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PREDICTING FUTURE CORPORATE EARNINGS WITH INDUSTRY AND GEOGRAPHIC SEGMENT DISCLOSURES

A DISSERTATION APPROVED FOR THE
MICHAEL F. PRICE COLLEGE OF BUSINESS

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1. Introduction

The Financial Accounting Standards Board (FASB) has issued two statements related to segment reporting: Statement of Financial Accounting Standards No. 14 (SFAS 14) and No. 131 (SFAS 131). SFAS 14 required segment information by both industry and geographic region, implying equal importance to each. In contrast, SFAS 131, which supersedes SFAS 14, adopts a two-tiered reporting structure, giving primary importance to operating segments and secondary emphasis to supplemental segments.[1] As a practical matter, most firms define industry segments as their operating segments and geographic segments as their supplemental segments (Herrmann and Thomas, 2000). Therefore, throughout this paper, I use the terms "industry" and "operating" to refer to SFAS 14 line of business segments and SFAS 131 operating segments. "Geographic" and "supplemental" refer to SFAS 14 geographic segment disclosures and SFAS 131 supplemental segment information.[2]

A principal objective of both standards is to provide information that allows users to better predict the future performance of a firm (FASB, 1976, ¶ 5; FASB,

[1] Operating segments are defined as those parts of the company that are evaluated by a chief corporate decision maker (FASB, 1997, ¶ 5). Supplemental segment information, referred to as enterprise-wide disclosures, requires additional geographic or industry information not reported already as operating segment information (FASB, 1997, ¶ 36). See Appendix A for a more detailed discussion of the changes from SFAS 14 to SFAS 131.

[2] The small proportion of multinational companies that disclose geographic segments as operating segments are excluded from my sample, as explained later in the paper.

1997, ¶ 3). Both standards appear to be issued in response to users (in particular analysts) desiring more predictive financial statement information than provided by consolidated information alone.[3] This study examines the predictive ability of operating versus supplemental (or industry versus geographic) segment information and their combined predictive ability. I also examine whether certain firm characteristics explain the greater predictive ability of one type of segment disclosure versus the other.

To measure predictive ability of segment information, I employ three mechanical models to generate earnings forecasts. Two models generate earnings forecasts using firm-specific segment disclosures contained within the annual reports. These two models combine segment sales disclosures with (1) consolidated profit margins and (2) segment earnings to forecast consolidated earnings. The third model generates consolidated earnings forecasts by combining firm-specific segment disclosures with *alternative* sources of information.[4] Most of the prior research uses

[3] Predictive ability is an essential component of relevant information, which along with reliability, forms the cornerstone of decision useful information (Statement of Financial Accounting Concepts No. 2).

[4] *Alternative* sources used in this study are similar to prior research and includes industry shipment sales, country nominal gross domestic product (NGDP) and exchange rate information. The inclusion of this information in mechanical forecasts is described in more detail in Appendix B. I use *external* throughout the paper to describe the earnings forecast model which incorporates this *alternative* information since it highlights the key difference between this model and the other two models which use only the information within the annual report.

alternative information in mechanical forecasting models to test predictive ability.[5] Recent examples include Berger and Hann (2003) for industry segment (IND) information and Behn, Nichols, and Street (2002) for geographic segment (GEO) information. The approach results in a joint test of the predictive ability of the alternative information and the IND or GEO disclosures provided by the MNC. In general, the results of these mechanical forecasting studies suggest that IND and GEO disclosures enable better predictions of consolidated amounts than does consolidated information alone. However, none of the prior research directly compares the predictive ability of IND versus GEO disclosures. Furthermore, prior research has not considered the incremental predictive ability of a combined model employing both IND and GEO disclosures. Finally, comparing mechanical forecast models that use only firm-specific segment information within the annual report with those that also incorporate alternative information allows for separate tests of the incremental usefulness of alternative information when used in conjunction with firm-specific segment information. Understanding the relative predictive ability of the firm-specific IND and GEO disclosures and alternative information is important since users' prediction models are likely to incorporate both types of information.

The results provide some evidence to suggest that IND disclosures can be more predictive than GEO disclosures. However, this result is dependent upon accurate (perfect forecast) predictions of *alternative* industry sales growth information being incorporated into the forecast. If the prediction of *alternative* information is no more accurate than the prior year industry sales growth (ex-ante forecast), I find no evidence

[5] See Kinney (1971) for further discussion on the approach used by analysts

to suggest that earnings forecasts are more accurate when developed using GEO or IND information. In addition, a simple forecast that combines information in both segment disclosure types is no better at predicting future consolidated earnings than is IND or GEO information alone. Consistent with prior research comparing segment-based forecasts to consolidated forecasts, I provide some evidence to suggest that GEO and IND disclosures are more predictive of future earnings than consolidated information alone. However, whereas GEO disclosures are only more predictive when using only GEO disclosure sales information, IND disclosures are only more predictive when forecasters are able to accurately predict *alternative* industry growth information (perfect forecast assumption). Further analysis indicates that the predictive benefits of incorporating *alternative* information differ across disclosure types. If accurate predictions of *alternative* industry sales growth information can be made, they can be combined with IND disclosure sales information to generate a more accurate earnings forecasts than those generated using only the information provided in the IND disclosure. In contrast, I find no evidence to suggest that combining accurate predictions of *alternative* NGDP and exchange rate information with the GEO disclosure sales information can generate more accurate forecasts of earnings than those generated using only the information provided in the GEO disclosure.

This study also adds to the segment reporting literature examining the usefulness and limitations of segment *earnings* information. Recent research suggests that analysts forecast errors are no more accurate for MNCs voluntarily disclosing GEO segment earnings in the post- SFAS 131 period (Hope et al., 2006a). Consistent with this finding, I find evidence to suggest that under the current SFAS 131

disclosure requirements, more accurate mechanical earnings forecasts can be generated using segment sales information as opposed to segment earnings information.

Finally, this study adds to the segment reporting literature relating firm characteristics to the usefulness of segment information. Prior research has limited its investigation to the relation between firm characteristics and the predictability of one type of segment disclosure (industry or geographic) to the cross-section of firms. In contrast, I test whether firm characteristics can explain when one segment disclosure type has more predictive ability relative to the other segment disclosure type reported by the same MNC. This study suggests that the usefulness of segment information in predicting future earnings is positively related to the variance in sales growth across the reported segments. The finding is consistent with the assumption that current growth reflects a shift in the composition of a company's operations that can be sustained into the next period. I find no evidence to suggest that the difference in the number of segments or the percentage of foreign operations are associated with the differential predictive ability of GEO or IND sales information.

These results are of interest to users, preparers, and standard setters. First, a better understanding of the predictive ability of operating (industry) and supplemental (geographic) segment information may help investors and analysts better predict changes in earnings, which are positively related to changes in firm value (Ball and Brown, 1968). Second, managers have incentives for improving earnings predictability. Prior research finds that information uncertainty is priced by investors (Easley, Hvidkjaer, and O'Hara, 2002) and that less predictable earnings lead to a

higher cost of equity capital (Affleck-Graves, Callahan, and Chipilkatti, 2002; Lambert, Leuz, and Verrecchia, 2007). To the extent that management can use segment disclosures to reduce information uncertainty, the firm's cost of capital can be reduced and market value will increase. My study suggests that knowledge of the ability of users to forecast industry growth and the difference in the variability of disclosed IND and GEO segment growth are important factors to consider. Finally, a better understanding of the predictive ability of segment information can aid standard setters in assessing the costs and benefits of increasing/decreasing both operating and supplemental segment disclosure information. SFAS 131 no longer requires earnings information to be disclosed for supplemental (geographic) segment information in the annual report, and information for these segments is not required for interim periods. My results suggest that these policy choices may not harm the overall disclosure environment of MNCs, at least in terms of the predictive ability of earnings. My study may be particularly relevant in light of the International Accounting Standards Board (IASB) adopting segment reporting standards that are consistent with those of the United States generally accepted accounting principles (US GAAP).

The paper proceeds as follows. Section 2 discusses prior research and hypotheses development. Section 3 details the research design and present descriptive statistics. Section 4 presents the empirical results, and conclusions are offered in section 5.

