most frequently referred to by advocates of SFAS 131, restated from one industry segment under SFAS 14 to seven operating segments under the new standard. Such reporting changes were applauded by many analysts (Reason [2001]). Another objective of the new standard is to increase the relevance of segment reporting, mainly by allowing users to assess the performance of individual operating segments in the same way that management does. The FASB and the Association of Investment Management & Research (AIMR) believe that, overall, the management approach is preferable to the industry segment approach.

Critics of the new standard, on the other hand, believe that it compromises the comparability and reliability of segment reporting (e.g.,

[1] SFAS 14 is FASB Statement No. 14, *Financial Reporting for Segments, of a Business Enterprise* (FASB [1976]). SFAS 131 is FASB Statement No. 131, *Disclosures about Segments of an Enterprise and Related Information* (FASB [1997]).

Springsteel [1998], McConnell, Pegg, and Zion [1998]). Among the major criticisms are the lack of a segment profit definition, the abandonment of the requirement that segment data conform to generally accepted accounting principles (GAAP), the fact that internal cost allocations are subject to considerable discretion, and the concern that managers have strong incentives to manipulate internal segment information used in performance evaluation. Given the potential advantages and disadvantages of the new standard, it is unclear whether SFAS 131 facilitates a superior or inferior information environment.

The main research issue we address in this study is: Does SFAS 131 affect investors' and analysts' ability to predict firm performance? Specifically, we examine the following questions:

1) Does SFAS 131 induce companies to report a higher number of segments and more disaggregated information?
2) If there is any difference in the segment information reported under SFAS 131 versus SFAS 14, was it available to analysts and investors even under the old reporting regime?
3) If there is any new segment information resulting from SFAS 131, does it affect the expectations of analysts and investors?

In addition to the impact of SFAS 131 on the information environment, we explore its potential impact on the monitoring environment. We investigate whether the difference in information, if any, between the new and old standards better reveals the amount of firm diversification and the extent of resource transfers between segments. Such information can be useful for monitoring decisions if it leads to the revelation of underlying agency problems.

Our initial results provide descriptive evidence on whether SFAS 131 achieved one of its stated goals—to increase the number of reported segments and provide more disaggregated information. Of the 2,999 firms in our sample, the percentage (number) of multisegment firms increases from 22% (664) under SFAS 14 to 40% (1,207) under SFAS 131. Furthermore, about a quarter of the SFAS 14 single-segment firms become multisegment firms under the new standard. Overall, 23% of the sample firms report more segments in their restated report than in their original, whereas less than 2% report fewer. These descriptive results support the findings of previous work using small samples (see Herrmann and Thomas [2000] and Street, Nichols, and Gray [2000]).

Our results indicate that analysts had access to at least some of the SFAS 131 information during the year before its adoption. These tests begin with the development of a measure that captures the new segment information. We use an industry-based mechanical forecasting model to generate two sets of one-year-ahead earnings and revenue forecasts—the first based on the SFAS 131 restated segment data and the other based on the SFAS 14 original data. Using the difference between the two sets of mechanical forecasts to proxy for the new segment information, we examine its association with one-year-ahead analyst forecasts generated in the first half of the adoption year (i.e., before SFAS 131 segment data became available). We find that the new segment information is associated with the analyst forecasts, consistent with analysts' knowing at least some of the new segment information before it was externally reported.

To explore whether analysts knew all of the new segment information before it was publicly reported, we investigate whether there was any improvement in analyst forecast accuracy following the release of the first 10-K containing the new segment data. For the sample of firms that changed their number of reported segments upon restatement, we find that analysts' earnings forecast errors are significantly reduced in the post–SFAS 131 period. Thus, although the previous test indicates that analysts knew some of the new segment information before it was made public, they also appear to have been unaware of a significant portion of the new data.

If analysts were unaware of a significant portion of the segment data revealed by the new standard, the same may have been true of the aggregate market. We examine this issue by developing three trading rules based on the mechanical forecasts. The first rule buys (sells short) shares of firms for which the SFAS 131 segment-based earnings forecast exceeds (is below) the SFAS 14 segment-based earnings forecast. The second rule implements the analogous strategy based on revenue forecasts. The third trading strategy goes long (short) only in companies in which the forecasts for both earnings and revenues are higher (lower) based on the new standard.

We implement each rule starting from the month following the release of the last SFAS 14 10-K and extending forward for 12 months. The results indicate that market prices did not fully impound the new segment information as of 12 months before the release of the restated annual segment data. Moreover, there is some evidence that the market was more uninformed about the new segment information that leads to lower projections of earnings or revenues than about the new information that leads to more positive projections.

We turn next to the issue of why expectations about firm performance are altered when the restated segment data differ from the historical segment data. Using the difference between the two sets of mechanical forecasts as a proxy of the difference in expectations, we find that reporting more disaggregated information and more transfers between segments under the new standard is associated with a bigger decline in mechanical earnings projections under SFAS 131. Thus, it appears that information related to the level of diversification and cross-segment transfers revealed under the new standard affects expectations about firm performance. This result leads us to our last research question: Does SFAS 131 facilitate improved monitoring?

Prior studies find that diversified firms trade at a discount relative to standalone firms (Lang and Stulz [1994], Berger and Ofek [1995]) and that the "diversification discount" is associated with measures of agency problems (Denis, Denis, and Sarin [1997]). There is also evidence suggesting that internal capital markets in conglomerates transfer funds across segments in a suboptimal manner (Lamont [1997], Shin and Stulz [1998], Rajan, Servaes, and Zingales [2000]). If the new standard is able to induce companies to more fully reveal their diversification and funds transfer strategies, the resulting segment data could better reflect any underlying agency problems.

Under this scenario, one would expect to find a post–SFAS 131 increase in the diversification discount for firms with restated segment data that reflect more diversification and cross-segment resource reassignments than the historical data do. Consistent with the market's being able to partially see through the SFAS 14 data, we find that even in the pre-adoption period, the firms that later restate from single-segment to multisegment status have a small diversification discount. In the post-adoption period, however, the discount for these "hidden" diversifiers increases to exceed slightly the average discount of the firms that reported multiple segments under SFAS 14. Furthermore, we find that the greater the increase in reported cross-segment transfers as a result of adopting SFAS 131, the more the firm reduces its real transfers during the year leading up to its first SFAS 131 annual report. These findings are consistent with the conjecture that SFAS 131 results in the provision of information useful in the monitoring process.

The rest of the paper is organized as follows. Section 2 provides a detailed discussion of the pros and cons of SFAS 131. Section 3 reviews related literature, section 4 describes the sample selection, section 5 presents the empirical tests, and section 6 concludes.

2. *Background on SFAS 131*

SFAS 131 was issued by the FASB in June 1997 and is effective for fiscal years commencing after December 15, 1997. The management approach along with the other provisions of SFAS 131 offers several trade-offs relative to SFAS 14's industry approach. Most fundamentally, the new standard provides greater, but more individualized, insight into the management strategy of each firm, thus reflecting a trade-off between more relevance and less comparability.

2.1 POTENTIAL ADVANTAGES OF SFAS 131

SFAS 14 was most widely criticized for its loose definition of "industry," which allowed managers of diversified firms to report all operations "as being in a single, very broadly defined industry segment" (FASB 131, ¶58). The FASB believed that the management approach would offer less discretion about segment definition and that, as a result, the information provided under SFAS 131 would be less subjective than what was provided under the industry approach. Therefore, the FASB expected the new standard to induce more segmentation.[2]

In addition to the circumvention issues arising from the industry approach, defining segments on the basis of industry was viewed as problematic for other reasons. For instance, Albrecht and Chipalkatti [1998] maintain that if managerial responsibilities were not organized along industry lines, external financial disclosures on an industry basis "would be artificial and irrelevant for analyzing the risks and rewards of the actual business segments of the enterprise, making enterprise cash flow predictions problematic."

As summarized in Ernst & Young's [1998] report on segment disclosures, the management approach "enhances users' ability to predict actions or reactions of management that can significantly affect the enterprise's prospects for future cash flows." The FASB also claimed that the management approach would bridge inconsistencies (which often existed under the industry approach) between segment disclosures and other significant sections of an enterprise's annual report, such as the business review and Management Discussion and Analysis sections.

2.2 POTENTIAL DISADVANTAGES OF SFAS 131

The major criticism of SFAS 131 is that it is likely to reduce the comparability of segment information between similar lines of business within the same industry because the chief operating decision maker (CODM) at each company can use a different measure of financial information to make operating decisions. Moreover, whereas the old standard specified the definition of segment profit, the new rule does not define the measure of segment profit or loss to be disclosed. Instead, it allows any measure used internally for decision making to be reported as the segment profit. Finally, SFAS 131 does not require the measure of segment profit used to be consistent with the assets attributed to the segment (as SFAS 14 did). For example, depreciation expense may be allocated to a segment, but the assets to which the depreciation relates need not be allocated to any segment.[3]

Under the old rule, segment information was measured using the same GAAP policies used in preparing the consolidated statements. In contrast, the management approach requires that the segment information presented be measured just as it is for internal purposes. This outcome surprised many analysts.[4] At the time the standard was introduced, however, it was also expected that deviations from GAAP in the new segment reports

[2] The new standard does allow multiple operating segments to be combined into one reporting segment if the aggregation is consistent with the objectives and basic principles of SFAS 131 and the operating segments have "similar" economic and basic characteristics (see Ernst & Young [1998] for a more detailed discussion).

[3] The concerns discussed in this paragraph were the major reason one of the FASB's seven board members, Mr. Leisenring, dissented from the issuance of SFAS 131.

[4] For example, Springsteel [1998] quotes Pat McConnell, the director of accounting analysis at Bear, Stearns & Company and chairwoman of the IASB's steering committee on segment

would be limited by the requirement to provide reconciliations explaining any material differences between the segment figures and the firm-level (GAAP) results. Thus, it was anticipated that firms that would otherwise have large reconciling items would alter the internal cost-allocation methods or formulas they used for tracking segments when those methods deviated significantly from GAAP.

The issue of internal cost allocations creates a related concern. Under SFAS 131, adjustments and eliminations made in preparing an enterprise's consolidated financial statements and allocations of revenues, expenses, gains, or losses are only included in the reported measure of profit or loss if these items are included in the measure reported to the firm's CODM.[5] Because of the potential for misleading information that may result from arbitrary allocations, however, the FASB decided they must be allocated in a way that is "reasonable."

Finally, the management approach to segment reporting results in the external reporting of information that had previously been completely within management's prerogatives. Although this may facilitate the ability of external parties (such as analysts) to expropriate the monitoring function of internal parties such as the board of directors, it clearly creates questions about the objectivity of the reported information.

2.3 OVERALL IMPACT OF SFAS 131

This section has summarized arguments made by analysts, managers, the FASB, and others about the advantages and disadvantages of SFAS 131 in providing segment information. These opposing arguments do not facilitate clear predictions about whether SFAS 131 improves the reporting of segment information. Thus, SFAS 131's impact on the information and monitoring environment is an empirical issue.

3. Review of the Literature on Segment Disclosures

Much of the research on industry segment data has focused on the usefulness of these data for improving the accuracy of forecasts of firm sales and earnings. Empirical studies have evaluated time-series sales and earnings models as well as analyst forecasts of earnings. As summarized in Pacter [1993], these studies produced two main findings. First, the availability of industry segment data improves time-series sales and earnings forecasts and the earnings estimates of sell-side analysts. In addition, the improvements in forecast accuracy are generally observed with the availability of segment

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reporting. She explains: "I'm very surprised at this standard. When we at the AIMR suggested the management approach the first time, in our report Financial Reporting in the 1990s and Beyond, never did we imagine the FASB would introduce a standard that didn't follow GAAP definitions for all the segment disclosures."

[5] Conversely, SFAS 14 required allocation of operating expenses not directly traceable to a segment, regardless of whether such an allocation was made for internal reporting purposes.

revenue data, although some studies attribute significant effects to the incremental disclosure of segment earnings amounts.

Recent studies explore other issues related to segment reporting. Givoly, Hayn, and D'Souza [1999] assess the measurement error in segment disclosures and find the information content of segment data to be negatively related to its measurement error. Botosan and Harris [2000] examine the determinants of managers' decisions to increase segment disclosure frequency and find that firms with a decline in liquidity and an increase in information asymmetry are more likely to increase their disclosure frequency. Leuz [1999] concludes that German firms are more likely to increase the amount of segment information they disclose when the potential for such disclosures to create competitive harm is smaller. Finally, Piotroski [1999, 2002] investigates whether discretionary expansions of segment reporting communicate value-relevant information and what the effect of such expansions is on the precision of investor beliefs about future earnings realizations. He finds that improved segment disclosure yields a positive valuation benefit and that segment-reporting disaggregation has a positive effect on the precision of investor beliefs.

This study, on the other hand, focuses specifically on the effects of the FASB's recent mandated change in segment reporting rules from SFAS 14 to SFAS 131. Bar-Yosef and Venezia [2000] and Street, Nichols, and Gray [2000] find that the number of segments reported increased significantly in the year firms adopted SFAS 131. Ettredge, Kwon, and Smith [2000] claim that greater operational complexity, and prior underreporting, are associated with the extent of the increase in the number of segments upon adoption of the new standard.[6] Herrmann and Thomas [2000] find that adoption of SFAS 131 resulted in about two-thirds of their 100 sample firms' changing how they defined their reportable operating segments, implying that the remaining one-third defined segments consistent with the internal organization of the company even under SFAS 14. Herrmann and Thomas also find an increase in the number of firms providing segment disclosures and, in contrast to Street, Nichols, and Gray, an increase in the number of items disclosed for each operating segment. Finally, Venkataraman [2001] shows that the post–SFAS 131 changes in average forecast accuracy and precision of common information are higher at firms that change their reported segments to comply with SFAS 131 relative to firms that do not change.

Our study differs from prior studies of SFAS 131 in the following ways. We construct a database containing the restated SFAS 131 segment data for the final SFAS 14 fiscal year. These restated data allow us to compare the segment information generated under the two reporting regimes for the same firm at the same time and, hence, to isolate real changes from reporting changes.

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[6] Contrary to the intent of SFAS 131, Ettredge, Kwon, and Smith (2000) report that a small minority of firms continues to report segment information on a basis inconsistent with their introductory annual report information (14%) and MD&A (8%).

Our sample covers a larger number of firms than do prior studies and thus is more representative of the population. Furthermore, despite the extant descriptive evidence about the increase in the number of reported segments, only the concurrent Venkataraman [2001] study provides direct empirical evidence on the impact of SFAS 131 on the information environment. Last, in addition to examining its information effects, we explore the impact of the new standard on the monitoring environment.

4. *Sample Selection and Data*

Our initial sample includes firms listed on Compustat's annual database, the Center for Research in Security Prices (CRSP) monthly returns file, and the IBES detail database with minimum sales of $20 million and industry segment data available on Compustat's industry segment file. To isolate the effect of SFAS 131 from real changes (such as acquisitions and divestitures), we collect restated segment data from the first SFAS 131 10-Ks. Under the new standard, multisegment firms are required to restate their segment reporting for at least two prior years.[7] This requirement allows us to compare directly segment reporting for the lag adoption year under the old and new reporting regimes. The original SFAS 14 segment data are obtained from the last SFAS 14 10-K (available in Compustat's industry segment file); the restated SFAS 131 segment data are hand collected from the first SFAS 131 10-K (see figure 1, panel A).

With respect to the restated segment data, we first identify all multisegment firms in our initial sample based on the SFAS 131 adoption-year segment information. We then collect the restated data for the fiscal year before the adoption year (i.e., the lag adoption year) from the adoption year's 10-K segment footnote. Firms without 10-Ks in the Securities and Exchange Commission's (SEC) Edgar database are deleted from the initial sample.

The adoption year multisegment firms we initially identify consist of all firms with multiple SFAS 131 "internal operating" segments. Although firms could choose to internally organize their segments in numerous ways, the SFAS 131 footnotes reveal that most firms define operating segments in essentially the same two basic ways mandated under SFAS 14: line of business (LOB) and geographic. LOB segments are defined based on industry classification, whereas geographic segments are defined based on the location of such things as customers or production facilities. In this study, we are interested in the impact of LOB segment reporting on the information and monitoring environment. Thus, we ignore the SFAS 14 geographic segments. To avoid overstating the change in the number of reported LOB

[7] For example, most firms first adopted SFAS 131 for their 1998 fiscal year. These companies are required to disclose SFAS 131 segment information for the 1998, 1997, and 1996 fiscal years. For such firms, we refer to 1998 as the adoption year and 1997 as the lag adoption (or restated) year. Our objective in most of the analyses is to compare the 1997 restated segment information (based on SFAS 131) reported in the 1998 annual report to the historical segment information (based on SFAS 14) provided in the 1997 annual report.