2. Prior research and hypotheses development

2.1. Comparing industry and geographic segment earnings/sales predictive ability

Prior research provides considerable evidence to suggest that segment disclosures are an important piece of information in predicting future earnings and sales. Some researchers examine whether they can improve forecasts by using segment information in mechanical models (researcher predictive ability). Other studies examine whether analysts are more accurate when segment information is available (analyst predictive ability). I follow the *researcher predictive ability* approach. In general, prior results suggest that IND and GEO disclosure information each provide more accurate predictions of future consolidated sales and earnings than when only consolidated information is used (Kinney, 1971; Collins, 1976; Silhan, 1982, 1983; Roberts, 1989; Balakrishnan et al., 1990; Ahadiat, 1993; Herrmann, 1996).[6] In addition, mechanical forecasts of consolidated information improve when constructed using SFAS 131 rather than SFAS 14 segment information (Behn, Nichols, and Street, 2002; Berger and Hann, 2003).

The FASB's intent when issuing SFAS 131 was to provide the investor with a view of the segments of a firm as seen through the eyes of management. Herrmann and Thomas (2000) find that after adopting SFAS 131, most MNCs define primary operating segments by products and services and supplemental segments by geographical area. This suggests that management evaluates performance and makes

[6] The "analyst predictive ability" research provides similar overall conclusions (see e.g. Baldwin, 1984; Swaminathan, 1991; Nichols, Tunnel, and Seipel, 1995; Piotroski, 2002; Berger and Hann, 2003).

decisions using IND information. However, the optimal segment structure for internal evaluation and decision making may be suboptimal for purposes of predictive ability. For example, a firm may choose its segment structure based on a stewardship objective rather than a valuation or predictive objective. If a stewardship objective is used in defining segments of the firm, then the operating segment information disclosed under SFAS 131 may not provide an optimal assessment of the firm's expected future performance.

An additional consideration in comparing the predictive ability of IND and GEO disclosures is the increasingly global environment in which US firms operate. The growth of foreign earnings has far outpaced the growth of domestic earnings, increasing 78 percent over the last decade (Hilsenrath 2005). Of the ten largest U.S. firms listed on the NYSE, approximately one-half of their revenues are generated from foreign operations (Meek and Thomas, 2004). Because the GEO operations are likely to vary in growth and profitability, GEO information may have more predictive ability than IND information when globally diversified firms choose operating segments based on objectives other than predicting future performance. This study compares the predictive ability of both disclosure types in a period when operations of MNCs are very global in nature and where management considers industry disclosures to be more relevant for managing the company.

The first part of my study compares consolidated earnings forecasts constructed using only GEO and IND *sales* information in the current reporting

environment.[7] Prior mechanical forecast research (Kinney, 1971; Collins, 1976; Roberts, 1989) suggests that earnings forecasts using segment sales information are likely to provide earnings forecasts that are at least as accurate as forecasts using segment earnings information. Givoly, Hayn, and D'Souza (1999) suggest that the lack of incremental predictive ability of segment earnings information is due to the increased measurement error from cost allocations, management intervention, and the operational structure of MNCs. My first hypothesis stated in the null is as follows:

> H1: Consolidated earnings forecasts using IND sales information are no more accurate than consolidated earnings forecasts using GEO sales information.

As a benchmark to prior studies, I also examine whether each of the segment-based forecasts is more predictive than a forecast using only consolidated information.

2.2. Examination of the combined predictive ability of industry and geographic segment disclosures

My first hypothesis examines whether IND disclosures are more or less predictive than GEO disclosures. A logical extension of this analysis is to examine whether the information in both segment disclosure types can be combined to

[7] As stated earlier, I begin with tests using only segment information contained within the annual report in order to avoid the joint test of the predictive ability of IND and GEO segment information provided by the MNC in annual reports and the *alternative* information which is combined with the IND and GEO information.

construct a consolidated earnings forecast that is superior to a forecast constructed using the information in only one type of segment disclosure. The FASB recognized the benefit of disaggregating each industry segment's operations by geographic area, referred to as the "matrix" approach (SFAS 14, ¶ 14). However, few if any firms disclose segment information in this manner.[8] As such, analysts and investors cannot know with certainty the amount of earnings from industry segment X in geographic region Y when more than one segment is reported in both the IND and GEO disclosures. Although the amount of estimation error increases when combining both segment disclosure types, the incremental predictive ability of the disclosure information could more than offset this problem. My next two hypotheses are as follows:

> H2a: Consolidated earnings forecasts using both IND and GEO sales information are no more accurate than consolidated earnings forecasts using only IND sales information.

> H2b: Consolidated earnings forecasts using both IND and GEO sales information are no more accurate than consolidated earnings forecasts using only GEO sales information.

[8] SFAS 131 is silent on the matrix presentation for industry and geographic disclosures. The omission may be due to the scarcity of firms reporting segment disclosures using this format under SFAS 14.

2.3. Incorporating additional information

Comparing the accuracy of consolidated earnings forecasts based on IND or GEO sales information and prior year segment sales growth is a very direct and equitable approach which generates as large a sample size as possible. However, a trade-off to this approach is that it is less likely to represent the actual forecasting techniques adopted by investors since it uses a limited amount of the segment information available. In this section, I consider alternative forecasting methods.

2.3.1 Examining the incremental benefit of segment earnings disclosure information

The use of segment sales information is in large part due to prior research suggesting that consolidated earnings forecasts using either industry or geographic segment earnings may not be any more predictive than when using segment sales information (Kinney, 1971, Collins, 1976; Roberts 1989). However, whether the current SFAS 131 segment reporting environment will provide results similar to those in prior studies is unclear. Berger and Hann (2003) and Behn et al. (2002) find that consolidated mechanical sales forecasts are significantly more accurate using restated SFAS 131 industry and geographic segment sales information as opposed to the same SFAS 14 information. In contrast, these studies find no significant improvement in consolidated earnings forecasts using SFAS 131 segment earnings information.[9] I re-examine the prior finding that segment earnings information is no more predictive

[9] Neither of these studies directly tests the difference in accuracy of consolidated earnings forecasts using sales or sales and earnings information.

than sales information in the SFAS 131 period. This leads to my third hypothesis which is as follows:

H3: The accuracy of consolidated earnings forecasts are similar when constructed based on segment sales or segment earnings information.

2.3.2. Incorporating alternative growth rate and exchange rate information

My initial analysis incorporates an expectation of growth that is based on the past segment disclosure information. When comparing IND and GEO forecasts that are based solely on the disclosures in the financial statements, the comparison is "equitable" in the sense that the test does not naturally favor either IND or GEO to the detriment of the other type of disclosure. However, most of the prior literature adopts an approach which estimates expected segment growth using specialists' forecasts of sales in a particular industry or changes in a country's NGDP and exchange rates. Pacter (1993) suggests that segment information is more predictive than consolidated information because *alternative* information can be integrated with the segment information in a way that is not possible with aggregate information. I re-examine the first three hypotheses for earnings forecasts generated using country or industry specific alternative information as well as firm specific IND and GEO segment disclosure information. Now my tests are similar to most of the prior research and examine the joint hypothesis of the predictive ability of *alternative* information and of IND (GEO) information provided within the MNCs annual report.

2.4. Relation between firm characteristics and the relative predictive ability of industry and geographic segment disclosures.

H1 examines which disclosure type, on average, provides more accurate consolidated earnings forecasts. In this section, I consider whether certain firm characteristics are associated with the accuracy of GEO-based forecasts of consolidated earnings relative to IND-based forecasts. Prior research has limited its investigation to the relation between firm characteristics and the predictive ability of one type of segment disclosure (industry or geographic) for the cross-section of firms (i.e., Piotroski, 2002; Ettredge, Kwon, and Smith, 2002; Behn et al, 2002; Chen and Zhang, 2003; Botosan and Stanford, 2005; Ettredge, Kwon, Smith, and Zarowin, 2005; Hope, Thomas, and Winterbotham, 2006b). In contrast, I test whether firm characteristics are associated with increases in the forecast accuracy of one segment disclosure type relative to the other segment disclosure type reported by the same MNC. The firm characteristics I examine are as follows:

1) Number of segments: Prior research indicates that the number of industry or geographic segments disclosed is positively related to the predictability of consolidated earnings. Ahadiat (1993) finds some evidence to suggest that as the number of geographic segments increases, the predictive ability of segment-based forecasts increases.[10] Herrmann (1996), Piotroski (2002), and Ettredge et al. (2002,

[10] However, when controlling for different firm characteristics by aggregating the firms with more than two segments into only two segments Ahadiat's results are no longer significant at conventional levels. Also, Silhan (1982, 1983) provides no evidence of the increased usefulness from greater than three industry segments.

2005) suggest that the quality of disclosure is also important. Herrmann (1996) finds evidence of increased forecast accuracy as segment information is disaggregated from consolidated to continent level to country level.[11] Both Piotroski (2002) and Ettredge et al. (2002, 2005) provide evidence to suggest that greater IND disaggregation is more informative to analysts and investors. Taken together, these studies suggest that the disclosure type with more disaggregated segment information will generate a more accurate consolidated earnings forecast.

2) Percentage of foreign operations: As a MNC's operations become increasingly global, it is more likely that segment disclosures by geographic area provide more predictive information. Hope et al. (2006b) and Hope, Kang, Vasvari, Thomas (2006) provide evidence to suggest that investors in MNCs that have a larger proportion of foreign operations are more likely to find geographic earnings disclosures to be decision useful. This suggests that as the foreign operations of MNCs increase in relation to total operations, GEO disclosures will provide more accurate consolidated earnings forecasts than do IND disclosures.

3) Variation in segment growth opportunities: One of the FASB's objectives in requiring segment disclosures is to provide relevant information about the different types of business activities and economic environments in which the firm operates. This information should help users of the financial statements to better assess the performance and growth prospects of the firm (FASB 1997, ¶ 3). Presenting segment information based on one disclosure type or another may or may not reveal very

[11] Both Hermann (1996) and Silhan (1982, 1983) simulate firm information based on unrelated single segment firms.

different conclusions regarding the future consolidated performance. Holding all else constant, if two segment disclosures identify identical expected growth across segments, both will predict identical future performance. In addition, if both disclosures' growth and profitability are no different than those provided in the consolidated financial statements, segment information is of no use to users in forecasting future earnings. Therefore, the range of expected segment growth must differ across segment disclosure types in order for the forecast models to generate different predictions.

Greater variance in disclosed growth rates could aid or hinder the accuracy of earnings forecast predictions. On the one hand, if current realized growth in one disclosure type is a good indicator of future growth, then forecasts based on that disclosure type should be more accurate. The assumption being made is that current growth reflects a shift in the composition of a company's operations that can be sustained into the next period. On the other hand, if current realized growth in one disclosure type does not reflect the ability of managers to continue similar growth next year then variation in segment growth may be negatively related to forecast accuracy. One example that could be consistent with a negative relation between variance in segment growth and forecast accuracy is if growth rates have a tendency to mean revert. The very high and low growth segments will not be sustainable in future years,

resulting in larger forecast errors for the disclosure with higher variance in segment growth than the disclosure with lower variance in segment growth.[12]

Taken together, my fourth hypotheses are as follows:

H4: The difference in the accuracy of consolidated earnings forecasts based on GEO information versus IND information is unrelated to the following:

a) the difference in the number of geographic segments versus industry segments.

b) the percentage of the company's operations reported as foreign.

c) the difference in the diversity of growth opportunities across geographic segments versus the diversity of growth opportunities across industry segments.

3. Research Design, Sample Selection, and descriptive statistics

3.1. Comparative predictive ability tests

My approach follows in the spirit of prior research which uses simple mechanical forecasting models based on annual segment data (Kinney, 1971; Collins,

[12] Another example that is consistent with the negative relation between variance in segment growth and forecast accuracy is if management, on average, take actions that shift the composition of the firm towards its low growth segments and away from its high growth segments.

1976; Roberts, 1989; Balakrishnan et al., 1990; Herrmann, 1996; Behn et al, 2002; and Berger and Hann, 2003). Similar to prior studies, the design is the most appropriate given the nature of the segment data and the questions I want to ask. Investors and researchers struggle to obtain consistent segment information over long periods of time.[13] Balakrishnan et al. (1990) find that the average life of disclosed segments for their sample was around five years. While quarterly data could provide sufficient information for more sophisticated time series techniques (e.g. Box Jenkins approach), SFAS 131 requires only operating segment data to be disclosed for interim periods.[14] Thus, forecasts based on supplemental segment information must rely on a simple mechanical approach.[15]

In general, the mechanical forecast research using segment information indicates that a percentage growth forecasting model provides the most accurate prediction of future earnings and sales. The initial approach I adopt uses only segment

[13] In fact, the only study (Ahadiat, 1993) that uses a more sophisticated Box Jenkins time-series approach to obtain one-year-ahead earnings forecasts requires a sample period pre-dating the implementation of SFAS 14. Even so, the study includes a caveat that it is limited by the lack of a sufficient number of years in the estimation period.

[14] Under SFAS 14 interim data is voluntary for all segment disclosure types. However, Botosan and Harris (2000) find that almost 2/3rds of firms in their sample voluntarily disclosed industry segment information under SFAS 14.

[15] Silhan (1982, 1983) models a quarterly earnings time-series process. However, he uses 60 purely single segment firms meeting various sample requirements (no foreign listing, not a subsidiary, amongst others) during the 1976-77 forecasting period to simulate conglomerate firms of between two to ten differing industry segments to bypass the problem of insufficient segment data.

sales information and a consolidated profit margin to develop one-year-ahead consolidated earnings forecasts. First, one-year-ahead segment sales are predicted based on current segment sales and a measure of expected growth for each segment. Expected growth is based on current realized growth. Then, consolidated profit margins are applied to the one-year-ahead forecasts of sales. In equation form, the one-year-ahead consolidated earnings forecast constructed using segment sales information is as follows:

$$E(X_{t+1}^{cons} \mid seg) = \sum_{j=1}^{J} \left[1 + E\left(GWTH_{j,t+1}^{seg}\right)\right] * S_{j,t}^{seg} * (X_t^{cons} / S_t^{cons}) \qquad \textit{Model A}$$

Where

$E(X_{t+1}^{cons} \mid seg)$ is the one-year-ahead forecast of consolidated earnings, and seg refers to the use of either the IND or GEO segment information,

S_t^{cons} is consolidated sales in period *t*,

$S_{j,t}^{seg}$ is sales in period *t* for segment *j*,

X_t^{cons} is consolidated earnings in period *t*, and

$E\left(GWTH_{j,t+1}^{seg}\right)$ is the expected growth from period t to t+1 for segment j (discussed in detail below).

Tests of comparative forecast accuracy (H1 and H2) are performed using *Model A*, which forecasts consolidated earnings using *segment* sales and *consolidated* profit margins. I use segment sales as the primitive information in constructing the

consolidated earnings forecasts because prior research suggests such forecasts are at least as accurate as using segment earnings as the primitive (Kinney, 1971, Collins, 1976; Roberts 1989). Segment sales are also more commonly disclosed than are segment earnings, allowing for an increase in sample size.

Segment growth expectations, $E\left(GWTH_{j,t+1}^{seg}\right)$, are constructed based on past sales growth in each segment.[16] Constructing the forecast in this manner implies certain assumptions about how future earnings are expected to relate to the current year growth. One implicit assumption is that each company will shift its operations towards the segments that have been higher growth segments in the past and will shift its operations away from those segments that have been low growth segments. As the variation in sales growth increases across segments, the assumed shifts grow bigger. Shifts to successful segments and away from segments with lower realized growth cause the sum of forecasted next year segment sales to increase with the variation in realized segment growth. Since Model A applies the sum of forecasted segment sales to a consolidated profit margin, forecasted consolidated earnings is larger (smaller) when variation in segment growth is larger and profit margin is positive (negative). Stated another way, for any company with a positive realized profit margin today, *Model A* always produces a higher forecast of next period's consolidated earnings for the segment disclosure type that discloses the higher variation in sales growth across segments.

[16] Prior year growth and the average growth for the past two years were used as measures of expected growth. Since average growth results were inferior in all cases, I do not report these results.