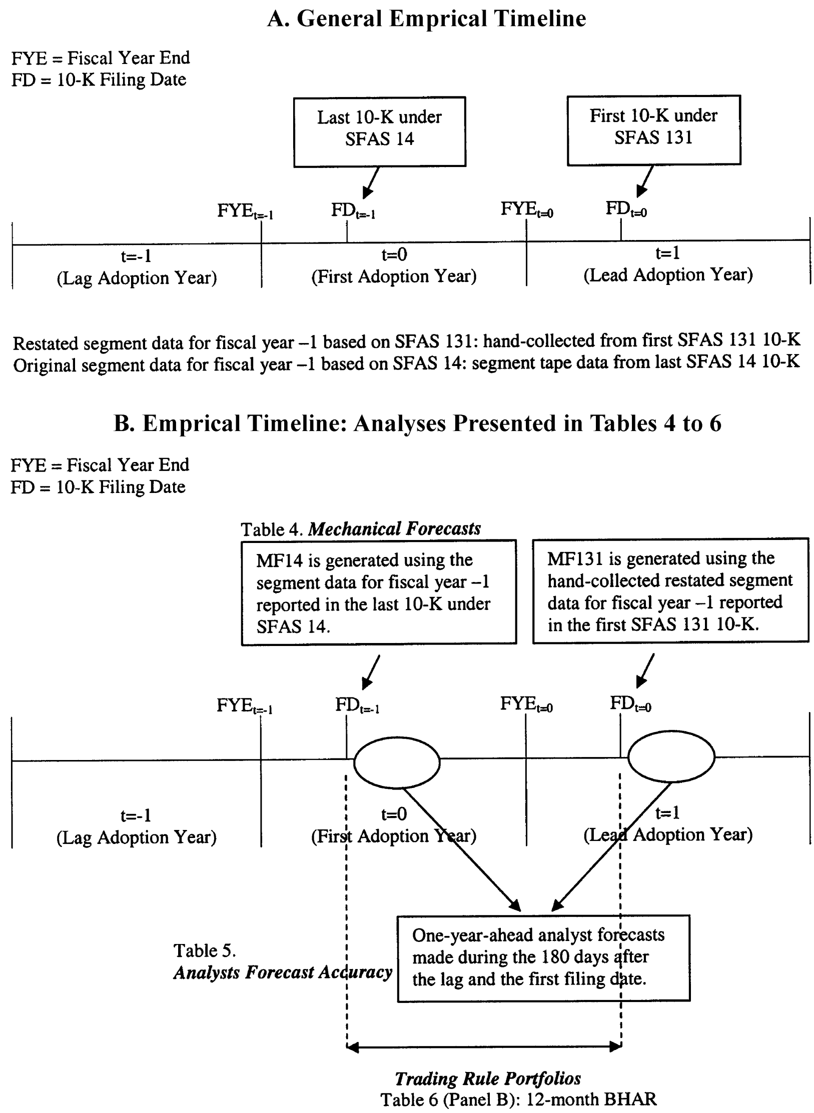

FIG. 1.—Timeline for data collection and empirical analysis.

segments, we aggregate all SFAS 131 geographic segments in the following manner. For firms that report only geographic segments, we regard them as a single LOB segment. For firms that report *both* LOB and geographic segments, we aggregate all geographic segments that belong to the same LOB. In our sample, all geographic segments in a firm always report the same segment Standard Industrial Classification (SIC) code on Compustat. The aggregation mechanism for the SFAS 131 segments is illustrated next for Pepsico Inc. for the year ended December 27, 1997.

Example: Pepsico Inc.

Original Data (*NSEG* = 4):			Aggregated Data (*NSEG* = 2):		
Segment Name	SIC	Sales	Segment Name	SIC	Sales
Frito-Lay: International	2096	$3,409	Frito-Lay	2096	$10,376
Frito-Lay: North America	2096	6,967	–	–	–
Pepsi-Cola: International	2087	2,642	Pepsi-Cola	2087	10,541
Pepsi-Cola: North America	2087	7,899	–	–	–

The aggregation mechanism resolves a key difference between SFAS 14 and SFAS 131, namely, that geographic segments are reported as operating segments under SFAS 131 but are not included in the historical SFAS 14 LOB segments. The aggregation technique may not eliminate some of the infrequent classification differences between the old and new rules. For instance, under SFAS 131, internal reporting units can be based on such things as type of customer. Because of the wide discretion on LOB segment definitions available under SFAS 14, segments based on type of customer under the new standard may or may not have been reported as LOB segments under the old standard. To the extent that there exist SFAS 131 categories that are based neither on LOB nor location, it is possible for SFAS 131 segments to have been unreportable under SFAS 14. Although it is relatively straightforward to distinguish between geographic and LOB segments, it is difficult to identify accurately segments that are based neither on LOB nor location. After our detailed examination of the hand-collected SFAS 131 segment data, however, we believe that segments based on anything other than LOB or location are rare in our sample.

A final issue with our approach is that, to obtain comparability with the SFAS 14 LOB segment reporting, we rely on the SIC codes assigned by Compustat to classify our aggregated segments under SFAS 131. The assignment by Compustat of these SIC codes may seem more questionable under the new standard (where segments are defined by the firm's internal operating system) than under the old standard (where LOB segments were delineated along industry lines).

Therefore, to test whether it is equally appropriate to use the SIC classification of segments under both reporting regimes, we conduct the following test. We compute the correlations between the sales (earnings) of (1) segments and (2) stand-alone firms assigned to a given two-digit SIC code with the corresponding sales (earnings) of the entire industry. We compute these correlations under both SFAS 14 and our "aggregated" SFAS 131 segment reporting, using a procedure similar to that in Givoly, Hayn, and D'Souza [1999]. Although we are primarily interested in comparing the correlations between the segments and their industries under SFAS 14 versus SFAS 131, we use the correlations between the stand-alone firms and their industries as a benchmark to control for any potential time trend. The (untabulated) results show that there is not any difference between the two segment reporting regimes in the appropriateness of using SIC codes to classify segments. Both regimes produce the same correlations between the sales and earnings of the SIC-based segments with the sales and earnings of the entire industry (i.e., all segments and stand-alone firms) reporting in that two-digit SIC code (see Berger and Hann [2002] for additional details).

To ensure that our restated segment data capture only reporting changes related to the adoption of SFAS 131, we eliminate all observations contaminated by having their restated data partially reflect other changes at the firm in the adoption year (e.g., pooling acquisitions, discontinued operations, or changes from LIFO to other inventory accounting methods). We developed an algorithm to check for contaminated restatements in our initial sample. The algorithm compares the sum of segment revenues (and earnings) from the restated reports with the corresponding sum for the historical year; we consider an observation contaminated when the historical and restated sums differ by more than 1% of the restated sum (see Appendix A for an example). This occurs for 20% of the initial sample; these observations are eliminated to arrive at the final ("pure") sample of 2,999 observations.

For the pure sample, firm-level accounting data are obtained from the Compustat annual industrial, research, and full coverage files. Stock returns are collected from CRSP's monthly return file. Analyst forecast data are retrieved from IBES. We also collect 10-K filing dates from the SEC's Edgar database for the full sample (including single-segment firms) for use in the analyst forecast and trading rule analyses.

Finally, the construction of the mechanical forecasts and the excess value measure requires that we identify the primary SIC code for each segment. Although SFAS 131 follows the management approach as opposed to the industry approach, each segment is assigned an SIC code on Compustat's industry segment database, both before and after SFAS 131. Furthermore, because most firms report in their adoption-year 10-K the same set of segments for the current and restated years, we are able to identify the primary SIC codes assigned to each segment for the lag adoption year. Put differently, even though we do not have direct access to the industry information of the restated segments for the lag adoption year, we are able to use the primary SIC codes assigned to each segment for the adoption year on the segment database.

The only time we cannot use the adoption-year segment SIC code for a lag-adoption-year segment is when the segment has been divested during the adoption year. In those cases, the divested segment appears in the restated year in the hand-collected segment data, but not in the adoption year on Compustat's segment database. For most divested segments, we are able to assign a two-digit SIC code based on the description of the divested segment's business operations disclosed in the annual financial statement footnotes. We exclude from the relevant tests those firms for which a two-digit SIC code cannot be clearly assigned to all segments.

TABLE 1

Distribution of Single-Segment and Multisegment Firms Under SFAS 14 and SFAS 131 for the Lag Adoption Year

The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. The initial sample includes all firms listed in Compustat, CRSP, and IBES with restated segment data available for the lag adoption year. The pure sample is the subset of the initial sample for which restatements of historical segment data are made only because of the adoption of SFAS 131 (see section 4 for a more detailed discussion on the construction of the pure sample). The SFAS 131 restated segment data for the lag adoption year are taken from the footnotes of the annual reports in the adoption year.

Panel A: Initial sample

	SFAS 131		
	Single Segment	Multisegment	Total No. of Obs.
SFAS 14			
Single segment	1,806 (64.00%) [100.00%]	1,016 (36.00%) [52.75%]	2,822 (100%) [75.62%]
Multisegment	0 (0.00%) [0.00%]	910 (100.00%) [47.25%]	910 (100%) [24.38%]
Total no. of obs.	1,806 (48.39%) [100%]	1,926 (51.61%) [100%]	3,732

Panel B: Pure sample

	SFAS 131		
	Single Segment	Multisegment	Total No. of Obs.
SFAS 14			
Single-segment	1,792 (76.75%) [100.00%]	543 (23.25%) [44.99%]	2,335 (100%) [77.86%]
Multisegment	0 (0.00%) [0.00%]	664 (100.00%) [55.01%]	664 (100%) [22.14%]
Total no. of obs.	1,792 (59.75%) [100%]	1,207 (40.25%) [100%]	2,999

5. *Empirical Tests*

5.1 DESCRIPTIVE STATISTICS ON THE IMPACT OF SFAS 131 ON SEGMENT REPORTING

The first set of analyses provides descriptive evidence about the effects of SFAS 131 on segment disclosures. As discussed in section 4, to ensure that the restated data reflect only restatement due to adoption of SFAS 131, we eliminate 20% of the observations in the initial sample to arrive at the pure sample. Table 1 presents the number of business segments reported under SFAS 14 and 131 in the lag adoption year for both the initial (panel A) and the pure (panel B) samples.

With the initial sample, 36% of the single-segment firms become multisegment under SFAS 131, whereas the corresponding figure is 23% for the pure sample. In both samples, the number of multisegment firms increases significantly under the new standard—from 910 to 1,926 (a 112% increase) in the initial sample, and from 664 to 1,207 (an 82% increase) in the pure sample. The proportion of multisegment firms also increases greatly, from 25% (22%) to 52% (40%) for the initial (pure) sample. Moreover, in both samples, no firms change from reporting multiple segments under SFAS 14 to reporting a single segment under the new standard.[8] These results indicate a significant movement from single to multisegment reporting under the new reporting regime.[9]

Table 2 provides more detailed data on the magnitude of the reporting change. Panel A presents the distribution of the number of reported segments under the two reporting regimes for the lag adoption year. The entire distribution, except for single-segment firms, shifts upward under the new standard. For instance, under SFAS 14, only 11% of the sample has three or more segments, versus more than 23% under SFAS 131.

Panel B provides a breakdown of the reporting change in the number of segments. Note that 25% of the sample has a nonzero reporting change in the number of segments, with less than 2% moving downward and the other 23% shifting upward. Most of the upward movement involves reporting one to three more segments. Of the firms that have a nonzero reporting change in the number of segments, 49% have increased by one segment and 28% by two segments. Panel C further breaks down the reporting change by the initial number of segments reported under SFAS 14 (for firms reporting one to four segments under SFAS 14). For instance, of the 23% of the single-segment firms that have changed to multisegment under SFAS 131, about 48% become two-segment firms (i.e., +1 segment) and 32% become three-segment firms (i.e., +2 segments).

Note that a potential concern with table 2 and the analyses that follow is that some of the changes we label as being due to reporting could instead

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[8] We examined whether the complete absence of firms with a reporting change from multiple segments to one segment resulted from our sample selection criteria. On the full Compustat segment database, 98 firms reported multiple segments in their last SFAS 14 year and one segment in their SFAS 131 adoption year. We investigated these 98 observations and found that 75 decreased the number of reported segments because of real changes at the firm (divestitures and discontinued operations). We could not obtain a 10-K for 13 of the firms and found no information on divestitures or discontinued operations in the 10-Ks for the remaining 10 firms. Thus, similar to the results reported in table 1, there is an insignificant number of Compustat firms that restate from multiple segments to a single segment as a result of adopting SFAS 131.

[9] Overall, the magnitude of the reporting change is greater under the initial sample. As a result, drawing inferences from the pure sample might understate the effect of the new rule. However, it is crucial that we isolate the effect of SFAS 131 from other restatements in our empirical analysis. Hence, we focus on the pure sample in all analyses and report only those results in this article.

TABLE 2

Number of Reported Segments and Reporting Change in the Number of Segments for the Lag Adoption Year

The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. The initial sample includes all firms listed in Compustat, CRSP, and IBES with restated segment data available for the lag adoption year. The pure sample is the subset of the initial sample for which restatements of historical segment data are made only because of the adoption of SFAS 131 (see section 4 for a more detailed discussion on the construction of the pure sample). The reporting change in the number of segments is equal to the difference between the number of restated segments based on SFAS 131 in the lag adoption year and the number of segments based on SFAS 14 in the lag adoption year.

Panel A: Number of reported segments: SFAS 14 vs. SFAS 131

	SFAS 14				SFAS 131			
No. of Segments	Frequency	Percent	Cumulative Frequency	Cumulative Percent	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	2,335	77.86	2,335	77.86	1,792	59.75	1,792	59.75
2	334	11.14	2,669	89.00	524	17.47	2,316	77.23
3	193	6.44	2,862	95.43	376	12.54	2,692	89.76
4	82	2.73	2,944	98.17	193	6.44	2,885	96.20
5	32	1.07	2,976	99.23	75	2.5	2,960	98.70
6	14	0.47	2,990	99.70	26	0.87	2,986	99.57
7	8	0.27	2,998	99.97	11	0.37	2,997	99.93
8	0	0.00	2,998	99.97	0	0.00	2,997	99.93
9	0	0.00	2,998	99.97	2	0.07	2,999	100.00
10	1	0.03	2,999	100.00	–	–	–	–

Panel B: Reporting changes

	Pure Sample				Nonzero Reporting Change Sample			
Δ in No. of Segments	Frequency	Percent	Cumulative Frequency	Cumulative Percent	Frequency	Percent	Cumulative Frequency	Cumulative Percent
−3	1	0.03	1	0.03	1	0.14	1	0.14
−2	4	0.13	5	0.17	4	0.54	5	0.68
−1	39	1.3	44	1.47	39	5.31	44	5.99
0	2,264	75.49	2,308	76.96	–	–	–	–
+1	357	11.9	2,665	88.86	357	48.57	401	54.56
+2	208	6.94	2,873	95.80	208	28.3	609	82.86
+3	89	2.97	2,962	98.77	89	12.11	698	94.97
+4	30	1	2,992	99.77	30	4.08	728	99.05
+5	6	0.2	2,998	99.97	6	0.82	734	99.86
+6	1	0.03	2,999	100.00	1	0.14	735	100.00

TABLE 2 — *Continued*

Panel C: Reporting changes

SFAS 14		Reporting Change in the Number of Segments Under SFAS 131								
No. of Segments	No. of obs.	−2	−1	0	+1	+2	+3	+4	+5	+6
1	2,335	–	–	1792	259	172	78	28	5	1
				(76.75)	(11.09)	(7.37)	(3.34)	(1.20)	(0.21)	(0.04)
2	334	–	–	242	60	23	7	2	–	–
				(72.46)	(17.96)	(6.89)	(2.10)	(0.60)		
3	193	–	21	132	26	10	4	–	–	–
			(10.88)	(68.39)	(13.47)	(5.18)	(2.07)			
4	82	1	11	59	8	2	–	–	1	–
		(1.22)	(13.41)	(71.95)	(9.76)	(2.44)			(1.22)	

be due to internal growth. We therefore examine what portion of the sample firms with positive reporting changes have segments that failed, in the lag adoption year, to meet the quantitative thresholds that applied to both the old and new segment reporting rules (i.e., segments could remain unreported if they did not contribute 10% or more to firm revenue, profit or loss, or assets). This examination is conducted in the lag adoption year based on the restated SFAS 131 data.

Recall that panel B of table 2 showed that we have 691 firms with a positive reporting change in the number of segments. Of these 691 firms (with 1,749 segments), we find that 128 firms had a total of 155 segments that fell below the quantitative thresholds in the lag adoption year. However, 110 of these 155 segments also fell below the quantitative threshold in the adoption year. A majority of these small segments were categorized as "other" segments (which are not always the same as the corporate or elimination segments we have excluded in our study). We are thus left with 45 segments (from 37 firms) in which the reported increase is potentially attributable to internal growth. We have conducted sensitivity checks on all remaining analyses that use samples based on the reported change in the number of segments. In all cases, excluding these 37 firms produces results that are qualitatively and statistically similar to those we report.

Thus far, we have focused on the reported change in the number of segments. Although the number of reported segments serves as a good starting point in comparing the two reporting regimes, it is nevertheless a relatively crude measure of segment reporting. Hence, in addition to the change in the number of reported segments (*NSEG*), we also examine the effect of SFAS 131 on various measures of the extent of reported disaggregation and cross-segment transfers under the two reporting regimes. Specifically, we examine two additional measures of segment reporting disaggregation—*DISAGG* and *HERF*—and two measures of resource transfers across segments—*NLSEG* and *TRANSFER*. The definitions of these measures are summarized next and are detailed in table 3, panel A.

5.1.1. Measures of Disaggregation: DISAGG and HERF. *DISAGG*, based on Piotroski's [2002] fineness measure, is the natural log of the ratio of the number of reported segments to the number of business activities.[10] The higher *DISAGG*, the greater is the number of reported segments relative to the number of business activities, and thus the more disaggregated is the reported segment information. The revenue-based Herfindahl index, *HERF*, is widely used as a proxy for the level of diversification. In the context of

[10] We change the name of the variable from Piotroski's fineness moniker because Blackwell's theorem gives the term "fineness" a specific meaning that does not apply to our measure. In constructing the *DISAGG* measure, the number of business activities is measured as the number of two-digit SIC codes the firm operates in during the year. We collect these data from the Standard & Poor's (1997–1999) *Register of Corporations, Directors and Executives.*

TABLE 3

Descriptive Statistics on Measures of Disaggregation, Cross-Segment Transfers, Mechanical Forecasts, and Mechanical Forecast Errors

This table presents descriptive statistics under the two reporting regimes for the lag adoption year. The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. Panel A summarizes the variable definitions. Panel B presents univariate analysis on the changes in the disaggregation and cross-segment transfer measures under the two reporting regimes. Panel C reports univariate analysis on mechanical earnings and revenue forecasts and (absolute) forecast errors. The reporting change in the number of segments (reporting Δ in *NSEG*) is equal to the difference between *NSEG131* and *NSEG14*, where *NSEG131* and *NSEG14* are the number of reported segments under restated SFAS 131 and historical SFAS 14, respectively, for the lag adoption year.

Panel A: Variable definitions: Disaggregation, cross-segment transfers, mechanical forecasts, and forecast errors

Disaggregation measures:

NSEG = the number of segments.

DISAGG = the natural log of $\frac{\text{\# of segments}}{\text{\# of business activities}}$,

where the number of business activities is measured as the number of different two-digit SIC codes the firm operates in during the segment report year. The SIC code information is collected from the *Standard & Poor's Register of Corporations, Directors and Executives.*

HERF = the Herfindal index based on revenues. It is calculated as:

$$\frac{\sum_{i=1}^{n} S_i^2}{\left(\sum_{i=1}^{n} S_i\right)^2}, \text{ where } n = \text{number of segments, and } S_i = \text{segment } i\text{'s sales}$$

Cross-segment transfer measures:

$$TRANSFER = \text{Max}\left[\frac{\textit{Sum of segment Excess CAPX} - \textit{Firm level Excess CAPX}}{\textit{Market Value of Equity}}, 0\right] \times 100,$$

where:

$$\begin{aligned} \textit{Excess CAPX} &= \max[\textit{CAPX} - (\textit{OPS} + \textit{DEP}), 0] \\ \textit{CAPX} &= \text{capital expenditure} \\ \textit{OPS} &= \text{operating profits} \\ \textit{DEP} &= \text{depreciation expense} \end{aligned}$$

NLSEG = the number of segments with losses.

Mechanical earnings and revenue forecasts:

MEF131/14 = one-year-ahead mechanical earnings per share forecasts (×100) based on the restated SFAS 131 and original SFAS 14 segment data, respectively. See Appendix B for details.

MRF131/14 = one-year-ahead mechanical revenue per share forecasts (×100) based on the restated SFAS 131 and original SFAS 14 segment data, respectively. See Appendix B for details.

Mechanical earnings and revenue forecast errors:

$$MEFE131/14 = \frac{\text{Abs}[\textit{Actual earnings per share} - \textit{Mechanical earnings per share forecast}]}{\textit{Price per share}} \times 100$$

$$MRFE131/14 = \frac{\text{Abs}[\textit{Actual revenue per share} - \textit{Mechanical revenue per share forecast}]}{\textit{Price per share}} \times 100$$

TABLE 3 — *Continued*

Panel B: Univariate analysis of the reporting changes in the disaggregation and cross-segment transfer measures for the lag adoption year

Means	SFAS 14	SFAS 131 (Restated)	Difference. Between SFAS 131 and SFAS 14 (*t*-stat)	No. of Obs.
Disaggregation:				
NSEG	1.41	1.79	0.38***	2,999
			(23.99)	
DISAGG	−0.14	0.07	0.21***	2,771
			(25.79)	
HERF	0.91	0.83	−0.07***	2,992
			(−23.42)	
Cross-segment transfer:				
TRANSFER	1.59	2.20	0.62***	2,389
			(5.46)	
NLSEG	0.20	0.29	0.09***	2,950
			(11.55)	

Panel C: Univariate analysis of mechanical earnings and revenue forecasts and (absolute) forecast errors for the lag adoption year

Means	Mechanical Forecast SFAS 14	Mechanical Forecast SFAS 131	Difference between 131 and 14 (*t*-stat)	Mechanical Abs. FE SFAS 14	Mechanical Abs. FE SFAS 131	Difference between 131 and 14 (*t*-stat)
Earnings						
Full sample ($N = 2{,}589$)	270.65	253.98	−16.68 (−8.32)	9.19	9.42	0.23*** (2.60)
Reporting Δ in *NSEG* > 0 ($N = 514$)	359.43	277.01	−82.42*** (−8.78)	7.53	8.90	1.37*** (3.54)
Reporting Δ in *NSEG* = 0 ($N = 2{,}046$)	245.95	245.75	−0.20 (−0.50)	9.53	9.48	−0.05 (−0.98)
Reporting Δ in *NSEG* < 0 ($N = 29$)	439.81	425.82	−13.99 (−0.79)	14.95	14.36	−0.58 (−0.36)
Revenue						
Full sample ($N = 2{,}797$)	2413.69	2419.66	5.97* (1.84)	33.67	33.27	−0.39* (−1.70)
Reporting Δ in *NSEG* > 0 ($N = 641$)	2979.42	3001.34	21.92* (1.76)	35.58	33.73	−1.85* (−1.85)
Reporting Δ in *NSEG* = 0 ($N = 2{,}120$)	2216.45	2218.52	2.07 (1.09)	33.16	33.17	0.02 (1.24)
Reporting Δ in *NSEG* < 0 ($N = 36$)	3955.78	3907.39	−48.39 (−1.08)	29.53	30.92	1.39 (0.80)

***Significant at the 1% level (two-tailed test); *Significant at the 10% level (two-tailed test).

this study, it is also used to proxy for the level of information disaggregation. The lower *HERF*, the higher is the level of reported diversification and information disaggregation.[11]

5.1.2. Measures of Resource Transfers Across Segments: NLSEG & TRANSFER. *NLSEG* represents the number of loss segments. It provides a crude proxy for transfers across segments because, empirically, loss segments persist longer when they are part of a diversified firm than when they must stand alone and fund their own losses (see Berger and Ofek [1995]).

TRANSFER is a relatively more sophisticated measure of the level of resource transfers across segments. The intuition behind the construction of this measure is as follows. If a segment's free cash flow is not sufficient to cover its investments, some investments are being subsidized by a combination of: the other segments, excess operating cash flow the segment in question had in prior years, and the external capital market. Using the level of capital expenditure (*CAPX*) as a proxy for investment and the sum of operating profits and depreciation to proxy for free cash flow, we first compute the sum of excess *CAPX* (i.e., max [*CAPX* − (operating profits + depreciation), 0]) across all segments.[12] We then compare it with excess *CAPX* at the firm level to control for investments that are funded out of either prior years' retained cash flow or external financing. If the sum of excess *CAPX* at the segment level is greater than that at the firm level, *TRANSFER* captures this difference and thus proxies for the level of transfers used to fund segment investments.

This direct approach to measuring transfers is similar to that used by Billett and Mauer [Forthcoming] and differs from the literature's two indirect approaches. The first indirect approach (e.g., see Shin and Stulz [1998] and Shin and Park [1998]) is to regress segment capital expenditures on a proxy for the segment's Tobin's *Q*, the segment's own cash flow, and the cash flow of the firm's other segments. A positive coefficient estimate on other segment cash flow is interpreted as evidence of cross-segment transfers. Because segment *Q* is unobservable, it is typically proxied by the median (or average) *Q* of single-segment firms in the segment's industry. Whited [2001] criticizes this technique, arguing

[11] *HERF* is equal to one for single-segment firms and is decreasing in the reported level of diversification. In addition to capturing the reported number of segments, *HERF* also captures the relative size of the segments. For example, assume that Firm A and Firm B both have two segments. Whereas Firm A allocates 90% of its revenue to one segment and 10% to the other, Firm B allocates its revenue equally across the two segments. In this example, Firm B's *HERF* will be lower than that of Firm A (i.e., Firm B's segment reporting is considered more disaggregated than that of Firm A).

[12] Of the SFAS 131 segments with *CAPX* and operating profit data, about 10% have missing depreciation data. To maximize the number of usable observations, we assume that depreciation is zero or insignificant for these segments and assign depreciation a value of zero when it is missing. We conduct a sensitivity test excluding the firms with missing depreciation data for all their segments and find similar results in all analyses related to the *TRANSFER* measure.

that measurement error in Q severely biases the coefficient estimates on the cash flow variables.[13] She finds no evidence of segment transfers after using measurement error consistent estimators in the investment–cash flow regressions. Chevalier [2000] also criticizes the use of segment-level investment–cash flow sensitivities. She argues that the cash flow of other segments may be correlated with the investment opportunities of the investing segment.[14,15]

The second indirect approach (e.g., see Scharfstein [1998] and Rajan, Servaes, and Zingales [2000]) is to measure transfers by the difference between a segment's capital expenditures and the median (or average) capital expenditures of single-segment firms in the same industry. Segments with capital expenditures above (below) those of their industry are classified as receiving (providing) transfers. The industry-adjusted capital expenditure approach has been criticized for assuming that the investment opportunities facing divisions of diversified firms are the same as those of stand-alone firms in the same industry. Hyland [1999], Campa and Kedia [2002], Chevalier [2000], and Villalonga [2000] provide evidence that the investment opportunities of firms choosing to diversify differ systematically from those of firms that remain stand-alone entities. Thus, industry-adjusted capital spending provides a potentially biased estimate of the resource transfers across segments.

The approach we use of directly comparing a segment's capital expenditures with its own cash flow avoids the potential self-selection bias of the industry-adjusted capital expenditure measure. The direct approach also avoids the problems that arise when using investment–cash flow sensitivities to infer transfers. Our measure of transfers does not, however, indicate whether the shift of funds between segments is value decreasing or value enhancing. The resource relocation could be value decreasing if it arises because of agency problems. These conflicts occur in internal capital markets if, for example, divisional managers distort resource allocation through rent-seeking behavior. Meyer, Milgrom, and Roberts [1992], Rajan and Zingales [2000], and Scharfstein and Stein [2000] present models in which the internal capital market allocates too much funding to the weakest divisions. On the other hand, "efficient internal capital market" models argue that diversified firms reassign funds to allocate resources to their best use

[13] Whited's concern can be circumvented by estimating the investment-cash flow equations using a variable such as segment sales growth, instead of industry median Q, to proxy for the segment's investment opportunities (e.g., see Lamont [1997]).

[14] Chevalier supports her argument by documenting that the investment of one merger partner is correlated with the cash flow of the other partner *before* the merger, when cross-subsidization presumably cannot occur.

[15] The preceding concerns are specific to the use of *segment-level* investment–cash flow regressions as a means of detecting whether financially constrained segments are receiving cross-subsidies. A broader debate also exists about whether *firm-level* investment–cash flow sensitivities provide useful measures of firm-level financing constraints (see Kaplan and Zingales [1997, 2000], Hubbard [1998], and Fazzari, Hubbard, and Petersen [2000]).

(e.g., see Li and Li [1996], Matsusaka and Nanda [1997], Stein [1997], Weston [1970], and Williamson [1975]). Rather than trying to build into our measure an assessment of whether the cross-segment funds transmissions are efficient, we use subsequent tests to examine how the resource reassignments revealed by SFAS 131 affect the information and monitoring environment.

Finally, as in other studies, the construction of the *TRANSFER* measure is limited by the availability of segment data. Although we recognize that capital expenditures do not fully capture segment investments for some industries, it is the best measure among the items that are disclosed in the segment footnotes. To the extent that capital expenditures do not capture other potential investments (e.g., R&D expenditures), our measure likely understates the amount of resource movement across segments.

5.1.3. Descriptive Statistics on Measures of Dissaggregation and Cross-Segment Transfers. Table 3, panel B presents the univariate analysis for the disaggregation and cross-segment transfer measures under the two reporting regimes. For comparison purposes, we also report the univariate statistics on *NSEG*. Given the increase in the number of reported segments, it is not surprising that both *DISAGG* and *HERF* indicate a significant increase in disaggregated reporting under SFAS 131. The change in *DISAGG* from −0.14 to 0.07 indicates that the average number of reported segments moved from 14% below the number of two-digit SIC codes under SFAS 14 to 7% above under SFAS 131.[16] With respect to the measures of resource reassignment, the change in the number of loss segments mechanically moves in the same direction as the number of reported segments. Note, however, that the number of loss segments increases by 45% under the new standard, which is substantially higher than the 27% increase in the number of reported segments. *TRANSFER*, the reported level of cross-segment transfers, increases from 1.6% of market value under the old rule to 2.2% with the new rule, consistent with an increase under SFAS 131 in the reported level of resource transfers across segments.

5.2 ANALYSIS OF THE IMPACT OF SFAS 131 ON THE INFORMATION ENVIRONMENT

The preceding results suggest an increase in the level of disaggregated information under SFAS 131. We therefore investigate whether the segment information "revealed" by SFAS 131 was already obtainable by analysts and investors even under the old reporting regime. We then examine whether the SFAS 131 information affects analyst and investor expectations.

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[16] The percentages stated represent logarithmic percentages.

5.2.1. Did Analysts Have Access to the "New" Information Before SFAS 131? To address the first question, we develop a measure that captures the segment information revealed under SFAS 131.[17] We use an industry-based mechanical (time-series) forecasting model to generate one-year-ahead revenue and earnings forecasts, using both the lag adoption year's historical (SFAS 14) and restated (SFAS 131) segment data (see figure 1, panel B). Although a large body of literature (e.g., Brown and Rozeff [1978], Fried and Givoly [1982], Brown et al. [1987]) suggests that analyst forecasts are superior to our mechanical forecasts as proxies for investor expectations, the mechanical models offer three advantages in our setting. First, we can use the restated SFAS 131 data to compare mechanical forecasts made for the same firm at the same time using the new versus old segment accounting. In contrast, this is not possible using analyst forecasts because analysts did not have restated data available when they made their forecasts under the old reporting regime. Second, the time-series models are not affected by any changes in the incentives for private information acquisition that may result from the change in public disclosure quality.[18] Finally, mechanical predictions allow for a larger sample than do analyst forecasts, particularly for revenue forecasts.

One-year-ahead revenue for each segment is projected as the segment's lag-adoption-year revenue multiplied by [1 + forecasted industry sales growth rate]. One-year-ahead earnings for each segment is the segment's projected sales multiplied by the ratio of segment earnings to segment sales for the lag adoption year. We then calculate the one-year-ahead mechanical revenue and earnings forecasts (*MRF14/131* and *MEF14/131*) as the sum of the one-year-ahead segment revenues and earnings, respectively, under the two reporting regimes. A more detailed discussion on the computation of the mechanical forecasts is provided in Appendix B.

Descriptive statistics on mechanical forecasts. In panel C of table 3, we report univariate statistics for the mechanical earnings and revenue forecasts, and the corresponding forecast errors. For firms reporting more segments under the new standard, the average level of forecasted revenue under SFAS 131 is higher by the marginal amount of 22 cents a share, and the average revenue forecast error is smaller by 2% of price. For earnings, however, firms that increase the number of reported segments have forecasts that average 82 cents a share less under SFAS 131 and the corresponding average

[17] Note that in the context of this section, "revealed" information refers to the segment data that is disclosed under SFAS 131, but not under SFAS 14. Our measure of revealed information therefore does not capture or address whether the SFAS 131 information was available to the market even before its mandated disclosure.

[18] A stream of analytical research shows that public disclosure and private information acquisition can be substitutes (e.g., Verrecchia [1982], Diamond [1985]), complements (e.g., Lundholm [1988], McNichols and Trueman [1994]), or that either is possible depending on the precision of the public information (e.g., Lundholm [1991], Indjejikian [1991]).

earnings forecast error is larger than under SFAS 14 by about 1% of price. The findings suggest that greater disaggregation improves the prediction of future revenues but that, when it comes to using the improved revenue forecasts as inputs for forecasting earnings, this advantage is more than offset by some other disadvantage of the new standard (such as the absence of a definition of profit or loss).

Note that our focus on LOB information creates a limitation in using the mechanical forecasts to evaluate the impact of SFAS 131. We ignore the geographic segment data reported under the old standard and aggregate geographic segments into LOB segments under the new standard (as described earlier). This approach does not create a bias in the SFAS 131 mechanical forecasts relative to the SFAS 14 forecasts. For the firms that report both geographic and LOB segments under SFAS 131, the geographic segments always have the same SIC code as the LOB segments (at least in our sample). With our aggregation of geographic segments, we effectively do not have any such segments in our data, so we are comparing only LOB segments between the two reporting regimes. On the other hand, we acknowledge that if the mechanical forecast models were to effectively incorporate geographic as well as LOB segment data, we might document less of an "improvement" in segment reporting than our industry-based approach shows. It is not, however, obvious how to incorporate the geographic data into our mechanical forecasting models and we are primarily interested in LOB rather than geographic segment reporting because of the related monitoring issues arising from the literature on LOB diversification. Attempting to measure the effect of SFAS 131 on both LOB and geographic segments is beyond the scope of this study.