The implicit assumption that the company emphasizes its successful segments in the coming year is a reasonable way to forecast next year's performance. Suppose a profitable company has more sales growth variation in GEO than in IND. If the company can exploit the higher growth regions while deemphasizing the low growth regions, the company should do well, and the mechanistically higher GEO-based forecast will be more accurate. On the other hand, if the company shifts its emphasis based on growth in IND, it will unlikely be able to generate as much future earnings, so the lower IND forecast will be more accurate. Thus, comparing the forecasts constructed from GEO and IND information is still an interesting empirical issue. However, macroeconomic events during the out-of-sample test period become potential confounding factors. If a macroeconomic event leads to all firms in the out-of-sample period experiencing very good (bad) performance, this will favor a forecast using high (low) variance segments.[17]

3.1.1. Development of the comparative predictive ability test statistics

To compare the predictive ability of IND and GEO disclosures, I first compute the forecast of consolidated earnings, $E(X_{t+1}^{cons} | seg)$. Three separate calculations of $E(X_{t+1}^{cons} | seg)$are performed for each firm: $E(X_{t+1}^{cons} | ind)$, $E(X_{t+1}^{cons} | geo)$, $E(X_{t+1}^{cons} | comb)$ where *ind* (*geo*) [*comb*] refers to consolidated forecasts based on industry (geographic) [combined] segment information.[18]

[17] Robustness tests controlling for macroeconomic shocks are discussed and reported in section 4.4.

[18] The combination (*comb*) forecast exploits both geographic segment (*geo*) and industry segment (*ind*) information The development of the combined forecast is explained more fully in the next section

I then compute the absolute percentage error APE_{t+1}^{seg} for each firm and each segment disclosure type:

$$APE_{t+1}^{seg} = \left| \frac{X_{t+1}^{cons} - E(X_{t+1}^{con}|seg)}{X_{t+1}^{con}} \right| \quad (1)$$

I compute the difference in APE_{t+1}^{seg} for each firm, ($Diff\_APE_{i,t+1}^{H}$), based on the hypothesis (H) being tested:

$$DIFF\_APE_{i,t+1}^{H1} = APE_{i,t+1}^{ind} - APE_{i,t+1}^{geo} \quad (2a)$$

$$DIFF\_APE_{i,t+1}^{H2a} = APE_{i,t+1}^{ind} - APE_{i,t+1}^{comb} \quad (2b)$$

$$DIFF\_APE_{i,t+1}^{H2b} = APE_{i,t+1}^{geo} - APE_{i,t+1}^{comb} \quad (2c)$$

A positive (negative) value for $Diff\_APE_{i,t+1}^{H1}$ indicates that the MNC's consolidated earnings forecast is more precise when using geographic (industry) segment disclosure information. Similarly, a positive value for $Diff\_APE_{i,t+1}^{H2\cdot}$ indicates that the MNC's consolidated earnings forecast is more precise when using combined segment disclosure information. A negative value implies that the forecast is more precise when using either IND or GEO disclosure information. The null hypotheses for my tests are that the median $Diff\_APE_{i,t+1}^{H1}$ equals zero. I use non-

parametric tests which are less sensitive to extreme values of forecast errors. Two non-parametric statistics adopted in prior research are the Fisher Sign Test (Hollander and Wolfe, 1973) and the Wilcoxon Signed Rank Test (Lehman, 1975). Finally, consistent with prior studies (e.g. Balakrishnan et al., 1990; Herrmann, 1996; Behn et al., 2002; Berger and Hann, 2003) *AE* is also truncated at ±1 (i.e., ±100 percent) to control for outliers. I also report mean test statistics using a two-tailed paired t-test. [19]

3.1.2. Development of combined forecasts based on industry and geographic disclosures

The combined forecast incorporates the information in both GEO and IND disclosures. I combine both disclosures under the assumption that the weighted geographic growth expectations for each GEO apply to each IND sales amount and vice versa for weighted industry growth expectations. Each segment growth expectation is weighted based on the percentage of GEO (IND) sales to total sales. For example, the expected sales forecast, SF_{t+1}^{seg}, for a MNC with two industry segments and two geographic segments that have expected weighted growth rates of

[19] McNees (1976), Makridakis and Wheelwright (1978b), and Mahmoud (1983) indicate that choosing between alternative forecasting techniques is not a standard procedure and should consider the characteristics of each data set. In addition to the reported test statistics, I calculate a mean APE test statistic that takes the average APE for each firm before the difference between APE_i^{ind} and APE_i^{geo} is calculated. Non-parametric results for the difference in mean APE for each firm are similar. Mean squared errors are not used due to the measure weighting larger errors more heavily than small errors. This approach is not appropriate given my sample properties.

i_1, i_2, g_1, g_2 and have end of year sales of (I_1, I_2, G_1, G_2) would be calculated as follows:[20]

$$SF_{t+1}^{ind} = \left[(g_1 + g_2) * I_{1,t} + (g_1 + g_2) * I_{2,t}\right] \quad (3)$$

$$SF_{t+1}^{geo} = \left[(i + i_2) * G_{1,t} + (i_1 + i_2) * G_{2,t}\right] \quad (4)$$

Equations 3 and 4 are then combined to form SF^{comb}:

$$\frac{SF_{t+1}^{ind} + SF_{t+1}^{geo}}{2} = SF_{t+1}^{comb} \quad (5)$$

For firms with very different amounts of sales and growth in sales across IND and GEO, SF_{t+1}^{comb} will provide a combined forecast that weights the growth and size differences in both disclosure types. If the firm's segments have the same growth rates and sales amounts, all forecasts will be equal.[21]

The combined sales forecast is multiplied by a consolidated profit margin to form the combined consolidated earnings forecast. This forecast is compared to the

[20] Weighted growth rates are calculated by multiplying each expected segment growth rate by the corresponding ratio of sales within each segment to total sales for the firm: $g_1 = \frac{G_1}{\sum_{i=1 \text{ to } n} G_i} * E(GRWTH_{G1})$

[21] Since the expected growth rates used in this study are based on prior year segment information, the weighting process reduces to a simple mean of the geographic and industry forecast.

consolidated earnings forecasts using IND or GEO information alone as described in section 3.1.

3.1.3. Benchmark tests

As a benchmark to prior studies, I also examine whether the segment-based forecasts are more predictive than forecasts using only consolidated information. Annual *consolidated* random walk earnings models have been shown to be no worse, in general, than more sophisticated prediction models (Bao, Lewis, Lin, and Manegold, 1983; Hopwood, McKeown, and Newbold, 1982). As such, my primary consolidated forecast benchmark is formed using a random walk model of the consolidated annual earnings process. [22]

3.2 Predictive ability tests incorporating additional information.

3.2.1 Incorporating segment earnings information

The information set used in forecasting can be broadened by incorporating segment earnings information into the mechanical model. In equation form, the one-year-ahead consolidated earnings forecast is constructed as follows:[23]

[22] Kormendi and Lipe (1987) show that time series properties differ across firms, implying that random walk properties may not be most appropriate. Although the aim of the benchmark tests is to compare to prior research, I consider a percentage change consolidated model in addition to the random walk model used in these studies.

[23] Appendix C describes in more detail the construction of APEs using both segment sales and earnings information.

$$E(X_{t+1}^{cons}|seg) = \sum_{j=1}^{J} E\left(X_{j,t+1}^{seg}\right) \qquad \textit{Model B}$$

Where

$E\left(X_{j,t+1}^{seg}\right) = E\left(S_{j,t+1}^{seg}\right) * \left(X_{j,t}^{seg} / S_{j,t}^{seg}\right)$

$X_{j,t}^{seg}$ is earnings in segment j in period *t,*

$E\left(S_{j,t+1}^{seg}\right) = \left[1 + E\left(GWTH_{j,t+1}^{seg}\right)\right] * S_{j,t}^{seg}$, and all other elements are as described earlier.

Hypothesis 3 is a within disclosure type examination of the predictive ability of sales versus earnings information. Therefore, the $Diff\_APE_{i,t+1}^{H3}$ test statistic is calculated based on the mean difference in absolute forecast error when the same segment disclosure type consolidated earnings forecast, $E(X_{t+1}^{cons}|seg)$, is constructed using *Model B* (segment sales and earnings information) versus *Model A* (segment sales information):

$$Diff\_APE_{i,t+1}^{H3} = APE_{i,t+1}^{Model\ B} - APE_{i,t+1}^{Model\ A} \qquad (6)$$

The $Diff\_APE_{i,t+1}^{H3}$ test statistic is calculated in a similar fashion as described in section 3.1.1.