Regression models. We use the difference between *MRF14* (*MEF14*) and *MRF131* (*MEF131*) as a proxy for the new information disclosed under SFAS 131 and examine the association between analyst forecasts and (nonpublic) new segment information in the lag adoption year. We examine this association for all firms with a nonzero reporting change, which we define as a reporting change in either *NSEG* or *HERF* (i.e., $NSEG14 \neq NSEG131$ or $HERF14 \neq HERF131$).[19] However, not every firm with a nonzero reporting change has a nonzero difference in the two sets of mechanical forecasts. For instance, if the new segment(s) has (have) the same SIC code as the old segment(s), our (industry-based) mechanical forecasting model creates identical forecasts. Thus, for the analyses (i.e., tables 4, 6, and 7) that use the differences in mechanical forecasts across the two reporting regimes, we focus on the sample of firms with a nonzero difference in the mechanical forecasts (which is a subset of the firms with a nonzero reporting change).

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[19] Note that a firm can have a zero reporting change in *NSEG* and a nonzero change in *HERF* if it simply reclassifies its existing segments. In this study, we view *both* a change in the number of reported segments (i.e., the change sample reported in panel B of table 2) and a pure reclassification (even without a change in the number of reported segments) as a nonzero reporting change.

We refer to this sample as the *DIF_MF* (i.e., $MF14 \neq MF131$) sample.[20] The following regression is estimated on the *DIF_MF* sample:

$$AF = \alpha + \beta_1 MF131/14 + \beta_2 LOGMKTV + \beta_3 VOLATILITY + \varepsilon, \quad (1)$$

The dependent variables are defined as follows:

AF:

AEF/ARF = the mean of one-year-ahead analyst earnings and revenue forecasts made during the 180 days after the lag adoption year's 10-K filing date (i.e., the last 10-K under SFAS 14)

The independent variables are defined as follows:

MF131/14:

MEF131/14 = one-year-ahead mechanical earnings forecasts, based on the restated segment data under SFAS 131 and the original segment data under SFAS 14 for the lag adoption year

MRF131/14 = one-year-ahead mechanical revenue forecasts, based on the restated segment data under SFAS 131 and the original segment data under SFAS 14 for the lag adoption year

LOGMKTV = log of the market value of stockholders' equity.

VOLATILITY = the standard deviation of monthly returns for 36 months (with at least 24 monthly returns available), starting at the beginning of year $t-2$, where year t is the adoption year

The main variable of interest is *MF131* and its comparison with *MF14* in the alternative specification of equation (1). If analysts did not have access to the SFAS 131 segment data during the lag adoption year (and hence used only the segment information reported under SFAS 14 in generating their forecasts), we expect β_1 to be insignificantly different from zero when it is the coefficient estimate for the *MF131* variable. Conversely, a positive and significant β_1 for this specification would suggest that analysts had access to at least some of the information reported under the new rule, even before the information becomes public. The last two independent variables are included to control for firm size and volatility, which are used in prior research to proxy for the difficulty of forecasting. We use these variables as controls for the *level* of the forecasts because the calendar-time clustering of our sample creates the concern that the difficulty of forecasting could be correlated with the level of the forecast.

To provide additional evidence about the impact the SFAS 131 data had on analysts in the year before adoption, we examine whether SFAS 14 data had

[20] For the rest of the analyses (i.e., tables 5 and 9), we focus on the sample of firms with a nonzero reporting change in either *NSEG* or *HERF*.

a lower association with analyst forecasts for firms with a nonzero reporting change than for firms with a zero reporting change. We address this question by examining the following regression for the pooled sample of firms with nonzero and zero reporting changes:

$$AF = \alpha + \beta_1 MF14 + \beta_2 (MF14 * DIF\_MF) + \beta_3 LOGMKTV + \beta_4 VOLATILITY + \varepsilon, \quad (2)$$

DIF_MF:

DIF_MEF/DIF_MRF = an indicator variable with the value of 1 for firms with different mechanical earnings and revenue forecasts using historical SFAS 14 data versus restated SFAS 131 figures

The pooled sample includes the *DIF_MF* sample and the zero-reporting-change sample. The main variable of interest is the interaction term *MF14 * DIF_MF*. A negative and significant β_2 would suggest that analysts are less responsive to SFAS 14 data for the firms revealing new information under SFAS 131.

Regression results. Table 4 presents the results for models (1) and (2). Columns 2 and 3 and 5 and 6 show that the level of both the SFAS 14 mechanical forecast (*MF14*) and SFAS 131 mechanical forecast (*MF131*) are positively associated with analyst forecasts (for both earnings and revenue).[21] The positive association is much stronger in the revenue regression, where, on average, a 1 dollar per share increase in the mechanical revenue forecast (under both SFAS 14 and SFAS 131) is associated with a 90 cent per share increase in analysts' revenue forecast. Table 4 also reports Vuong's [1989] test statistic, which assesses the relative explanatory power of *MF131* versus *MF14*.[22] For the earnings models (columns 2 and 3), Vuong's *Z*-statistic is 1.23, suggesting that *MF14* and *MF131* have similar explanatory power. For the revenue models (columns 5 and 6), although the difference between their adjusted R^2 is only 2% (0.78 − 0.76), the difference is statistically significant (Vuong's *Z*-statistic = 2.87).

For earnings, analyst forecasts in the lag adoption year are affected equally by the (nonpublic) new earnings information and the (public) old information. Analysts thus appear to use the SFAS 131 information before it is

[21] The number of observations used in this regression analysis is significantly less than that of the change sample reported in panel B of table 2 for several reasons. First, we lose a significant number of observations (about 26% of the pure sample) because of the lack of analyst earnings forecast data. This problem is even more severe for analyst revenue forecast data (more than 60% of the pure sample is missing revenue data). Second, about 10% of the sample reports only segment revenue data, with segment earnings data missing. Last, for about 13% of the firms with a nonzero reporting change, the new reporting segment under SFAS 131 has the same SIC code (at the four- or three-digit level) as the original segment. In these cases our mechanical forecasting model generates the same forecast under both reporting regimes.

[22] See Appendix 2 in Dechow [1994] for a detailed discussion of Vuong's [1989] test.

TABLE 4

Relation Between Pre–SFAS 131 Analyst Forecasts and SFAS 131 Data for the Lag Adoption Year

The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. This table summarizes regression results from estimating equations (1) and (2). The *DIF_MF* sample includes firms with different mechanical forecasts (*MF*) using historical SFAS 14 data versus restated SFAS 131 data (i.e., $MF14 \neq MF131$). The pooled sample includes the *DIF_MF* sample and a no reporting-change sample of firms with no difference across the two sets of mechanical forecasts (i.e., $MF14 = MF131$) and no reporting change in *NSEG* and *HERF*. The dependent variables, *AEF* and *ARF*, are computed as the mean of one-year-ahead analyst earnings and revenue forecasts made during the 180 days after the lag adoption year's 10-K filing date. *MEF131* (*MEF14*) and *MRF131* (*MRF14*) are the one-year-ahead mechanical earnings and revenue forecasts based on the restated SFAS 131 (original SFAS 14) segment data. See Appendix B for details on the construction of the mechanical forecasts. *DIF_MEF* (*DIF_MRF*) is an indicator variable with the value of 1 for firms with different mechanical earnings (revenue) forecasts using historical SFAS 14 data versus restated SFAS 131 data. *LOGMKTV* is the natural logarithm of the market value of stockholders' equity. *VOLATILITY* is the standard deviation of monthly returns for 36 months (with at least 24 monthly returns available), starting at the beginning of year *t*–2, where year *t* is the adoption year. Vuong's [1989] *Z*-statistic compares *MF14* and *MF131* as competing nonnested models for the different *MF* sample. A significant and positive *Z*-statistic indicates that *MF131* has greater explanatory power than does *MF14*.

	Analyst Earnings Forecasts (*AEF*)			Analyst Revenue Forecasts (*ARF*)		
	Different *MF* Sample		Pooled Sample	Different *MF* Sample		Pooled Sample
Intercept	10.85	5.98	31.36***	1304.27**	1367.96**	102.75
	(0.50)	(0.27)	(2.67)	(2.24)	(2.44)	(0.31)
MEF14	0.17***	–	0.24***	–	–	–
	(14.66)		(32.05)			
MEF131	–	0.22***	–	–	–	–
		(14.81)				
MEF14 ∗ DIF_MEF	–	–	−0.01	–	–	–
			(−1.35)			
MRF14	–	–	–	0.90***	–	1.20***
				(26.46)		(48.56)
MRF131	–	–	–	–	0.90***	–
					(27.67)	
MRF14 ∗ DIF_MRF	–	–	–	–	–	−0.23***
						(−6.86)

TABLE 4 — *Continued*

	Analyst Earnings Forecasts (*AEF*)			Analyst Revenue Forecasts (*ARF*)		
	Different *MF* Sample		Pooled Sample	Different *MF* Sample		Pooled Sample
LOGMKTV	17.10***	17.17***	8.54***	−83.83	−92.97*	−29.06
	(7.36)	(7.43)	(6.35)	(−1.46)	(−1.68)	(−0.84)
VOLATILITY	−443.35***	−404.22***	−380.69***	−1822.19	−1914.05	2709.72*
	(−4.21)	(−3.83)	(−7.06)	(−0.70)	(−0.76)	(1.80)
Adjusted R^2	0.57	0.57	0.51	0.76	0.78	0.74
Vuong's *Z*-statistic	1.23			2.87***		
No. of obs.:						
With different *MF*	432		432	235		235
With no reporting Δ	–		1,534	–		779
Total	432		1,966	235		1,014

***Significant at the 1% level (two-tailed test); **Significant at the 5% level (two-tailed test); * Significant at the 10% level (two-tailed test).

made public, consistent with their being aware of part of the new segment earnings information before it is made public. For revenues, it appears that analyst forecasts in the lag adoption year are marginally more affected by the (nonpublic) new revenue information than by the (public) old information. A possible explanation is that the incremental revenue information was more highly associated with whatever analysts think drives future revenues than what the old revenue information was. We also acknowledge that estimation error and a relatively small sample may play a role in these results.

Columns 4 and 7 of table 4 report the results for model (2). Although the coefficient estimate on the interaction term $MF14 * DIF\_MF$ is negative in both the earnings and the revenue regressions, it is only significant for the revenue regression. Thus, relative to the sample of firms with a zero reporting change, the association between analyst revenue forecasts and SFAS 14 mechanical revenue forecasts is lower by 23 cents per share (a 19% decrease) for the sample of firms with different mechanical forecasts.[23] However, when we regress *ARF* on *MRF14* separately for the *DIF_MF* and the zero-reporting-change samples (results not tabulated), the adjusted R^2s are almost identical (0.76 and 0.73). It appears that although there is a stronger association between SFAS 14 mechanical revenue forecasts and analyst forecasts for the zero-change sample, the explanatory power of the SFAS 14 data is similar across the two samples.

An assessment of other potential sources of SFAS 131 data. Analysts' apparent access to some of the SFAS 131 data before the filing of the adoption-year 10-K could have arisen either through private information acquisition or through public disclosures that preceded the 10-K. We therefore assess whether mandated filings occurring before the adoption-year 10-K contained information about the new segment data. The filings we consider are the lag adoption year's 10-K (which has its MD&A discussion affected by the SEC's [1989] Financial Reporting Release No. 36 [FRR 36]),[24] the adoption-year 10-Qs (which could include early adoption of SFAS 131 and which are affected by the SEC's [1987] Staff Accounting Bulletin No. 74 [SAB 74]), and the adoption-year annual report (which, for some firms, might be issued shortly before the adoption-year 10-K is filed with the SEC).

Disclosures in the adoption-year 10-Qs could preempt some of the SFAS 131 segment information provided in the adoption-year 10-K. Early adoption of SFAS 131 in a quarterly filing is, however, unlikely. If a firm voluntarily

[23] The negative correlation between *LOGMKTV* and *VOLATILITY* is relatively large (about −0.40), raising a potential multicollinearity concern. As a sensitivity check, we performed all table 4 regressions again excluding *VOLATILITY*. The results were qualitatively and statistically similar to those reported in table 4.

[24] FRR 36 states that discussion of the firm's segments should be included in the MD&A when material. Thus, the MD&A from the lag adoption year's 10-K filing could contain some of the information later provided by the restatement to SFAS 131 in the adoption year's 10-K.

provided segment disclosures under SFAS 131 at an interim date during the adoption year, it would need to provide corresponding disclosures for the comparative interim period in the prior year and for the prior annual period. These added costs of adoption at an interim filing date greatly discouraged such adoption, with a random examination of all adoption year interim filings for 100 of our sample firms showing that none of them adopted early at an interim filing date.

Despite the lack of SFAS 131 figures in adoption-year interim reports, the adoption-year 10-Q filings may have provided some information about the new segment data for another reason. SAB 74 dictates that the quarterly financial statement filings in the adoption year provide some indication of the impact that adoption of SFAS 131 is expected to have on the firm's reported segments. These statements were generally limited, however, to giving a brief overview of SFAS 131, stating when the firm planned to adopt it, and briefly indicating whether adoption would change the firm's reported segments.

Finally, a minor issue is that our tests assume the first filing containing the SFAS 131 annual footnote data is the adoption-year 10-K. For some firms, the issuance date of the annual report may slightly precede the 10-K filing date. Because our tests of the association of SFAS 131 data with analyst and market expectations are conducted using 12-month windows, the potential for information leakage by a matter of days for a subset of firms is not a major concern.

5.2.2. Is There Improvement in Analyst Forecast Accuracy? Given that analysts (apparently mainly through private information acquisition) appear to have known at least some of the new segment information before it was externally reported, the next question we address is: did the new standard result in disclosure of information that was new to analysts? We address this question by investigating whether there is any improvement in analyst forecast accuracy under the new reporting regime. If analysts already had access to all the segment information made public by mandating the management approach, analyst forecast accuracy would be unaffected by SFAS 131. We therefore compare the accuracy of one-year-ahead analyst forecasts made after the last SFAS 14 10-K filing with the accuracy of the corresponding forecasts made after the first SFAS 131 10-K filing (see figure 1, panel B). To control for any time trend in analyst forecast accuracy, we also include the no-reporting-change firms (i.e., $NSEG14 = NSEG131$ and $HERF14 = HERF131$) in the analysis as a benchmark and examine the following regression for the pooled sample of change (i.e., $NSEG14 \neq NSEG131$ or $HERF14 \neq HERF131$) and no-change firms:

$$\begin{aligned} AFE_t = \alpha &+ \beta_1 POST131 + \beta_2 CHANGE + \beta_3 CHANGE * POST131 + \delta_1 MFE_t \\ &+ \delta_2 LOGMKTV_t + \delta_3\ AFOLLOW_t + \delta_4 VOLATILITY_t + \delta_5 AGE_t \\ &+ \delta_6 MTIMELY_t + \delta_7 D\_LOSS_t + \varepsilon, \end{aligned} \tag{3}$$

$$AFE_t = \alpha + \beta_1 POST131 + \beta_2 RPC\_NSEG + \beta_3 RPC\_NSEG * POST131 + \delta_1 MFE_t + \delta_2 LOGMKTV_t + \delta_3 AFOLLOW_t + \delta_4 VOLATILITY_t + \delta_5 AGE_t + \delta_6 MTIMELY_t + \delta_7 D\_LOSS_t + \varepsilon, \quad (4)$$

$$AFE_t = \alpha + \beta_1 POST131 + \beta_2 RPC\_DISAGG + \beta_3 RPC\_DISAGG * POST131 + \delta_1 MFE_t + \delta_2 LOGMKTV_t + \delta_3 AFOLLOW_t + \delta_4 VOLATILITY_t + \delta_5 AGE_t + \delta_6 MTIMELY_t + \delta_7 D\_LOSS_t + \varepsilon, \quad (5)$$

$$AFE_t = \alpha + \beta_1 POST131 + \beta_2 RPC\_HERF + \beta_3 RPC\_HERF * POST131 + \delta_1 MFE_t + \delta_2 LOGMKTV_t + \delta_3 AFOLLOW_t + \delta_4 VOLATILITY_t + \delta_5 AGE_t + \delta_6 MTIMELY_t + \delta_7 D\_LOSS_t + \varepsilon, \quad (6)$$

where $t = -1$ (the lag adoption year) and 0 (the first adoption year). The dependent variables are defined as follows:

For $t = -1$ (pre-131):

$AFE = |X_0 - AF_{-1}|$ deflated by price per share, where X_0 = actual earnings (revenue) per share for the adoption year
AF_{-1} = the mean of one-year-ahead analyst earnings (revenue) forecasts during the 180 days after the lag adoption year's 10-K filing date

For $t = 0$ (post-131):

$AFE = |X_1 - AF_0|$ deflated by price per share, where X_1 = actual earnings (revenue) per share for the year after the adoption year
AF_0 = the mean of one-year-ahead analyst earnings (revenue) forecasts during the 180 days after the adoption year's 10-K filing date

The independent variables are defined as follows:

POST131 = an indicator variable with the value of 1 for forecasts made after the first SFAS 131 10-K, and 0 for those made after the last SFAS 14 10-K
CHANGE = an indicator variable with the value of 1 (0) for firms in the change (no-change) sample
HERF14/131 = *HERF* computed based on SFAS 14 and 131 for the lag adoption year
RPC_NSEG = reporting Δ in *NSEG*: *NSEG131 − NSEG14*
RPC_DISAGG = reporting Δ in *DISAGG*: *DISAGG131 − DISAGG14*
RPC_HERF = reporting Δ in *HERF*: *HERF131 − HERF14*

MFE (*MEFE* & *MRFE*):

$MFE_{t=-1} = |X_0 - MF14|$ deflated by price
$MFE_{t=0} = |X_0 - MF131|$ deflated by price

$LOGMKTV_t$ = log of the market value of stockholder's equity in year t

$AFOLLOW_t$ = the number of analysts issuing an earnings forecast during the 180 days after the 10-K filing date for year t

$VOLATILITY_t$ = the standard deviation of monthly returns for 36 months (with at least 24 monthly returns available), with the last month at the end of year $t-1$

AGE_t = the number of years the firm has been on Compustat at the start of year t

$MTIMELY_t$ = the mean difference of (forecast date − filing date) for year t

D_LOSS_t = an indicator variable with the value of 1 if actual earnings for year t is negative, and 0 otherwise

We use a two-year panel data specification rather than directly estimating models that use the change in *AFE* as the dependent variable. The disadvantage of using the change in *AFE* as the dependent variable is that, for models (4) to (6), we would only be able to interpret variables equivalent to the interaction terms and would not be able to evaluate the impact of the noninteracted reporting change variables.[25]

The main variables of interest are the interaction of *POST131* with the dichotomous reporting change variable, *CHANGE*, in model (3) and with the continuous reporting change variables (*RPC_NSEG*, *RPC_DISAGG*, and *RPC_HERF*) in models (4) to (6). We include the forecast errors from our mechanical forecasting model to control for forecasting difficulty. We also include measures of firm size, analyst following, firm volatility, and age because these variables are shown in the prior literature to be associated with

[25] We also examine the following change-based regression models for the pooled sample of change and no-change firms:

$$AFE = \alpha + \beta_1 CHANGE + \delta_1 \Delta MFE + \delta_2 \Delta LOGMKTV + \delta_3 \Delta AFOLLOW + \delta_4 \Delta VOLATILITY + \delta_5 \Delta D\_LOSS + \varepsilon,$$

$$AFE = \alpha + \beta_1 RPC\_NSEG + \delta_1 \Delta MFE + \delta_2 \Delta LOGMKTV + \delta_3 \Delta AFOLLOW + \delta_4 \Delta VOLATILITY + \delta_5 \Delta D\_LOSS + \varepsilon,$$

$$AFE = \alpha + \beta_1 RPC\_DISAGG + \delta_1 \Delta MFE + \delta_2 \Delta LOGMKTV + \delta_3 \Delta AFOLLOW + \delta_4 \Delta VOLATILITY + \delta_5 \Delta D\_LOSS + \varepsilon,$$

$$AFE = \alpha + \beta_1 RPC\_HERF + \delta_1 \Delta MFE + \delta_2 \Delta LOGMKTV + \delta_3 \Delta AFOLLOW + \delta_4 \Delta VOLATILITY + \delta_5 \Delta D\_LOSS + \varepsilon.$$

The results (not tabulated) generate inferences that are qualitatively and statistically similar to those we report in table 5 from estimating models (3) to (6).

forecast accuracy (e.g., Lang and Lundholm [1993], Alford and Berger [1999]).[26]

Panel A of table 5 presents univariate statistics comparing the analyst forecast errors for the pre– and post–SFAS 131 periods for both the change and no-change samples. The average earnings forecast error for the change sample decreases significantly, from 2.41% of price to 1.94%. The difference in forecast errors for the change sample is also significantly more negative than for the no-change sample. With respect to revenue forecasts, the average forecast error for the change sample does not differ significantly across the periods, remaining between 11% and 12% of price in both years. The average revenue forecast error for the no-change sample, however, increases significantly from 10.79% of price to 12.94%. In contrast to the earnings forecast error results, the differences across the two samples are insignificantly different in both periods.

Panel B shows that, when applying model (3) to the earnings forecasts, the coefficient of −0.91 on the interaction term *CHANGE* ∗ *POST131* is significantly negative (consistent with the univariate results).[27] In other words, for the sample of firms with a nonzero reporting change, annual earnings forecast accuracy improves by 0.91% of price under the new reporting regime. Similarly, for models (4) and (5), the coefficients of the interaction terms between the *POST131* indicator and the reporting changes (in *NSEG* and *DISAGG*) are negative and significant. The −0.46 estimate on *RPC_NSEG* ∗ *POST131* indicates that a one-segment reporting increase is associated with 0.46% more of a decrease in analysts' earnings forecast error in the post-131 era. The positive sign for model (6) on the *RPC_HERF* ∗ *POST131* interactive term is also in a direction consistent with this inference, although the coefficient estimate is not significant at the 10% level.

The last four columns of panel B in table 5 present the analogous results for analysts' revenue forecasts. For the revenue forecast results, when applying model (3), the coefficient on the interaction term *CHANGE* ∗ *POST131* is not reliably different from zero (consistent with the univariate result in panel A). In addition, for models (4) to (6), although the coefficient estimates on the interaction terms are in the predicted directions, they are all insignificant at conventional levels. Thus, the mandated public disclosure of SFAS 131 segment information appears to assist analysts in predicting future earnings, but not future revenues. One potential explanation for these findings is that analysts may have had access to most of the (relatively standardized) SFAS 131 segment revenue information even before the new

[26] In addition to examining the impact of SFAS 131 on analyst forecast accuracy, we also explore its impact on the information production environment. Specifically, we perform similar analyses on analyst following (results not reported) and do not find any significant change in analyst following after the adoption of the new reporting standard.

[27] Table 5, panel B, and table 8 both report estimations performed on samples containing two consecutive annual observations for the identical set of firms. All inferences in these two tables remain unchanged when significance levels are calculated using Rogers-White standard errors.

TABLE 5

Analyst Forecast Accuracy and SFAS 131 Data

This table presents the analyses on the effect of SFAS 131 on analyst forecast accuracy. Panel A reports the univariate analysis results. Panel B summarizes the pooled cross-sectional regression results from estimating equations (3) to (6). The sample includes the change and the no-change samples. The change sample includes firms with a nonzero reporting change in either *NSEG* or *HERF;* the rest of the firms are included in the no-change sample. Regressions reported in Panel B include both the lag ($t = -1$) and the first ($t = 0$) adoption year of SFAS 131. Analysts earnings (revenue) forecast error for $t = -1$ and $t = 0$, $AEFE_t$ ($ARFE_t$), is the absolute difference between X_{t+1} and AF_t. X_{t+1} is the actual earnings (revenue) per share for year $t+1$; AF_t is the mean of one-year-ahead analyst earnings (revenue) forecasts during the 180 days after year t's 10-K filing date. *POST131* is an indicator variable with the value of 1 for the adoption year (i.e., $t = 0$) and 0 for the lag adoption year (i.e., $t = -1$). *CHANGE* is an indicator variable with the value of 1 (0) for firms in the change (no-change) sample. *RPC_NSEG, RPC_DISAGG,* and *RPC_HERF* are the reporting change in *NSEG, DISAGG,* and *HERF,* respectively, computed using historical SFAS 14 and restated SFAS 131 segment data for the lag adoption year. *NSEG* is the number of segments. *DISAGG* is the natural logarithm of the ratio of the number of segments to the number of business activities. *HERF* is the Herfindal index computed based on revenues. Mechanical earnings/revenue forecast error, *MEFE/MRFE,* for $t = -1$ ($t = 0$) is the absolute difference between actual earnings/revenue per share for the first adoption year and the mechanical earnings/revenue forecast generated using SFAS 14 (SFAS 131) segment data deflated by price per share. $LOGMKTV_t$ is the natural logarithm of the market value of stockholders' equity in year t. $AFOLLOW_t$ is the number of analysts issuing an earnings forecast during the 180 days after the 10-K filing date for year t. $VOLATILITY_t$ is the standard deviation of monthly returns for 36 months (with at least 24 monthly returns available), with the last month at the end of year $t-1$. AGE_t is the number of years the firm has been on Compustat at the start of year t. $MTIMELY_t$ is the mean difference of: (forecast date – filing date) for year t. *D_LOSS* is an indicator variable with the value of 1 if actual earnings for year t is negative, and 0 otherwise.

Panel A: Univariate analysis on analyst forecast error

	Pre-131	Post-131	Difference. Between Pre- & Post-131 (*t*-stat)	No. of Obs.
Analysts earnings forecast error (*AEFE*)				
Change sample	2.41	1.94	−0.47** (−1.98)	387
No-change sample	2.98	3.26	0.28 (1.42)	1,101
Difference between change and no-change samples	−0.57* (−1.65)	−1.32*** (−4.92)	−0.75** (2.44)	
Analysts revenue forecast error (*ARFE*)				
Change sample	11.34	11.82	0.48 (0.30)	174
No-change sample	10.79	12.94	2.15* (1.75)	484
Difference between change and no-change samples	0.55 (0.29)	−1.12 (−0.52)	−1.67 (−0.83)	

TABLE 5 — *Continued*

Panel B: Regression analysis on analyst forecast error

	Analyst Earnings Forecasts Errors (*AEFE*)				Analyst Revenue Forecasts Errors (*ARFE*)			
Intercept	4.60***	4.62***	4.55***	4.67***	18.27***	18.24***	19.36***	18.45***
	(6.81)	(6.84)	(6.64)	(6.91)	(4.09)	(4.08)	(4.50)	(4.13)
POST131	0.04	−0.01	−0.02	−0.09	2.32*	2.66**	2.31*	2.20*
	(0.19)	(−0.04)	(−0.07)	(−0.44)	(1.76)	(2.12)	(1.86)	(1.76)
CHANGE	−0.91	–	–	–	2.38	–	–	–
	(−0.19)				(1.33)			
CHANGE	−0.91***	–	–	–	−1.63	–	–	–
∗ *POST131*	(−2.13)				(−0.65)			
RPC_NSEG	–	0.04	–	–	–	0.67	–	–
		(0.25)				(0.79)		
RPC_NSEG	–	−0.46**	–	–	–	−1.71	–	–
∗ *POST131*		(−2.16)				(−1.42)		
RPC_DISAGG	–	–	0.09	–	–	–	2.06	–
			(0.29)				(1.16)	
RPC_DISAGG	–	–	−1.05**	–	–	–	−2.96	–
∗ *POST131*			(−2.32)				(−1.19)	
RPC_HERF	–	–	–	0.37	–	–	–	1.28
				(0.49)				(0.29)
RPC_HERF	–	–	–	1.28	–	–	–	3.53
∗ *POST131*				(1.21)				(0.56)
MEFE	0.16***	0.16***	0.16***	0.16***	–	–	–	–
	(25.50)	(25.47)	(25.23)	(25.40)				
MRFE	–	–	–	–	0.23***	0.23***	0.21***	0.23***
					(17.27)	(17.22)	(16.25)	(17.14)
LOGMKTV	−0.68***	−0.68***	−0.68***	−0.68***	−1.64***	−1.57***	−1.80***	−1.54**
	(−7.51)	(−7.55)	(−7.37)	(−7.53)	(−2.75)	(−2.63)	(−3.11)	(−2.58)
AFOLLOW	0.04**	0.04**	0.04**	0.04**	−0.01	−0.02	−0.02	−0.03
	(2.08)	(2.12)	(2.25)	(2.08)	(−0.06)	(−0.19)	(−0.15)	(−0.24)
VOLATILITY	4.95*	4.93*	4.35*	5.05*	−31.88**	−32.38**	−30.47**	−31.87*
	(1.88)	(1.87)	(1.65)	(1.92)	(−1.99)	(−2.03)	(−2.00)	(−1.99)
AGE	0.00	0.00	0.00	0.00	0.08	0.09*	0.11**	0.09*
	(0.52)	(0.43)	(0.10)	(0.36)	(1.58)	(1.72)	(2.17)	(1.71)
MTIMELY	0.00	0.00	0.01	0.00	0.00	0.00	−0.00	0.00
	(0.97)	(0.95)	(1.62)	(0.90)	(0.16)	(0.13)	(−0.15)	(0.12)
D_LOSS	2.04***	2.05***	2.26***	2.04***	−1.18	−1.08	−0.55	−1.05
	(7.80)	(7.83)	(8.31)	(7.78)	(−0.76)	(−0.70)	(−0.35)	(−0.68)
Adjusted R^2	0.29	0.30	0.29	0.29	0.22	0.22	0.22	0.22
No. of obs.:								
Pre-131:								
Change	387	387	376	387	174	174	166	174
No change	1,101	1,101	1,030	1,101	484	484	453	484
Post-131:								
Change	387	387	376	387	174	174	166	174
No change	1,101	1,101	1,030	1,101	484	484	453	484
Total	2,976	2,976	2,812	2,976	1,316	1,316	1,238	1,316

***Significant at the 1% level (two-tailed test); **Significant at the 5% level (two-tailed test); *Significant at the 10% level (two-tailed test).

standard, while having less access to the (more firm-specific) new segment earnings data.

5.3 DID STOCK PRICES FULLY REFLECT SFAS 131 DATA EVEN BEFORE ITS ADOPTION?

If analysts were not fully aware of the segment data revealed under the new standard, the stock market also may have found the new SFAS 131 data to be valuable. We investigate this issue by developing three trading rules based on the mechanical forecasting models and examining the abnormal returns of the corresponding hedge portfolios. Each rule is implemented beginning the month following the release of the last SFAS 14 10-K and continuing for 12 months (see figure 1, panel B). The first rule buys (sells short) shares of firms for which the SFAS 131 segment-based one-year-ahead mechanical earnings forecast exceeds the corresponding SFAS 14 forecast. The second rule implements the analogous strategy based on the one-year-ahead mechanical revenue forecasts. The third trading strategy goes long (short) only in companies in which the mechanical forecasts for both earnings and revenues are higher (lower) based on the new standard. Based on the long (short) positions described in these trading rules, we compute three sets of abnormal returns for the long (short) portfolios. The hedge portfolio return is the sum of the long and short portfolio abnormal returns.

5.3.1. Twelve-Month Abnormal Returns. In computing long-term abnormal returns, Barber and Lyon [1997] find that matching sample firms to control firms with similar sizes and book-to-market ratios yields well-specified test statistics. We follow this approach in computing our measure of abnormal returns by computing the 12-month $BHAR_{SB}$ (buy-and-hold abnormal return using size- and book-to-market matched control firms) as follows:

$$\prod_{t=1}^{12}[1+R_{it}]-\prod_{t=1}^{12}[1+E(R_{it})],$$

where R_{it} is the return of the sample firm i for month t, and $E(R_{it})$ is the return for month t of a control firm that is matched on size and book-to-market at the end of the lag adoption fiscal year.[28] In finding a size- and book-to-market matched firm to compute $BHAR_{SB}$, we first identify all firms with a market value of equity between 80% and 120% of the market value of equity of the sample firm at the end of the lag adoption fiscal year. From this set of firms, we choose the one with the book-to-market ratio closest to that of the sample firm.

Panel A of table 6 provides descriptive statistics on the distribution of the mechanical forecasts. Among the firms with different mechanical earnings forecasts under the two reporting regimes, about 70% have lower forecasts

[28] The sample for the trading rule analysis includes all observations with different mechanical forecasts under the two reporting regimes (i.e., firms with different segment definitions under the two reporting regimes). We ideally would consider all companies with no reporting change as potential control firms but do not do so because of the data collection that would be required. An alternative is to use our no-change firms as the controls, but this would compromise the matching process because of our relatively small sample size. We therefore identify the size and book-to-market matched control firms by beginning with the population of firms that are in both Compustat and CRSP, with all necessary data available. We then exclude (1) all firms with different SFAS 14 versus SFAS 131 mechanical forecasts, (2) all firms with a reporting change in the number of segments (because some observations have missing mechanical forecast data), (3) all "contaminated" observations from our original sample.