3.2.2. Incorporating alternative information

When comparing IND and GEO forecasts that combine *alternative* information with the segment information, the test becomes a joint test of the usefulness of the segment information and the ability to incorporate *alternative* data. My initial tests rely solely on disclosed segment data and are the most equitable method of comparing both disclosure types. However, as Pacter (1993) points out, a financial analyst is likely to combine segment information with *alternative* data when assessing the future prospects of the company. Comparing forecasts using only segment information to those that incorporate *alternative* data can provide insights as to how GEO and IND disclosures are able to generate more accurate forecasts. However, the key is to obtain the best possible *alternative* data. GEO forecast research examines the potential predictive ability of incorporating 'the best possible' *alternative* data by introducing a perfect forecast scenario whereby actual rather than forecasted *alternative* growth rates are incorporated into the model (Balakrishnan et al, 1990; Herrman 1996; Behn et al, 2002). I adopt this approach in my comparison of the potential predictive ability of IND or GEO segment information. The approach avoids inequities related to the quality of the *alternative* growth rate forecast data that are applied to IND and GEO information while examining the joint test of the usefulness of the segment information and the ability to incorporate *alternative* data.[24]

[24] Although perfect forecasts reduce the inequity, I re-assess each hypothesis using forecasts of growth. Since the U.S. Department of Commerce's *U.S. Industry and Trade Outlook* no longer provides expert forecasts for many industries, I use prior year industry sales and country GDP growth rates as expectations of future IND and GEO growth.

Besides growth rates, segment disclosure information also allows other potentially predictive *alternative* data to be incorporated into the forecast. For example, Roberts (1989) and Herrmann (1996) indicate that exchange rate and inflation information are significant factors in producing more accurate earnings forecasts using GEO information compared to using consolidated information. Balakrishnan et al. (1990) suggest that identifying differences in exchange rates and inflation across countries and regions provides a potential predictive advantage for geographic segment information since a larger *alternative* information set can be identified and incorporated into the forecast. IND segments and consolidated information can only identify global or US changes in inflation levels or exchange rate changes.[25] Both growth and exchange rate variables are incorporated into the forecast in a similar manner as Balakrishnan et al (1990) and Behn et al (2002), and my approach is discussed further in Appendix B.

3.3 Firm characteristics analysis

H4a through H4c address whether firm characteristics can explain differences in the accuracy of consolidated earnings forecasts constructed based on IND information versus GEO information. I use rank regressions to regress the difference in the absolute forecast errors from the test of H1 on two firm characteristics expected

[25] Since most MNCs continue to have greater domestic sales than foreign sales, incorporating changes in US inflation into IND forecasts is appropriate.

to affect the predictive ability of one disclosure type over another.[26] The coefficients β_1 and β_2 are used to test H4a and H4b in the following regression equation:

$$R\_Diff\_APE^{H1}_{i,t+1} = \alpha_0 + \beta_1 R\_D\_Seg_{i,t} + \beta_2 R\_ForPct_{i,t} + \varepsilon_{i,t} \quad (7)$$

$R\_Diff\_APE^{H1}_{i,t+1}$ is a rank variable of $Diff\_APE^{H1}_{i,t+1}$ defined above (equation 2a)

$R\_D\_Seg_{i,t}$ is measured as the difference between the number of GEO disclosed and the number of IND disclosed by the MNC. A positive coefficient on $R\_D\_Seg_{i,t}$ suggests that the disclosure type reporting more segments provides an increasingly accurate forecast relative to the other disclosure type.

$R\_ForPct_{i,t}$ is a rank variable of the percentage of foreign sales to total sales for each firm year. I expect that as firms' operations become increasingly foreign, consolidated forecasts based on GEO information rather than IND information are more likely to be predictive of future operations of the MNC. Thus, I expect a positive coefficient on $R\_ForPct_{i,t}$.

H4c asks whether the difference in variation of reported segment growth in IND and GEO disclosures ($D\_VarGrowth_{i,t}$) is related to the difference in the accuracy of forecasts created using information in each disclosure type. $D\_VarGrowth_{i,t}$ is measured as:

[26] Ranks of the variables are used due to the non-normal distribution of the dependent variable. Ranks are based on 20 equal partitions of the sample distribution.

$$D\_VarGrowth_{i,t} = \sum_{j=1}^{J}\left[\left(\frac{S_{j,i,t}^{geo}}{S_{i,t}^{cons}} * \left(g_{j,i,t}^{geo} - \bar{g}_{i,t}^{geo}\right)^2\right)\right] - \sum_{j=1}^{J}\left[\left(\frac{S_{j,i,t}^{ind}}{S_{i,t}^{cons}} * \left(g_{j,i,t}^{ind} - \bar{g}_{i,t}^{ind}\right)^2\right)\right] \quad (8)$$

where, $\bar{g}_{i,t}^{seg} = \sum_{j=1}^{J}\left(S_{j,i,t}^{seg} / S_{i,t}^{cons} * g_{j,i,t}^{seg}\right)$, $g_{j,i,t}^{seg}$ is sales growth in segment *j* of the appropriate disclosure type (*ind* or *geo*), *J* refers to the number of segments, and all other variables are as described earlier. [27] In essence, the variance measure takes into account the relative size of each segment in the calculation of how much variation in segment growth there is in each disclosure type.

As discussed in developing H4c, the relation between $D\_VarGrowth_{i,t}$ and $Diff\_APE_{i,t+1}^{H1}$ is expected to be positive if managers take actions consistent with sustaining recent segment growth trends in GEO (IND) segments when $D\_VarGrowth_{i,t}$ is positive (negative). This leads to a positive relation between $D\_VarGrowth_{i,t}$ and $Diff\_APE_{i,t+1}^{H1}$. If managers' actions sustain trends in the segment type with less variable growth or if the segment growth is mean reverting, then the opposite result is expected.

Empirically, the GEO- and IND-based forecasts are fairly similar. As a result, actual earnings generally either exceed or are less than both forecasts. Recall that the model assumption forces the disclosure type with more varied segment growth to have a higher forecast. As a result, whenever actual earnings are above (below) the two forecasts, the relation between $D\_VarGrowth_{i,t}$ and $Diff\_APE_{i,t+1}^{H1}$ is positive

[27] For ease of exposition, I use *J* for both industry and geographic segments. Note that the two "*J*'s in (4) often are not equal.

(negative). The result is an X-shaped scatter plot for $Diff\_APE_{i,t+1}^{H1}$ and $D\_VarGrowth_{i,t}$. The coefficient in a linear regression is unlikely to provide much insight given this non-linear plot. Therefore, in order to test the relation between the difference in consolidated earnings forecast accuracy and the variance in segment growth, I first partition the sample into two groups based on whether $D\_VarGrowth_{i,t}$ is positive or negative. Positive (negative) values of $D\_VarGrowth_{i,t}$ indicate that the variance in growth across the GEO (IND) disclosure is greater than it is across IND (GEO) disclosure. Recall that $Diff\_APE_{i,t+1}^{H1}$ is positive (negative) when geographic (industry) segments are more accurate. Therefore, if the proportion of MNCs in the positive (negative) $D\_VarGrowth_{i,t}$ group with a positive (negative) $Diff\_APE_{i,t+1}^{H1}$ is significantly larger than 50% of the sample of firms, the test indicates a positive relation between $D\_VarGrowth_{i,t}$ and $Diff\_APE_{i,t+1}^{H1}$. If the proportion of MNCs in the positive (negative) $D\_VarGrowth_{i,t}$ group with a negative (positive) $Diff\_APE_{i,t+1}^{H1}$ is significantly larger than 50% of the sample of firms, support is found for a negative relation between $D\_VarGrowth_{i,t}$ and $Diff\_APE_{i,t+1}^{H1}$. Thus a simple significance test for proportion is performed on the two groups to test whether the MNC's segment disclosure with higher variance in segment growth is more likely to provide a more accurate forecast of consolidated earnings than the segment disclosure with lower variance in segment growth.

3.4. Sample Selection

Table 1 outlines the sample selection procedures. The initial sample consists of all U.S. MNCs disclosing data for at least two industry segments and two geographic segments during the years 1999 through 2005. MNCs are deleted if they reported one of their segments with either no reference to specific 3-digit SIC code or provide no geographic details that are finer than a general description of foreign sales (e.g., Other International, Other foreign, etc.). MNCs with non-descript segments are not deleted if the number of segments before considering the non-descript segment are greater than or equal to the two segment minimum. The process causes 540 observations to be deleted. MNCs operating in financial or utility industries are excluded since these industries are likely to have very dissimilar properties relating current period earnings to the following period. This results in 330 observations being deleted. Firms are also excluded if they report geographic segments as their primary operating segments; 297 firm-year observations meet this criterion. An additional 246 firm year observations with operating losses are deleted and 52 firm-year observations missing Compustat data. Finally, 215 firm-year observations with large acquisitions or acquisitions which appear to have created a new segment for the firm are deleted. Large acquisitions are identified as cash paid at acquisition scaled by total assets of greater than 10%. This leaves a final full sample of 675 firm-years.[28]

[28] The truncated sample of 572 firm-years excludes an additional 103 firm-years with geographic or industry APEs greater than 100 percent.

3.5. Descriptive Statistics

Table 2 presents descriptive statistics for the APEs of next year's consolidated earnings from operations (Compustat data item 178). The three segment forecasts, $APE^{geo}_{i,t+1}$, $APE^{ind}_{i,t+1}$, and $APE^{comb}_{i,t+1}$, and two consolidated forecasts, $APE^{RW}_{i,t+1}$ and $APE^{PC}_{i,t+1}$are presented. Segment forecasts are generated based on the initial model using segment sales information and a consolidated profit margin. Columns 2 through 4 show the mean (median) statistics for each model's APE for the unadjusted full sample, the winsorized sample (APEs greater than 100 percent are winsorized), and the truncated sample (APEs greater than 100 percent are excluded). Column 2 and 3 indicate that the full sample and winsorized sample *median* APEs are smallest for $APE^{comb}_{i,t+1}$ (Full and Winsorized median of 0.2082). The full sample and winsorized sample *mean* APEs are smallest for $APE^{RW}_{i,t+1}$ (Full unadjusted mean, 0.6845 and winsorized mean, 0.3515). Column 4 indicates that both the truncated sample mean (0.2354) and median (0.1608) are smallest for $APE^{geo}_{i,t+1}$.

Table 3 presents the truncated sample mean and median statistics as well as the means and medians for quintiles partitioned based on the size of each firms' difference in $APE^{geo}_{i,t+1}$ and $APE^{ind}_{i,t+1}$, ($Diff\_APE^{H1}_{i,t+1}$). The median $APE^{geo}_{i,t+1}$is the largest in the extreme quintiles 1 and 5 of $Diff_APE^{H1}_{i,t+1}$and decrease in quintiles 2 and 4 to the smallest median APE in quintile 3. Aside from the quintile 1 median, $APE^{ind}_{i,t+1}$follows a similar pattern. This has the counterintuitive effect of weighting more heavily those observations with larger APE's in each of my main hypothesis tests when parametric mean tests are used. As such, I rely mainly on the non-parametric median test statistics

which are less affected by these extreme observations.[29] [30] I also present parametric paired t-test statistics for the winsorized and truncated samples as an indicator of magnitude and as additional support for any non-parametric findings. Truncating the APEs greater than 100 percent is consistent with the prior mechanical forecast research (Kinney, 1971; Collins, 1976; Roberts, 1989; Balakrishnan et al., 1990; Behn et al, 2002).

As a precursor to the statistical tests of firm characteristics expected to be related to $\text{Diff\_APE}^{\text{H1}}_{\text{i,t+1}}$, descriptive statistics for the variables used in the firm characteristics regression are shown in Table 3. Paired t-tests and sign tests are also presented and examine whether the full sample mean and median of $\text{D\_VarGrowth}_{\text{i,t}}$ and D_SEG are different from zero. The $\text{D\_VarGrowth}_{\text{i,t}}$ mean and median is 0.0040 and 0.0011. The median is significantly positive at the one percent level and indicates that more firms report larger variation in sales growth in their geographic segments than in their industry segments. This suggests that growth varies more across geographic regions than across industries. The mean and median D_SEG is 0.74 and 1. Both are significantly different from zero indicating that on average, geographic disclosures contain nearly one more segment than industry disclosures. This suggests

[29] As an additional analysis, I consider an alternative measure of $Diff\_APE^{H1}_{i,t+1}$ which deflates the variable by the average error size: $Pct\_Diff\_APE^{H1}_{i,t+1} = \frac{Diff\_APE^{H1}_{i,t+1}}{\left[(APE^{geo}_{i,t+1}+APE^{ind}_{i,t+1})/2\right]}$. The results for all of the main tests are not significantly different to those using $Diff\_APE^{H1}_{i,t+1}$.

that MNCs are operating in geographic regions whose economic characteristics are more diverse than its industry segments (products and services, etc.). Table 3 also presents the mean and median values for all of the independent variables across quintiles of $\text{Diff\_APE}_{i,t+1}^{H1}$. There appears to be no clear positive linear pattern across the quintiles of $\text{Diff\_APE}_{i,t+1}^{H1}$ for each of the independent variables, $\text{D\_Seg}_{i,t}$ and $\text{ForPct}_{i,t}$ which are each predicted to be positively related to $\text{Diff\_APE}_{i,t+1}^{H1}$.[31]

Finally, Table 3 presents the mean and median descriptive statistics for variables typically proxying for size (Assets, MVE, and Sales) and profitability (EPS). Typically, earnings forecast studies control for firm size as larger firms have more predictable earnings due to better overall information environments and a more stable earnings stream (e.g., Lang & Lundholm, 1993; Lang & Lundholm, 1996; Barron, Kile, & O'Keefe, 1999; Healy, Hutton, & Palepu,1999; Ashbaugh & Pincus, 2001; Hope, 2003; Hope et al., 2006). Earnings forecast studies also typically control for loss firms due to the transitory nature of negative earnings making it inherently more difficult to predict earnings (e.g. Brown, 2001; Heflin, Subramanyam, & Zhang, 2003; Hope, 2003). Since my sample selection process deletes firms with operating earnings losses, including a control variable for the effect of loss firms is not required. In addition, the size and profitability variables (Assets, MVE, Sales, and EPS) in Table 3, do not appear to be decreasing across the quintiles of the dependent variable,

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[30] Figure 1 provides a graphical representation of each $\text{Diff\_APE}_{i,t+1}^{H1}$ sample distribution. Kolmogorov-Smirnoff tests of goodness of fit for sample distributions indicates that neither the full, winsorized, nor truncated samples can be considered normal distributions

[31] Table 5 presents Pearson correlations for these variables and is discussed further in section *4.2*

$\text{Diff\_APE}^{\text{H1}}_{\text{i,t+1}}$. This suggests that the within-firm nature of the dependent variable may adequately control for size and profitability in the regression analysis.[32] [33]

4. Results

4.1. Comparative predictive ability tests

Table 4 presents the difference in APEs for each of the first two hypotheses. APEs are generated based on my initial analysis forecast models using only GEO and IND sales information. Panel A provides the results for the test of H1. $Diff\_APE^{H1}_{i,t+1}$ is the difference between the MNC's absolute consolidated earnings forecast error using IND information and the forecast error when using GEO information (i.e., $APE^{ind}_{i,t+1} - APE^{geo}_{i,t+1}$). If IND disclosures are more predictive than GEO disclosures, the absolute forecast errors for IND will be smaller than those for GEO. Therefore, $Diff\_APE^{H1}_{i,t+1}$ will be negative. Non-parametric Wilcoxon ranked sign tests and Fisher Sign tests are presented in the first two columns. The final two columns of Table 4 present parametric paired t-test statistics for the winsorized sample, and the

[32] Untabulated results including Assets and EPS as control variables in the regression analysis are similar and the coefficients on each of the control variables are insignificant.

[33] Table 3 may indicate that a non-linear relationship exists between these size variables and $Diff\_APE^{H1}_{i,t+1}$. If larger firms have more segments or a larger foreign presence, the firm characteristic analysis may still face an omitted variable problem. I transform the $Diff\_APE^{H1}_{i,t+1}$ by deflating by total sales rather than operating earnings to partially control for this. Untabulated results are not significantly different from my reported regression analysis.

truncated sample.[34] Although all four tests indicate that $Diff\_APE_{i,t+1}^{H1}$ is positive, none are significant at conventional levels. Therefore, the initial tests of H1 provide no evidence that MNCs' GEO disclosures provide more accurate consolidated earnings forecasts than do IND disclosures.