TABLE 6

Abnormal Returns of Trading Rule Portfolios Based on Mechanical Forecasts Generated from Restated SFAS 131 and Historical SFAS 14 Segment Information

Panel A of this table presents the distribution of the mechanical forecasts that are used to construct the trading rule portfolios. *MEF131/14* (*MRF131/14*) are one-year-ahead mechanical earnings (revenue) forecasts based on restated SFAS 131 and historical SFAS 14 segment data, respectively. Panel B summarizes the 12-month abnormal returns for three trading strategies that are based on (1) only mechanical earnings forecasts, (2) only mechanical revenue forecasts, and (3) both mechanical earnings and revenue forecasts. The hedge portfolio return is the sum of the short and long portfolio returns. The 12-month $BHAR_{SB}$ (buy-and-hold abnormal return using size and book-to-market matched control firms) is computed as:

$$\prod_{t=1}^{12}[1 + R_{it}] - \prod_{t=1}^{12}[1 + E(R_{it})],$$

where R_{it} is the return of sample firm i, and $E(R_{it})$ is the return of a control firm that is matched on size and book-to-market at the end of the lag adoption fiscal year (see figure 1, panel B). Panel C reports the three-day abnormal returns of the third trading strategy surrounding quarterly and annual earnings announcement and 10-K filing dates. The three-day cumulative abnormal return (*CAR*) is computed based on the Brown and Warner [1985] methodology:

$$CAR_{[-1,+1]} = \sum_{t=-1}^{+1} MAR_t,$$

where

$$MAR_t = \frac{1}{N_t}\sum_{i=1}^{N_t} AR_{it} \quad \text{and} \quad AR_{it} = R_{it} - E(R_{it})\, t = -1, 0, +1;$$

R_{it} is the return of sample firm i on day t and $E(R_{it})$ is the corresponding size decile portfolio return from CRSP on day t. The t-statistics for CAR are computed as follows:

$$\sum_{t=-1}^{+1} MAR_t \Bigg/ \left(\sum_{t=-1}^{+1} S^2[MAR_t]\right)^{1/2},$$

where

$$S^2[MAR_t] = \left(\sum_{t=-244}^{t=-6}[MAR_t - MMAR]^2\right) \Bigg/ 238 \quad \text{and} \quad MMAR = \frac{1}{239}\sum_{t=-244}^{t=-6} MAR_t.$$

Panel A: Distribution of mechanical revenue and earnings forecasts under SFAS 131 and SFAS 14

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Earnings forecasts:				
MEF131 < MEF14	401	15.49	401	15.49
MEF131 = MEF14	2,034	78.56	2,435	94.05
MEF131 > MEF14	154	5.95	2,589	100.00
Revenue forecasts:				
MRF131 < MRF14	313	11.19	313	11.19
MRF131 = MRF14	2,202	78.73	2,515	89.92
MRF131 > MRF14	282	10.08	2,797	100.00

TABLE 6 — *Continued*

Panel B: Twelve-month abnormal return of trading rule portfolios

	Long: *MEF131* > *MEF14* Short: *MEF131* < *MEF14*		Long: *MRF131* > *MRF14* Short: *MRF131* < *MRF14*		Long: *MEF131* > *MEF14* and *MRF131* > *MRF14* Short: *MEF131* < *MEF14* and *MRF131* < *MRF14*	
	No. of Obs	12-month *BHAR* (*t*-stat)	No. of Obs	12-month *BHAR* (*t*-stat)	No. of Obs	12-month *BHAR* (*t*-stat)
Hedge portfolio	500	0.07**	528	0.06	270	0.14***
		(2.38)		(1.24)		(2.64)
Short portfolio	359	0.11***	280	0.12***	188	0.15***
		(3.30)		(2.97)		(3.11)
Long portfolio	141	−0.04	248	−0.06	82	−0.01
		(−0.84)		(−1.41)		(−0.25)

Panel C: Three-day (−1 to +1) abnormal returns of trading rule portfolio surrounding quarterly and annual earnings announcement and 10-K filing dates

Trading Rule Portfolio:
Long: *MEF131* > *MEF14* and *MRF131* > *MRF14*
Short: *MEF131* < *MEF14* and *MRF131* < *MRF14*
Three-Day *CAR* (*t*-stat)

	No. of Obs	1st Quarter	2nd Quarter	3rd Quarter	Annual	10-K Filing
Hedge portfolio	265	−0.006	0.006	0.009	0.035***	0.000
		(−1.32)	(0.93)	(1.20)	(5.13)	(0.05)
Short portfolio	184	−0.005	0.003	0.004	0.017***	0.001
		(−1.43)	(0.74)	(0.80)	(3.85)	(0.17)
Long portfolio	81	−0.001	0.003	0.005	0.018***	−0.001
		(−0.16)	(0.52)	(0.91)	(2.60)	(−0.19)

***Significant at the 1% level (two-tailed test); **Significant at the 5% level (two-tailed test).

based on the SFAS 131 segment data. In contrast, the proportions of higher and lower revenue forecasts are about the same.

Panel B of table 6 summarizes the results of the three trading strategies. Note that the number of observations is lower than in panel A because of missing returns data. However, the proportion of firms with higher (lower) forecasts under SFAS 131 is almost identical in both panels. The first two columns of results in panel B report the sample sizes and annual abnormal returns for the hedge, short, and long portfolios under the earnings-based trading strategy. The middle two columns and the final two columns report analogous results for the revenue-based and combined trading strategies. The earnings-based trading strategy generates a positive and significant annual *BHAR* of 7% on the hedge portfolio, with the positive abnormal returns driven by the short portfolio.

Adoption of SFAS 131 is clustered in calendar time, raising the concern that cross-sectional dependence of the returns may inflate the test statistics because the number of sample firms overstates the number of independent observations. Lyon, Barber, and Tsai [1999] investigate this issue for $BHAR_{SB}$ and find that the use of the return on a size- and book-to-market matched control firm as a proxy for the expected return for each security controls well for calendar clustering of event dates. We therefore restrict our adjustment for calendar-time clustering to the sensitivity tests that use a 12-month cumulative abnormal return (*CAR*) instead of an annual *BHAR*.[29]

Panel B of table 6 indicates that the revenue-based strategy yields the weakest results, both in terms of the magnitude and statistical significance of the hedge portfolio's annual abnormal returns. A potential reason is that, relative to earnings, revenue is less value relevant. Another possibility is that analysts and investors had greater pre-adoption access to the (relatively standardized) SFAS 131 segment revenue data than to the (more firm-specific) segment earnings data.

Finally, the combined earnings- and revenue-based trading rule yields the largest annual abnormal return from the hedge portfolio, although it is not statistically different from that of the earnings-based strategy. The reason we include this combined trading rule is to exploit the potential trade-offs between the earnings- and revenue-based strategies. Earnings is more directly linked to value than is revenue, and hence, it is not surprising that the earnings-based trading rule dominates the revenue-based trading rule. On the other hand, our mechanical forecasting model generates more accurate revenue forecasts relative to earnings forecasts. A potential benefit of incorporating revenue-based information into the earnings-based strategy is that we might eliminate some of the noise in the selection of long versus short positions for the earnings-based portfolios. However, the insignificant abnormal returns from the revenue-based strategy and the insignificant difference between the abnormal returns of the earnings-based and the combined strategies suggest that the benefits of incorporating the revenue-based information in the trading strategy are not large.

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[29] As a sensitivity test of the table 6, panel B, results, we perform the analogous trading strategies using a 12-month *CAR* instead of an annual *BHAR*, beginning on the month following the release of the last SFAS 14 10-K and continuing for 12 months (i.e.,

$$CAR = \sum_{t=1}^{12} AR_{it}, \text{ where } AR_{it} = R_{it} - E(R_{it})$$

is the abnormal return in month t). R_{it} is the return of the sample firm i, and $E(R_{it})$ is the return of a control firm that is matched on size and book to market at the end of the lag adoption fiscal year. The control firms used in the sensitivity tests are identical to those used in the tabulated tests. In addition to using *CARs*, we also perform the analogous trading strategies using the mean monthly calendar-time abnormal returns

$$\left(MAR_t = \sum_{i=1}^{n} AR_{it}\right)$$

described in Lyon, Barber, and Tsai [1999]. This method treats each monthly average abnormal return as a single observation and the statistical significance of the *MARs* is evaluated using t-statistics derived from the time series of the monthly average abnormal returns. The sensitivity tests on both methods (i.e., *CARs* and *MARs*) produce results of marginally greater magnitude and statistical significance than those reported in panel B of table 6.

The trading rule results indicate that in the 12 months preceding the release of the restated annual segment data, the market was not aware of all of the segment information (especially on segment earnings) revealed under SFAS 131. Moreover, there is some evidence that the market was more uninformed about the new segment information that would lead to lower projections of future earnings or revenues, as the hedge returns are driven by the short portfolios. To further pursue the notion that the market may have been least informed about the negative components of the new segment information, we investigate whether the negative returns for the short portfolios are concentrated in firms revealing a new loss segment upon adoption of SFAS 131. We find that this is not the case for the separate earnings- and revenue-based trading rules (results not tabulated). For the combined trading strategy, untabulated results show the average abnormal return in the short portfolio for the 45 firms revealing a new loss segment is −20%, versus −14% for the 143 firms not revealing a new loss segment. The 6% difference in returns is not, however, statistically significant.

5.3.2. Abnormal Returns Surrounding Earnings Announcement and 10-K Filing Dates. The preceding results indicate that, 12 months before the filing of the adoption-year 10-K, the market was not aware of the new SFAS 131 information. We now turn to the issue of whether managers were informally bundling at least some of the new SFAS 131 information with their quarterly or annual earnings announcements in the adoption year. If SFAS 131 information is bundled into these information events, the price revisions around the announcements should be correlated with the mechanical forecast differences. We therefore examine the *CAR*s (for the combined trading portfolio) around the adoption year's three quarterly earnings announcements, the annual earnings announcement, and the filing of the adoption-year 10-K. We focus on the combined trading portfolio because it yields the strongest 12-month abnormal returns.

We follow the Brown and Warner [1985] methodology in computing the three-day *CAR* for the event window. Specifically, the three-day *CAR* is computed as follows:

$$CAR_{[-1,+1]} = \sum_{t=-1}^{+1} MAR_t,$$

where:

$$MAR_t = \frac{1}{N_t} \sum_{i=1}^{Nt} AR_{it}$$

$$AR_{it} = R_{it} - E(R_{it})$$

$$t = -1, 0, +1$$

R_{it} = the return of the sample firm i on day t

$E(R_{it})$ = the corresponding size decile portfolio return from CRSP on day t

The t-statistic for CAR is computed as follows:

$$\sum_{t=-1}^{+1} MAR_t \Bigg/ \left(\sum_{t=-1}^{+1} S^2[MAR_t]\right)^{1/2},$$

where

$$S^2[MAR_t] = \left(\sum_{t=-244}^{t=-6} [MAR_t - MMAR]^2\right) \Bigg/ 238$$

and

$$MMAR = \frac{1}{239} \sum_{t=-244}^{t=-6} MAR_t.$$

Note that we use 239 days (−244 through −6) in the estimation period in deriving the standard deviation and restrict the analysis to firms with at least 120 daily returns in the estimation period. Because a portfolio average abnormal return is used in the calculation of the standard deviation, the test statistic takes into account cross-sectional dependence in the abnormal returns.

Panel C of table 6 presents, for the combined trading portfolio, the three-day *CAR*s for the adoption year's three quarterly earnings announcements, the annual earnings announcement, and the 10-K filing date. The three-day *CAR*s for the short and long portfolios surrounding the three quarterly earnings announcements are not significantly different from zero, consistent with the conjecture that few firms adopted SFAS 131 for their interim reports in the adoption year. Similarly, the three-day abnormal returns around the 10-K filing date are insignificant. In contrast, the *CAR* surrounding the annual earnings announcement date is negative (positive) and significant for the short (long) portfolio, with a three-day *CAR* of −1.7% (1.8%). The 3.5% abnormal return of the hedge portfolio is also significant at the 1% level.[30] It thus appears that a significant portion of the new SFAS 131 segment information was bundled with the annual earnings announcement, preempting the detailed disclosure at the 10-K filing date.

5.4 WHY DOES THE REPORTING CHANGE LEAD TO ALTERED EXPECTATIONS ABOUT FIRM PERFORMANCE?

We now turn to the question of which aspects of the new segment information affect earnings forecasts. Specifically, we investigate whether the firms with greater increases in their reported levels of disaggregation and cross-segment transfers are associated with larger decreases in their earnings or revenue projections under SFAS 131.

[30] The results are qualitatively and statistically similar when we use 180 days or 120 days in the estimation period, or when we examine a five-day *CAR* [−2 to +2] instead of a three-day *CAR*.

Recall that we use the difference between the one-year-ahead mechanical forecasts under the two reporting regimes (*MF131* − *MF14*) as a proxy for the new segment information revealed under SFAS 131. To explore the source of the new information, we regress this measure on our disaggregation and transfer measures. Specifically, we examine the following regression models for firms with different mechanical forecasts under the two reporting regimes (i.e., $MF131 \neq MF14$):

$$MF131 - MF14 = \alpha + \beta_1 RPC\_NSEG + \beta_2 RPC\_TRANSFER + \beta_3 LOGMKTV + \varepsilon, \quad (7)$$

$$MF131 - MF14 = \alpha + \beta_1 RPC\_DISAGG + \beta_2 RPC\_TRANSFER + \beta_3 LOGMKTV + \varepsilon, \quad (8)$$

$$MF131 - MF14 = \alpha + \beta_1 RPC\_HERF + \beta_2 RPC\_TRANSFER + \beta_3 LOGMKTV + \varepsilon, \quad (9)$$

where:

MEF131/14 = one-year-ahead mechanical earnings forecasts based on the restated SFAS131 and original SFAS14 segment data for the lag adoption year
MRF131/14 = one-year-ahead mechanical revenue forecasts based on the restated SFAS131 and original SFAS14 segment data for the lag adoption year
RPC_NSEG = reporting Δ in *NSEG*: *NSEG131* − *NSEG14*
RPC_DISAGG = reporting Δ in *DISAGG*: *DISAGG131* − *DISAGG14*
RPC_HERF = reporting Δ in *HERF*: *HERF131* − *HERF14*
RPC_TRANSFER = reporting Δ in *TRANSFER*: *TRANSFER131* − *TRANSFER14*
LOGMKTV = log of the market value of stockholder's equity

The main variables of interest are *RPC_NSEG*, *RPC_DISAGG*, *RPC_HERF*, and *RPC_TRANSFER*, where *RPC_NSEG*, *RPC_DISAGG*, and *RPC_HERF* measure the reporting change in the level of disaggregated information, and *RPC_TRANSFER* measures the reporting change in the level of resource transfers across segments under the new standard.

The results are presented in table 7. For the earnings forecast regressions, the coefficient estimates on *RPC_NSEG* and *RPC_DISAGG* (*RPCHERF*) are negative (positive) and significant. Thus, reporting more disaggregated information under SFAS 131 is associated with more pessimistic earnings forecasts. Similarly, the firms revealing a higher level of transfers under the new standard also yield lower earnings projections, with the coefficient on *RPC_TRANSFER* negative and significant. Our findings are consistent with the reporting under SFAS 131 providing more disaggregated data and additional information about transfers that leads to lower forecasts of earnings. In contrast to the earnings forecast results, we are unable

TABLE 7

Regression Analysis on the Difference Between Mechanical Forecasts Under SFAS 131 and SFAS 14 for the Lag Adoption Year

The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. This table summarizes regression results from estimating equations (7) to (9). The cross-sectional regression analysis is performed on the sample of firms with different mechanical forecasts under SFAS 131 and SFAS 14. *MEF131/14* (*MRF131/14*) are one-year-ahead mechanical earnings (revenue) forecasts based on restated SFAS 131 and historical SFAS 14 segment data. *RPC_NSEG, RPC_DISAGG, RPC_HERF,* and *RPC_TRANSFER* are the reporting change in *NSEG, DISAGG, HERF,* and *TRANSFER,* respectively, computed using historical SFAS 14 and restated SFAS 131 segment data for the lag adoption year. *NSEG* is the number of segments. *DISAGG* is the natural logarithm of the ratio of the number of segments to the number of business activities. *HERF* is the Herfindal index computed based on revenues. *TRANSFER* is the excess of segment excess *CAPX* over firm-level excess *CAPX*. Excess *CAPX* is the maximum of (capital expenditure − cash flow) and 0. Segment cash flow is proxied by operating profits plus depreciation. *LOGMKTV* is the natural logarithm of the market value of stockholder's equity.

	MEF131 − MEF14			*MRF131 − MRF14*		
Intercept	61.78	117.83**	70.73	98.15	127.11	84.24
	(1.42)	(2.53)	(1.57)	(1.16)	(1.38)	(0.97)
RPC_NSEG	−27.41***			−8.44		
	(−2.61)	–	–	(−0.44)	–	–
RPC_DISAGG		−103.29***			−42.82	
	–	(−4.28)	–	–	(−0.93)	–
RPC_HERF			118.02**			−6.93
	–	–	(2.51)	–	–	(−0.08)
RPC_TRANSFER	−4.57***	−4.41***	−4.64***	−3.10	−3.02	−3.21
	(−4.80)	(−4.68)	(−4.87)	(−1.22)	(−1.17)	(−1.26)
LOGMKTV	−15.64**	−18.98***	−18.26***	−7.61	−9.14	−7.64
	(−2.56)	(−3.10)	(−2.95)	(−0.64)	(−0.75)	(−0.64)
Adjusted R^2	0.09	0.11	0.09	0.01	0.00	0.00
No. of Obs.	400	393	400	399	391	399

***Significant at the 1% level (two-tailed test); ** Significant at the 5% level (two-tailed test).

to explain the difference in the mechanical revenue forecasts between the two reporting regimes. Finally, we also estimate versions of equations (7) to (9) with the absolute value of the mechanical earnings and revenue forecast differences as the dependent variables. The results show that both greater disaggregation per se and higher reported cross-segment transfers are associated with an increase in the absolute amount of earnings information, but are not associated with the absolute amount of revenue information.