The tests of H2 are shown in panel B of Table 4. $Diff\_APE_{i,t+1}^{H2a}$ is the difference in absolute forecast errors generated using IND information and forecast errors generated using a combination of the MNC's IND and GEO information (i.e., $APE_{i,t+1}^{ind} - APE_{i,t+1}^{comb}$). Again, all tests indicate that the difference is positive, but none are significantly positive at conventional levels. $Diff\_APE_{i,t+1}^{H2b}$ is the difference in absolute forecast errors for forecasts generated using GEO information and forecast errors generated using a combination of the MNC's GEO and IND information (i.e., $APE_{i,t+1}^{geo} - APE_{i,t+1}^{comb}$). Both non-parametric tests are insignificant at conventional levels. Therefore, the initial tests indicate that a combination of GEO and IND information is no more predictive than using GEO or IND information alone.

Table 4, Panel C presents the benchmark test results. Although the purpose of this paper is to compare the predictive ability of a MNC's segment disclosures, examining whether segment information is more predictive than forecasts using consolidated information only is also informative. Panel C compares the absolute forecast errors generated using industry or geographic information or a combination of

[34] The Kolmogorov-Smirnoff test of goodness of fit indicates that the full, winsorized, and truncated samples cannot be considered normal distributions. As such, I place greater reliance on non-parametric tests in my tests of the main hypotheses.

both to the most accurate of either the random walk or percentage change consolidated model described earlier, APE^{Con}. The non-parametric sign test is negative for all tests and significant at the 10% level for the comparison of $APE_{i,t+1}^{geo}$ or $APE_{i,t+1}^{comb}$ versus the consolidated model. This suggests that forecasts generated using geographic or a combination of geographic and industry information is more accurate than when using only consolidated information. However, the non-parametric wilcoxon test which weights extreme observations more heavily in the test statistic suggests that there is an insignificant difference between all segment models and the consolidated models.

In summary, the results in Table 4 provide no evidence that either GEO information or a combination of GEO and IND information provides more accurate forecasts of future earnings than does IND information when APEs are generated using only IND and GEO sales disclosure information. However, there is limited evidence that either GEO information or a combination of GEO and IND information provides more accurate forecasts of consolidated earnings than does consolidated information alone.

4.2. Incorporating additional information into the forecast

4.2.1 Incorporating IND and GEO earnings information

Table 5 presents results testing the difference between segment models using only segment sales disclosure information (*Model A*) and those using segment sales

and earnings information (*Model B*).[35] The negative non-parametric test statistics (the Wilcoxon test statistic is significant at the one percent level) indicate that earnings forecasts generated using only IND segment sales information are more accurate than forecasts generated using IND segment sales and earnings information. This finding is consistent with recent mechanical forecast research suggesting that SFAS 131 segment reporting disclosures improved the forecast accuracy for IND and GEO sales disclosures but not for IND and GEO earnings disclosures (Berger and Hann, 2003; Behn et al., 2002). This result is also consistent with Hope et al. (2006a) who find no evidence to suggest that analysts forecast errors are reduced for MNCs voluntarily disclosing GEO segment earnings in the post- SFAS 131 period.

4.2.2 Incorporating alternative growth rate and exchange rate information

Panel A of Table 6a presents the results for tests of H1 and H2 when incorporating 'perfect forecast' *alternative* information into both the IND and GEO forecasts. Both non-parametric tests indicate that the most accurate segment forecast is $APE_{i,t+1}^{ind}$ (Both $Diff\_APE_{i,t+1}^{H1}$ and $Diff\_APE_{i,t+1}^{H2a}$ are negative and significant at less than the 1 percent level for the wilcoxon and sign tests). The paired t-tests indicate that, on average, APE^{ind} is around 2.3 percent to 2.6 percent more accurate than APE^{geo}, and 0.9 to 1.1 percent more accurate than APE^{comb}. This suggests that IND

[35] The sample size is considerably larger when using IND information versus GEO information. The sample size is reduced to only 90 firm-year observations for tests of *model A* versus *model B* when using GEO disclosure information since disclosure of GEO earnings is voluntary for the sample. Un-tabulated results for these observations are insignificant.

forecasts are significantly more accurate than GEO forecasts if 1) forecasters can accurately predict next period industry sales growth, country NGDP and exchange rate information, and 2) they combine this information with IND and GEO disclosure information.

In addition to the tests of H1 and H2, Panel C of Table 6a presents the benchmark tests of the difference in APE for the three segment models versus the best consolidated model, $Diff\_APE^{BM}_{i,t+1}$. $Diff\_APE^{BM1}$, $Diff\_APE^{BM2}$, and $Diff\_APE^{BM3}$ represent the test of the difference in APEs for the consolidated model versus the APE^{geo}, APE^{ind}, and APE^{comb} segment models respectively.[36] Insignificant non-parametric results for $Diff\_APE^{BM1}$ indicate that GEO forecasts developed using perfect forecast NGDP and exchange rate information are no more accurate than forecasts developed using only consolidated information. However, the negative non-parametric tests for $Diff\_APE^{BM2}$ in table 6a (the Wilcoxon test is significant at the 5 percent level) indicates that earnings forecasts generated using IND disclosures and perfect forecast *alternative* information are significantly more accurate than forecasts generated using only consolidated information.

Table 6b provides the results of H1, H2, and benchmark tests for forecasts incorporating ex-ante rather than perfect forecast *alternative* information. As such, the predictive quality of the *alternative* information is now reduced for both industry and

[36] Since my results suggest that the combined segment model APE^{comb} is no better than the most accurate segment forecast model, APE^{ind} or APE^{geo}, I do not discuss the results for $Diff_APE^{BM3}$as they are no different than those of the most accurate segment model.

geographic forecasts.[37] APEs are created in the same manner as in table 6a except that now industry sales, NGDP, and exchange rate changes are calculated based on current year information. Therefore, they do not incorporate look-ahead information. Non-parametric tests of H1 and H2 provide no evidence of a difference in forecast accuracy for IND, GEO, or a combination of both IND and GEO disclosure information when ex-ante *alternative* information is incorporated into the forecast.

In addition to the tests of H1 and H2, Panel C of Table 6b presents the benchmark tests of the difference in APE for the three segment models versus the best consolidated model, $Diff\_APE_{i,t+1}^{BM}$. Insignificant non-parametric results for $Diff\_APE^{BM1}$ indicate that GEO forecasts developed using ex-ante NGDP and exchange rate information are no more accurate than forecasts developed using only consolidated information. The positive non-parametric tests for $Diff\_APE^{BM2}$ in table 6b (the Wilcoxon test is positive and significant at the five percent level) indicate that forecasts generated using IND disclosures and ex-ante *alternative* information are less accurate than forecasts developed using only consolidated information.

Contrasting the results in Table 6a using perfect forecast *alternative* information to those using ex-ante information in Table 6b, it appears that the ability of the forecaster to accurately predict alternative industry growth information is an important factor in generating IND forecasts that are more accurate than forecasts

[37] Un-tabulated tests of the difference between IND (GEO) forecasts generated using perfect forecast information and IND (GEO) forecasts generated using ex-ante forecast information confirm that IND (GEO) forecasts using perfect forecast information are significantly more accurate (at the one percent level for all tests).

generated using either GEO information or consolidated information. The results also suggest that the ability of the forecaster to accurately predict country NGDP and exchange rate information is not a significant factor in generating more accurate forecasts than can be generated using only consolidated information.