5.5 SEGMENT INFORMATION AND AGENCY COSTS

We find (in section 5.3) that in the year preceding adoption the market was not fully aware of the restated segment data associated with lower earnings forecasts. We also show (in section 5.4) that the lower earnings forecasts are associated with restatements that reveal more disaggregated information (or a higher level of diversification) and a higher level of cross-segment transfers. One potential explanation for these results is that some firms with unsuccessful diversification strategies may have used the discretion afforded by SFAS 14 to withhold information indicative of the poor strategy. In this section, we test that conjecture.

Regulators often advocate the view that asymmetric information between managers and outside investors can be reduced by changes in mandated accounting disclosure, and that such a reduction in asymmetric information facilitates better external monitoring of managers. Under this view, "the two principal goals of financial statements are to enable appropriate monitoring to take place and to provide the basis to value securities" (OECD [1999 p. 19]).

As discussed earlier, prior studies (Lang and Stulz [1994], Berger and Ofek [1995]) find that diversified firms trade at a discount relative to stand-alone firms.[31] Furthermore, there is evidence from both empirical and analytical studies (Stulz [1990], Meyer, Milgrom, and Roberts [1992], Denis, Denis, and Sarin [1997], Lamont [1997], Rajan, Servaes, and Zingales [2000]) that the "diversification discount" is associated with measures of agency problems and the level of transfers across segments. The new standard could induce companies to reveal more information about their diversification or transfers and, consequently, could better reflect any underlying agency problems associated with the diversification strategy.[32] If so, we would observe an increased diversification discount at firms in which the restated segment data reflect more diversification and transfers than the historical data showed. We examine this conjecture by estimating the following regression models:

$$EXVS = \alpha + \beta_1 MSEG14 + \beta_2 SS\_MS + \beta_3 SS\_MS * POST131 + \beta_4 LOGASSET + \beta_5 EBIT + \beta_6 CAPX + \varepsilon, \quad (10)$$

$$EXVS = \alpha + \beta_1 D\_TRANSFER14 + \beta_2 D\_RPC\_TRANSFER + \beta_3 D\_RPC\_TRANSFER * POST131 + \beta_4 LOGASSET + \beta_5 EBIT + \beta_6 CAPX + \varepsilon, \quad (11)$$

[31] A considerable debate is ongoing, however, as to whether the diversification discount results from diversification per se as opposed to self-selection effects (in which firms with poorer prospects are more likely to diversify or segments with poorer prospects are more likely to be acquired than to stand alone). The view that diversification per se accounts for the discount is usually linked to the view that diversified firms, on average, have greater unresolved agency conflicts than their pure-play peers. The position that self-selection can explain part or all of the discount sometimes attributes the self-selection mainly to efficiency motives (e.g., Campa and Kedia [2002]) and sometimes ascribes the self-selection at least partly to agency problems that exist at the diversified firm before its diversifying acquisitions (e.g., Villalonga [2001]).

[32] A recent paper by Bens and Monahan [2001] finds that enhanced voluntary disclosure (as proxied by higher AIMR rankings) is associated with smaller diversification discounts.

where:

MSEG14 = an indicator variable with the value of 1 for firms reported as multisegment firms under SFAS 14 in the lag adoption year
SS_MS = an indicator variable with the value of 1 for firms that have changed from a single-segment firm under SFAS14 to a multisegment firm under SFAS131 in the lag adoption year, and 0 otherwise
POST131 = an indicator variable with the value of 1 for observations with *EXVS* measured at the end of the adoption year, and 0 when *EXVS* is measured at the end of the lag adoption year
D_TRANSFER14 = an indicator variable with the value of 1 for firms with *TRANSFER14* > 0, and 0 otherwise
D_RPC_TRANSFER = an indicator variable with the value of 1 if *RPC_TRANSFER* > 0, and 0 otherwise
RPC_TRANSFER = *TRANSFER131* − *TRANSFER14*
LOGASSET = log of total assets
EBIT = *EBIT*/Sales
CAPX = Capital Expenditures/Sales

Excess value (*EXVS*) is a widely used measure of the diversification discount (see Berger and Ofek [1995] for additional details not described herein). It measures the percentage difference between a firm's total value and the sum of the imputed values for its segments as stand-alone entities. The imputed value of each segment is calculated by multiplying the median ratio, for single-segment firms in the same industry, of total capital to sales by the segment's sales. The industry median ratios are based on the narrowest SIC grouping that includes at least five single-line businesses with at least $20 million of sales and sufficient data for computing the ratios.

The sum of the imputed values of a company's segments estimates the value of the firm if all of its segments are operated as stand-alone businesses. The natural log of the ratio of a firm's actual value to its imputed value is excess value, or the gain or loss in value associated with diversification. Positive excess value indicates that diversification is associated with a value of the segments beyond that of their stand-alone counterparts. Negative excess value indicates that diversification is associated with the market valuing the segments at less than their stand-alone peers.

For the pre–SFAS 131 period, the segments used to calculate the imputed values are from the restated SFAS 131 segment data for the lag adoption year. We use the restated data because it appears that the SFAS 131 segments are a more accurate reflection of the firm's actual segments, but the inferences discussed next are unchanged when we instead use the historical SFAS 14 segment data to calculate the imputed values in the pre–SFAS 131 period. For the post–SFAS 131 period, the imputed values are computed based on the segment data reported in the first adoption-year 10-K. Note that the market value of equity for the post–SFAS 131 period is measured at the end of the 10-K filing month rather than at the end of the fiscal year in which SFAS 131 was adopted. This is done to allow the firm's actual value for the post–SFAS 131 excess value calculation to be measured after the new segment data are public.

The results, presented in table 8, confirm (for our period) the Berger and Ofek [1995] findings with regard to the average diversification discount. We find that excess value averages 16% less for the firms that reported multiple segments under SFAS 14. In addition, even in the pre-adoption period, the firms that (subsequently) restate to multisegment status have excess values that average −7%. In the post-adoption period, however, the excess value for these "hidden" diversifiers decreases to −20%, insignificantly below the −16% of the firms that reported multiple segments under SFAS 14.

These results are consistent with the market's partially discounting diversification that was not revealed in public filings under SFAS 14, but only fully discounting hidden diversification when it is later revealed in the first 10-K to adopt SFAS 131. The decrease in market value (relative to sales) is consistent with the SFAS 131 data revealing agency problems.[33] It is also consistent with other explanations, such as SFAS 131 forcing firms to reveal valuable proprietary information to competitors. Disentangling these explanations is beyond the scope of this study and is instead pursued in Berger and Hann [2002].

Another potential interpretation of these results is based on the self-selection critique of the diversification discount literature. The decrease in excess value for firms that reported one segment under the old rules and multiple segments under the new rules indicates a negative change in stock prices relative to the accounting fundamentals (i.e., sales) at these firms. Even if SFAS 131 is viewed as an exogenous shock, however, the negative stock market reaction at these firms could arise either because SFAS 131 reveals suboptimal diversification or because the new statement itself changes the existing level of diversification from optimal to suboptimal *at firms with certain firm-specific characteristics*. For example, one might contend that the accounting change will create conditions generating higher than expected growth opportunities in segments of conglomerates that appear more profitable using the new rules for calculating segment profitability. The exogenous shock of the accounting change could therefore increase

[33] The exclusion of the contaminated firms could induce a selection bias in the table 8 tests. The contaminated observations were mainly firms that made divestitures or acquisitions in the adoption year. If these deleted firms tended to make more divestitures than acquisitions, the sample we are left with may be biased toward firms unwilling or unable to divest poorly performing businesses in the adoption year. Thus, the increased diversification discount for firms restating from single segment to multisegment might in part reflect the market's learning about management's unwillingness to divest bad businesses, rather than the market's learning more about the details of the lines of business. We test this alternative explanation by repeating the table 8 analyses on the initial sample. The results are qualitatively and statistically similar to those reported in table 8, arguing against the selection bias explanation.

TABLE 8

The Diversification Discount and SFAS 131 Segment Reporting

The table presents pooled cross-sectional regression results from estimating equations (10) and (11) on the full sample for the lag adoption ($t = -1$) and adoption ($t = 0$) years. The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. Excess value is the natural logarithm of the ratio of a firm's actual value to its imputed value. Firm imputed value is the sum of the segment imputed values, which are calculated by multiplying the median ratio, for single-segment firms in the same industry, of total capital to sales by the segment's sales. Lag adoption year ($t = -1$) excess value is computed based on the restated SFAS 131 segment data for the lag adoption year, and post-adoption year ($t = 0$) excess value is computed based on segment data reported in the adoption year annual report. The market value of equity for year 0 is measured at the end of the 10-K filing month. *MSEG14* is an indicator variable with the value of 1 for firms reported as multisegment firms under SFAS 14 in the lag adoption year. *SS_MS* is an indicator variable with the value of 1 for firms that have changed from a single-segment firm under SFAS 14 to a multisegment firm under SFAS 131 in the lag adoption year, and 0 otherwise. *POST131* is an indicator variable with the value of 1 for the adoption year and 0 for the lag adoption year. *TRANSFER14* (*TRANSFER131*) is segment excess *CAPX* minus firm-level excess *CAPX* computed using historical SFAS 14 (restated SFAS 131) segment data. Excess *CAPX* is the maximum of (capital expenditure − cash flow) and 0, where cash flow is operating profits plus depreciation. *D_TRANSFER14* is an indicator variable with the value of 1 for firms with *TRANSFER14* greater than zero, and 0 otherwise. The reporting change indicator, *D_RPC_TRANSFER,* has the value of 1 if the reporting change in *TRANSFER* is greater than zero, and 0 otherwise. $LOGASSET_t$ is the natural logarithm of total assets for year t. $EBIT_t$ is earnings before interest and taxes deflated by sales for year t. $CAPX_t$ is capital expenditure deflated by sales for year t.

	Excess Value	Excess Value
Intercept	−0.43***	−0.43***
	(−11.78)	(−10.88)
MSEG14	−0.16***	–
	(−6.07)	
SS_MS	−0.07*	–
	(−1.92)	
SS_MS ∗ POST131	−0.13***	–
	(−2.95)	
D_TRANSFER14	–	0.03
		(0.98)
D_RPC_TRANSFER	–	−0.19***
		(−4.26)
D_RPC_TRANSFER ∗ POST131	–	−0.02
		(−0.36)
LOGASSET	0.05***	0.05***
	(7.91)	(6.65)
EBIT	1.51***	1.51***
	(16.73)	(15.41)
CAPX	0.21***	0.19***
	(5.62)	(4.56)
Adjusted R^2	0.11	0.11
No. of Obs.:		
Pre-131	2,168	1,956
Post-131	2,168	1,956
Total	4,336	3,912

***Significant at the 1% level (two-tailed test); *Significant at the 10% level (two-tailed test).

the cost of an inefficient internal capital market, in turn increasing the cost of operating in multiple divisions and making refocusing optimal in response to the accounting change *at firms with certain characteristics*. Although we acknowledge that reasoning like this may explain our table 8 results, it does not appear to provide the most plausible explanation for our findings.

With respect to the second model in table 8, we do not find that firms with positive values of *TRANSFER* under SFAS 14 have more negative excess values. However, the firms that reveal a positive value of *TRANSFER* under SFAS 131 have excess values that average −19% across both the pre- and post-adoption periods. Unlike the previous finding, we do not find excess value to be significantly different in the post-adoption period for the firms with "hidden" transfers. These results suggest that SFAS 131 better reveals the level of resource movement across segments than does SFAS 14, although the market appears to have fully impounded such information even before the new standard.

To follow up on the table 8 findings, we regress the real change in *TRANSFER* on its reporting change for the sample of firms with a nonzero reporting change:

$$RC\_TRANSFER = \alpha + \beta_1 RPC\_TRANSFER + \beta_2 EXVS131 + \beta_3 LOGMKTV + \varepsilon, \tag{12}$$

To control for potential mean reversion in the level of transfers, we include *EXVS131* as an independent variable (*TRANSFER131* is too highly correlated with *RPC_TRANSFER* to be included in the regression). The results, presented in table 9, show that the greater the increase in reported transfers as a result of adopting SFAS 131, the more the firm reduces its real transfers during the year leading up to its first SFAS 131 annual report. These results are consistent with the segment information revealed under SFAS 131 being potentially useful in the monitoring process.

Two caveats are in order with regard to the table 9 results. As with table 8, the alternative self-selection explanation is also possible. In addition, although *RC_TRANSFER* is measured as the change in the SFAS 131 measurement of *TRANSFER* between the lag adoption year and the adoption year, it may still capture reporting discretion in addition to real changes. If reporting high levels of transmissions of funds across segments indeed imposes costs on managers, they may select adoption-year segment accounting policies in part to create the appearance of reducing the SFAS 131 measure of such transfers. Doing so is unlikely to impose contracting costs on the manager (because contracts in the pre-adoption period are probably not based on SFAS 131 figures) and could be achieved by strategic choices in both the selection of segments and the allocations of costs and revenues among the segments.

TABLE 9

Regression Analysis of the Real Change in Cross-Segment Transfers on the Reporting Change in Cross-Segment Transfers

This table presents the regression results from estimating equation (12). The cross-sectional regression analysis is performed on a sample of firms with a nonzero reporting change in either the number of segments or *HERF* (see panel A of table 3 for the definition of *HERF*). *RC_TRANSFER* measures the real change in *TRANSFER* from the lag adoption year to the adoption year (i.e., the difference between *TRANSFER* computed based on the adoption year SFAS 131 data and that computed based on the restated SFAS 131 data for the lag adoption year). The adoption year is the first fiscal year in which SFAS 131 was adopted and the lag adoption year is the preceding fiscal year. *RPC_TRANSFER* measures the reporting change in *TRANSFER* (i.e., the difference between *TRANSFER* computed based on the restated SFAS 131 and historical SFAS 14 data for the lag adoption year). *EXVS131* is excess value computed based on the restated SFAS 131 segment data for the lag adoption year. *LOGMKTV* is the natural logarithm of the market value of stockholder's equity.

	RC_TRANSFER
Intercept	4.82***
	(3.11)
RPC_TRANSFER	−0.53***
	(−11.74)
EXVS131	0.39
	(0.57)
LOGMKTV	−0.49**
	(−2.13)
Adjusted R^2	0.24
No. of Obs.	428

***Significant at the 1% level (two-tailed test); ** Significant at the 5% level (two-tailed test).

6. *Conclusion*

The purpose of this study is to shed light on the debate regarding the effects of the FASB's recent mandated change in segment reporting rules from SFAS 14 to SFAS 131. Our descriptive findings indicate that SFAS 131 achieved one of its stated goals—to increase the number of reported segments and provide more disaggregated information. Although analysts appear to have had access to some of the SFAS 131 segment information before it was externally reported, we also find a significant improvement in forecast accuracy after the adoption of the new standard. Thus, the mandated public disclosure of the segment data used for decision making within the firm appears to provide information to analysts that they were not able to obtain through private information acquisition alone. This inference extends from sell-side analysts to the market as a whole. We implemented various trading strategies based on the new SFAS 131 segment data for the 12 months preceding adoption of the new standard. We found a positive and significant annual buy-and-hold abnormal return would have been earned by taking short (long) positions based on whether the restated segment data for the lag adoption year indicated that future earnings performance would be worse (better) than that indicated by the historical segment data reported under SFAS 14. Overall, our results are consistent with the assertions of the AIMR and the FASB that the management approach offers new and useful information to investors that was not available to them under the industry segment approach.

Given the potential information benefits, we explore whether the new data offered under SFAS 131 is useful in monitoring decisions. Our results provide evidence that the new standard is effective in inducing diversified firms to reveal previously "hidden" information about the firm's diversification strategy and its resource transfers across segments. The new information affects market valuations and is associated with changes in firm behavior that are consistent with the new disclosures facilitating improved monitoring.

APPENDIX A

Boeing Segment Footnote Illustration

Example of Algorithm to Identify "Pure" versus "Contaminated" SFAS 131 Restatements, and Comparison of SFAS 14 and SFAS 131 Segment Information

Commentary on contaminated SFAS 131 restatements:

1) The algorithm we use to identify contaminated SFAS 131 restatements does classify Boeing as contaminated and it is thus dropped from our sample.
2) The steps in the algorithm are as follows:
   A) Calculate restated revenues and restated earnings as the sum of restated segment revenues and the sum of restated segment earnings, respectively. For Boeing these amounts are the 1996 figures from the 1997 10-K and total $35,453 million for revenues and $2,672 million (956 + 1,387 + 329) for earnings.
   B) Calculate historical revenues and earnings. For firms that were multisegment in the historical year, use the same summations as in part A. For Boeing these amounts are the 1996 figures from the 1996 10-K and total $22,681 million for revenues and $1,529 million for earnings. For firms that were single segment in the historical year, use their total revenues from the income statement and try every possible earnings-related item from their income statement (because it is not clear what the definition of segment earnings is under SFAS 131).
   C) Compare the revenue total from A with that from B. If the difference divided by the total from A is less than 0.01, the SFAS 131 restatement is pure. If it is greater, check whether ANY of the earnings measures from B result in a difference versus earnings from A that is less than 0.01 of the total from A. If so, the SFAS 131 restatement is pure. ONLY if BOTH the revenue and the earnings differences are greater than 0.01 of the restated totals is the SFAS 131 restatement classified as contaminated.

Commentary on general aspects of Boeing's change from SFAS 14 to SFAS 131 segment reporting (most of this commentary is taken from McConnell, Pegg, and Zion [1998]):

1) Boeing was an early adopter of SFAS 131, choosing to adopt in its 1997 financial statements.
2) The reason Boeing is found to be contaminated is that it had a pooling acquisition of McDonnell Douglas in 1997 (and the resulting contamination of its SFAS 131 restatement provides a potential motivation for its early adoption of the new standard).
3) Basically the same business segments are reported in both 1997 and 1996 if the McDonnell Douglas pooling is disregarded. The "Customer and Commercial Financing, Other" segment is new but is likely the result of the merger.
4) Basically there is the same breakdown of geographic sales in both 1997 and 1996 (note that in 1997, under SFAS 131, many firms no longer reported geographic information). The only changes in the geographic data are that the U.S. is displayed as a separate line in 1997 (it was omitted before) and a new sentence was added stating: "Less than 20% of operating assets are outside the U.S."
5) There is a slightly expanded explanation of the nature of the activities carried out in each segment in 1997.
6) Two new items of segment information are provided in 1997: (1) research and development expenses, and (2) liabilities. Note that SFAS 131 does not require this information.
7) Depreciation expense by segment was provided previously. In 1997, a number combining depreciation and amortization by segment is provided.
8) There is an explicit explanation of what has not been allocated to segments in 1997. There was no explanation in 1996.
9) The 1997 unallocated items of profit or loss are: (1) goodwill amortization, (2) capitalized interest amortization, (3) certain actuarial costs (it appears that this refers to pension and other postretirement costs), (4) interest and debt expense,* (5) other income principally interest,* (6) share value trust,* and (7) income taxes.*
10) The 1997 unallocated assets are: (1) cash and short-term investments,* (2) prepaid pension expense, (3) goodwill, (4) deferred tax asset,* and (5) capitalized interest.
11) The 1997 unallocated liabilities** are: (1) various accrued employee compensation and benefit liabilities, including accrued retiree health care payable; (2) taxes payable; and (3) debenture and notes payable.

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* It is clear from the display that these items were not allocated to segments in 1996, either. It is unclear whether the other items were or were not allocated before 1997.

** No liablilites were allocated in 1996. SFAS 131 does not require the allocation of liabilities.

Segment footnote excerpts from Boeing's SFAS 131 adoption-year 10-K (1997)

The Company has adopted SFAS of Financial Accounting Standards No. 131, Disclosures about Segments of an Enterprise and Related Information.

The Company is organized based on the products and services that it offers. Under this organizational structure, the Company operates in two principal areas: commercial aircraft, and information, space and defense systems. Commercial Aircraft operations principally involve development, production and marketing of commercial jet aircraft and providing related support services, principally to the commercial airline industry worldwide. Information, Space and Defense Systems operations principally involve research, development, production, modification and support of the following products and related systems: military aircraft, both land-based and aircraft-carrier-based, including fighter, transport and attack aircraft with wide mission capability, and vertical/short takeoff and landing capability; helicopters; space and missile systems; satellite launching vehicles; rocket engines; and specialized information services. Although some Information, Space and Defense Systems products are contracted in the commercial environment, the primary customer is the U.S. Government. No single product line in the Information, Space and Defense Systems segment represented more than 10% of consolidated revenues, operating profits or identifiable assets. The Customer and Commercial Financing, Other segment is primarily engaged in the financing of commercial and private aircraft, commercial equipment, and real estate.

Sales by geographic area consisted of the following:

(Dollars in millions)

Year ended December 31,	1997	1996	1995
Asia, other than China	$11,437	$8,470	$7,059
China	1,265	951	754
Europe	7,237	4,198	4,087
Oceania	1,078	821	658
Africa	192	156	154
Western Hemisphere, other than the United States	228	466	734
	21,437	15,062	13,446
United States	24,363	20,391	19,514
Total sales	$45,800	$35,453	$32,960

Unallocated costs include goodwill amortization, capitalized interest amortization, certain unallocated actuarial costs (including $600 million in 1995 for a special retirement charge described in Note 3 on page 59), and corporate costs not allocated to other internal reporting entities. Unallocated assets primarily consist of cash and short-term investments, prepaid pension expense, goodwill, deferred tax assets, and capitalized interest. Unallocated liabilities include various accrued employee compensation and benefit liabilities including accrued retiree health care, taxes payable, and debentures and notes payable. Unallocated capital expenditures and depreciation relate primarily to shared services assets. Sales are not recorded for inter-segment transactions.

Losses from operations for 1997 and 1995 include the impact of Douglas Products Division valuation adjustment and MD-11 accounting charge described in Note 3 on page 59.

(Dollars in millions)	Net earnings (loss)			Revenues			Research and development		
Year ended December 31,	1997	1996	1995	1997	1996	1995	1997	1996	1995
Commercial Aircraft	$(1,837)	$956	$(1,280)	$26,929	$19,916	$17,511	$1,208	$1,156	$1,232
ISDS	1,317	1,387	1,312	18,125	14,934	14,849	716	477	442
Other	381	329	355	746	603	600			
Unallocated expense	(216)	(54)	(703)						
Earnings (loss) from operations	(355)	2,618	(316)						
Other income, principally interest	428	388	280						
Interest and debt expense	(513)	(393)	(376)						
Share Value Trust	99	(133)							
Earnings (loss) before taxes	(341)	2,480	(412)						
Income taxes (benefit)	(163)	662	(376)						
	$(178)	$1,818	$(36)	$45,800	$35,453	$32,960	$1,924	$1,633	$1,674

	Assets at Dec. 31			Liabilities at Dec. 31			Dep. and amortization		
Year ended December 31,	1997	1996	1995	1997	1996	1995	1997	1996	1995
Commercial Aircraft	$12,763	$12,484	$12,923	$6,917	$5,824	$5,249	$570	$605	$629
ISDS	6,597	6,785	5,243	2,379	2,361	1,290	365	299	311
Other	4,716	3,903	4,441	396	286	285	91	110	116
Unallocated	13,948	14,708	9,270	15,379	15,907	12,526	432	252	250
	$38,024	$37,880	$31,877	$25,071	$24,378	$19,350	$1,458	$1,266	$1,306

	Capital expenditures,			Contractual backlog at net December 31 (unaudited)		
Year ended December 31,	1997	1996	1995	1997	1996	1995
Commercial Aircraft	$531	$336	$343	$93,788	$86,151	$73,715
ISDS	463	304	186	27,852	28,022	21,773
Other	1	1	1			
Unallocated	396	330	217			
	$1,391	$971	$747	$121,640	$114,173	$95,488

ISDS = Information, Space and Defense Systems.
Other = Customer and Commercial Financing, Other.

Segment footnote excerpts from Boeing's SFAS 14 lag adoption year 10-K (1996):

Note 21—Industry Segment Information

The Company operates in two principal industries: commercial aircraft, and defense and space. Commercial aircraft operations principally involve development, production and marketing of commercial jet aircraft and providing related support services, principally to the commercial airline industry worldwide. Defense and space operations principally involve research, development, production, modification and support of military aircraft and helicopters and related systems, space and missile systems, rocket engines, and information services, primarily through U.S. Government contracts. No single product line in the defense and space segment represented more than 10% of consolidated revenues, operating profits or identifiable assets.

Foreign sales by geographic area consisted of the following:

Year ended December 31,	1996	1995	1994
Asia, other than China	$6,478	$4,491	$6,149
China	757	721	1,254
Europe	2,205	1,901	3,277
Oceania	360	485	887
Africa	35	127	135
Western Hemisphere	285	474	142
	$10,120	$8,199	$11,844

Financial information by segment for the three years ended December 31, 1996, is summarized below. Corporate income consists principally of interest income from corporate investments. Activities previously identified as "Other industries" have been combined with defense and space because the amounts were not material and such remaining activities were organizationally aligned into the defense and space segment in 1995. Goodwill resulting from the acquisition of the Rockwell aerospace and defense business is included in the defense and space segment. Corporate assets consist principally of cash, cash equivalents, short-term investments and deferred income taxes.

Year ended December 31,	1996	1995	1994
Revenues			
Commercial aircraft	$16,904	$13,933	$16,851
Defense and space	5,777	5,582	5,073
Operating revenues	22,681	19,515	21,924
Corporate income	287	209	122
Total revenues	$22,968	$19,724	$22,046
Operating profit			
Commercial aircraft	$1,072	$391	$1,022
Defense and space	457	124	305
Operating profit	1,529	515	1,327
Corporate income	287	209	122
Debt and other corporate expense	(320)	(364)	(306)
ShareValue Trust appreciation	(133)		
Earnings before taxes	$1,363	$360	$1,143
Depreciation			

Year ended December 31,	1996	1995	1994
Commercial aircraft	$798	$837	$902
Defense and space	186	196	240
Total depreciation	$984	$1,033	$1,142
Capital expenditures, net			
Commercial aircraft	$564	$493	$619
Defense and space	198	136	176
Total capital expenditures, net	$762	$629	$795
Identifiable assets at December 31			
Commercial aircraft	$12,634	$14,195	$14,440
Defense and space	8,158	3,220	3,412
	20,792	17,415	17,852
Corporate	6,462	4,683	3,611
Consolidated assets	$27,254	$22,098	$21,463

APPENDIX B

Construction of Mechanical Revenue and Earnings Forecasts

As suggested by academics and practitioners (Pacter [1993]), a major benefit of segment data over consolidated data, well summarized in Collins [1975], is that "it allows an investor to better integrate individual company data with external sources of industry data (e.g., the financial press, trade association, and government publications and forecasts) in assessing the future earnings potential of multi-product [or multisegment] firms." In constructing the mechanical forecasts, we follow a procedure similar to that used by Collins, which relies heavily on industry sales growth data from external sources.

I) One-Year-Ahead Mechanical Revenue Forecast

The one-year-ahead mechanical revenue forecast is computed as follows:

$$MRF = E[S_t] = \sum_{i=1}^{n} s_{it-1} \times [1 + g_i] = \sum_{i=1}^{n} E[s_{it}],$$

where:

n = number of business segments
$s_{i,t-1}$ = segment i's sales revenues for the lag adoption year
g_i = forecasted industry sales growth rate for segment i

Industry Sales Growth Forecast (g_i)

We use the following two approaches to obtain the industry sales growth forecast:

1) Under the first approach, we obtain the industry sales growth forecast from the U.S. Department of Commerce's (1998–1999) *U.S. Industry and Trade Outlook*. This annual publication provides trends and forecast data on "value of shipments" for approximately 200 industries identified by four-

to one-digit SIC codes. Because the publication does not cover the entire population of industries (i.e., SIC codes), we use the available information to generate industry sales growth forecasts at broader SIC code levels. For example, we have the following industry data at the four-digit SIC code level for codes that start with 24XX.

Wood Products: Trends and Forecasts (from the 1998 *U.S. Industry and Trade Outlook*)

		Value of Shipments		
Industry Name	SIC Code	1997	1998	*g*
Sawmills and Planing Mills	2421	28164	29347	4.20%
Hardwood Veneer and Plywood	2435	2915	3056	4.84%
Softwood Veneer and Plywood	2436	6599	6839	3.64%
Manufactured Housing	2451	9648	10335	7.12%
Prefabricated Wood Buildings	2452	2936	3025	3.03%
Reconstituted Wood Products	2493	5804	6107	5.22%
	2400*	56066*	58709*	4.71%*

*Information not given in the publication.

To estimate the sales growth rate at the two-digit SIC code level, we compare the sum of the estimated value of shipments across all SIC codes that start with 24XX for 1997 and 1998: $56,066 million and $58,709 million, respectively. In this example, the sales growth forecast at the two-digit SIC code level is estimated to be 4.71%. The sales growth estimate at the three-digit level is computed in a similar fashion.

We use the narrowest SIC match based on the availability of industry data. Using this algorithm, the mechanical revenue forecast for 29% of all segments (including stand-alone firms) is based on four-digit SIC code industries, 27% on three-digit industries, 26% on two-digit industries, and 18% on one-digit industries.

2) In the second approach, we assume rational expectations in using the *ex post* industry sales growth rate to proxy for the *ex ante* expectation of this rate. In particular, the industry sales growth forecast is measured as the median actual industry sales growth (based on total sales from both stand-alone firms and segments of diversified firms) for the first adoption year. The industry median sales growth rates are computed based on the narrowest SIC grouping that includes at least five segments or firms with at least $20 million of sales. Using this algorithm, the mechanical revenue forecast for 89% of all segments (including stand-alone firms) is based on four-digit SIC code industries, 8% on three-digit industries, and 3% on two-digit industries.

The advantage of the first approach is that it provides us with *ex ante* industry sales growth forecasts. The disadvantage is that the definition of industry is relatively less refined. For some industries, trend and forecast data are available only at the two- or one-digit SIC code level. Moreover, even for those industries that are reported at the four- or three-digit level, trend and forecast data are often combined for several SIC codes in that level. This creates a potential problem in generating more refined forecasts even if more segments are reported under SFAS 131. Suppose firm A reported as a two-segment firm under SFAS 131 as opposed to a single-segment firm under SFAS 14. If the two segments had the same SIC code at the one-digit level, but different SIC codes at the two- or three-digit level, the first method might yield the same mechanical forecast under both SFAS 14 and SFAS 131. In that case, the first method would fail to reflect the potentially new information from SFAS 131 in the mechanical forecast.

Although the second approach offers more refined industry sales growth forecasts, the data are not available *ex ante*. Also, under the second approach, the mean absolute and mean squared forecast errors are bigger than under the first approach. To address these issues, we develop an algorithm that combines the two methods. Specifically, for the sample of firms with a different number of reported segments under SFAS 14 and SFAS 131, we choose the method that offers a more refined industry definition. For all other firms we always use the first approach.

Other Adjustments

On the segment database, corporate segments (and in some cases, "other" segments) are typically not assigned an industry SIC code. Hence, we are not able to compute a projected sales figure for those segments. For those corporate or other segments, we assume a constant sales growth rate. For a very small percentage of firms (less than 1%), the sum of segment sales deviates from the firm level sales figure. We exclude firm observations with $SALEDEV > 0.05$, where

$$SALEDEV = \frac{Firm\ sales_{t-1} - Sum\ of\ segment\ sales_{t-1}}{Sum\ of\ segment\ sales_{t-1}}$$

If the deviation is within 5% (i.e., $SALEDEV \leq 0.05$), we adjust the firm's projected sales figure (i.e., $E[S_t]$) by grossing up or down the firm-level projected sales figure by the percentage deviation (i.e., $E[S_t] \times (1 + SALEDEV)$).

II) One-Year-Ahead Mechanical Earnings Forecasts

Because industry sales growth forecasts are much more readily available than are industry earnings growth forecasts, we follow Collins [1975] in estimating the one-year-ahead mechanical earnings forecast by applying the segment profit margin to the segment sales forecasts described in the previous section. Specifically, the one-year-ahead mechanical earnings forecast is computed as follows:

$$MEF = E[X_t] = \sum_{i=1}^{n} \frac{e_{it-1}}{s_{it-1}} \times E[s_{it}],$$

where:

$$\begin{aligned} n &= \text{number of business segments} \\ e_{i,t-1} &= \text{segment } i\text{'s earnings for the lag adoption year} \end{aligned}$$

$$\text{If } e_{i,t-1} > 0, \text{ then } E[X_t] = E[S_t] \times \tfrac{e_{it-1}}{s_{it-1}}.$$

$$\text{If } e_{i,t-1} < 0, \text{ and } g_i > 0, \text{ then } E[X_t] = e_{i,t-1} + |e_{i,t-1}| \times \left(\tfrac{E[S_{it}]}{S_{it-1}} - 1\right).$$

$$\text{If } e_{i,t-1} < 0, \text{ and } g_i < 0, \text{ then } E[X_t] = e_{i,t-1} - |e_{i,t-1}| \times \left(1 - \tfrac{E[S_{it}]}{S_{it-1}}\right).$$

We deal with the problem associated with the deviation of firm earnings from the sum of segment earnings in a fashion similar to that described for revenues. The gross-up mechanism is more complex because of the negative earnings figures. The mechanism works as follows:

$$EARNDEV = \frac{Firm\ earnings_{t-1} - Sum\ of\ segment\ earnings_{t-1}}{Sum\ of\ segment\ earnings_{t-1}}$$

$$\text{If } E[X_t] > 0 \text{ and } X_{t-1} > \sum_{i=1}^{n} e_{it-1}, \text{ then } E[X_t] = E[X_t] \times (1 + EARNDEV).$$

$$\text{If } E[X_t] > 0 \text{ and } X_{t-1} < \sum_{i=1}^{n} e_{it-1}, \text{ then } E[X_t] = E[X_t] \times (1 - EARNDEV).$$

$$\text{If } E[X_t] < 0 \text{ and } X_{t-1} > \sum_{i=1}^{n} e_{it-1}, \text{ then } E[X_t] = E[X_t] \times (1 - EARNDEV).$$

$$\text{If } E[X_t] < 0 \text{ and } X_{t-1} < \sum_{i=1}^{n} e_{it-1}, \text{ then } E[X_t] = E[X_t] \times (1 + EARNDEV).$$

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