Table 6c examines the forecast accuracy of models incorporating *alternative* information (APE^{ext}) and those using only information within the segment disclosure (APE^{int}). Since APE^{int} is generated based on segment specific information only, there can be no error related to the inclusion of *alternative* information that is not specific to the MNCs disclosed segments. Therefore, the tests examine the trade-off between the benefits of incorporating more predictive *alternative* information with the costs of error resulting from information that is not segment specific. Panel A of Table 6c tests the difference between IND (GEO) forecasts generated using only IND (GEO) disclosure information versus one that also incorporates *perfect forecast alternative* information, $Diff\_APE^{ind\_pf}$ ($Diff\_APE^{geo\_pf}$). The positive Wilcoxon and Sign test statistics for $Diff\_APE^{ind\_pf}$ (significant at the one percent and five percent level) indicate that incorporating *alternative* IND information significantly improves the forecast of next year's income from operations. The benefits of including the *alternative* industry information significantly outweigh the costs of attaching them. In comparison, $Diff\_APE^{geo\_pf}$, the difference between GEO forecasts generated using only GEO disclosure information versus GEO forecasts that incorporates perfect forecast *alternative* information, is not significant. This suggests that additional error created when attaching country specific *alternative* information to the segment

disclosure information appears to negate any benefit that can be gained from accurately predicting NGDP and exchange rate information.[38] Panel B of Table 6c tests the difference between IND (GEO) APEs generated using only IND (GEO) disclosure information versus one that also incorporates *ex-ante alternative* industry (geographic) information, $Diff\_APE^{ind\_ea}$ ($Diff\_APE^{geo\_ea}$). The analysis in Panel B differs from that in Panel A only in the reduced predictive quality of the *alternative* information from perfect forecasts to ex-ante forecasts.[39] Both non-parametric results for $Diff\_APE^{ind\_ea}$ are insignificant. This suggests that the potential benefits of incorporating *alternative* information that is no more predictive than prior year industry shipment sales growth information do not outweigh the costs of incorporating non-firm specific information. The negative non-parametric sign test for $Diff\_APE^{geo\_ea}$ is marginally significant at the ten percent level. This suggests that the potential benefits of incorporating country NGDP and exchange rate information that is no more predictive than the prior year NGDP and exchange rate information is outweighed by the cost of attaching non-segment specific information.

[38] As mentioned earlier, untabulated tests provide evidence (significant at the 1 percent level) that the perfect forecast *alternative* information is significantly more accurate than the ex-ante *alternative* information for both IND and GEO forecasts and confirms the increased accuracy related to being able to predict NGDP and exchange rate information or Industry Shipment sales information.

[39] The sample size also differs due to available ex-post versus ex-ante *alternative* IND and GEO information.

4.3. Firm characteristic regression results

Table 7 presents the Pearson correlation coefficients for the variables used in the firm characteristics regression. Since $Diff\_APE_{i,t+1}^{H1}$ violates the normality assumption in linear regression analysis, I transform all variables into a ratio rank variable by dividing the simple rank of each variable by the number of sample observations minus one ($R\_Diff\_APE_{i,t+1}^{H1}$, $R\_D\_Seg_{i,t}$, and $R\_ForPct_{i,t}$). $R\_D\_Seg_{i,t}$ is the only variable with a positive correlation with $R\_Diff\_APE_{i,t+1}^{H1}$(consistent with the predicted direction). $R\_ForPct_{i,t}$ is negatively correlated with $R\_Diff\_APE_{i,t+1}^{H1}$. However, all correlations are insignificant at conventional levels. Since $D\_VarGrowth_{i,t}$ is mechanically related to $Diff\_APE_{i,t+1}^{H1}$, this relation is not included in the regression.[40]

Table 8 presents the results for the regression of the rank transformed difference in absolute forecast errors from H1 ($R\_Diff\_APE_{i,t+1}^{H1}$) on firm characteristics that are expected to explain when MNCs' GEO or IND disclosures are likely to be relatively more predictive. The coefficients for $R\_D\_Seg_{i,t}$, $R\_ForPct_{i,t}$ are both insignificant indicating no direct relation between the difference in forecast

[40] The following section analyzes the relation between $Diff_APE_{i,t+1}^{H1}$and $D\_VarGrowth_{i,t}$ using a more appropriate test of proportion. However, including $D\_VarGrowth_{i,t}$ in the regression does not change any results and has a positive relationship with $Diff\_APE_{i,t+1}^{H1}$ (significant at the one percent level) consistent with the later tests.

accuracy for both disclosure types and the difference in segments reported and the size of foreign operations.[41]

As mentioned earlier, making inferences about the relation between $D\_VarGrowth_{i,t}$ and $Diff\_APE_{i,t+1}^{H1}$ is inappropriate in the regression format of Table 8. Table 9 provides a test of the proportion of firms' whose GEO (IND) disclosure reveals the largest variation in growth across its segments and leads to a more accurate GEO (IND) forecast. The proportion of MNCs whose IND (GEO) disclosure has greater variance in segment growth and leads to a more accurate consolidated earnings forecast is denoted as Π_{ind} (Π_{geo}) in Panel A and B. The IND (GEO) disclosure with greater variance in segment growth but leads to a less accurate consolidated earnings forecast is denoted by 1- Π_{ind} (1- Π_{geo}). Panel B of table 9 indicates that both Π_{ind} (60 percent) and Π_{geo} (61.1 percent) are significantly greater than fifty percent (p-values of less than one percent). In addition, the proportion of Π_{ind} and Π_{geo} in relation to the whole sample is also significantly greater than would be expected by chance (Z-Statistic for Π_{geo} + Π_{ind}=50% of 5.21). This suggests that the MNC's segment disclosure that reports greater variation in its segment growth is likely to provide a more accurate forecast of consolidated earnings relative to the same MNC's forecast constructed using the disclosure which reports a smaller variation in segment growth.

[41] I re-examine the prior findings which led to the following predictions for my sample of MNCs: 1) the positive relation between IND (GEO) segment APEs and the number of reported IND (GEO) segments, and 2) the positive relation between GEO segment APEs and the size of foreign operations. Untabulated results indicate that these prior findings are also insignificantly related to the mechanically generated forecast errors in my sample period.

This implies that, given the model's forecast assumptions, the user of segment information will be more likely to accurately predict next year's consolidated earnings when using the information in the segment disclosure with the more varied segment growth.

4.4. Robustness tests of comparative ability results

4.4.1 Adjustment for mean reversion

My primary forecast model estimates expected segment growth rates based on prior year growth in segment sales. However, in the long run, sales growth has a mean reverting property suggesting that extreme prior year growth levels may not continue. I incorporate an estimate of GEO (IND) segment mean reversion in sales growth by winsorizing the sample of GEO (IND) segments at the top and bottom 20 percent of the sample.[42] Table 10 presents the results of H1, H2, and benchmark tests when the absolute percentage forecasts are adjusted for the estimated mean reversion of extreme IND and GEO segment sales growth and consolidated growth for the consolidated percentage change model. All results are insignificant and are consistent with the main analysis tests with the exception of the non-parametric sign benchmark tests. When adjusting for mean reversion, the negative $DIFF\_APE_{i,t+1}^{BM2}$ (the difference between APE^{geo} and APE^{con}) and $DIFF\_APE_{i,t+1}^{BM3}$ (the difference between APE^{comb} and APE^{con}) are no longer significant at the 10% level.

[42] I also winsorize at the top 10% of the sample. The results (not shown) are similar to those reported.

4.4.2. Controlling for macro-economic events

Without controlling for macroeconomic outcomes in the out-of-sample years, a caveat is necessary that the current results may not generalize to other years. The overall level of 'good' news or 'bad' news in each sample year can result in the positive relation between variation in growth rates across segments and the predictive ability. This is due to the disclosure type with the most varied segment growth providing the highest forecast. If the sample period being forecasted has more good years than bad years, the disclosure type with the most variation in segment growth is likely to provide the most accurate predictions. I control for this by removing an estimate of a MNCs' earnings that is due to either the overall "good" or "bad" economic conditions from the MNCs' actual earnings in the year being forecast. An initial measure of a "good" and "bad" economic environment is created based on the average percentage change in operating earnings for all firms listed on the Compustat database for the forecast year. This estimate of the overall "good" or "bad" economic conditions is then removed from the APEs by subtracting it from the percentage forecast errors generated based on each model.[43] Table 11 presents the results of H1,

[43] The estimate is subtracted before the absolute value is taken in order to preserve the sign of the forecast error. In doing so, negative (positive) macroeconomic changes will reduce or increase the unadjusted APEs of MNCs dependent upon the original sign of the forecast error. For example, a positive (negative) macro-economic shock adjustment will reduce (increase) the APE of a MNC with an overly optimistic forecast.

H2, and benchmark tests for forecast errors adjusted for macroeconomic shocks. In general the results for H1 and H2 are similar to the main analysis.[44]

Benchmark tests are presented in panel C of Table 11. In contrast to my main analysis, all segment models, $APE_{i,t+1}^{ind}$, $APE_{i,t+1}^{geo}$, and $APE_{i,t+1}^{comb}$ are significantly more accurate than the most accurate consolidated forecast, APE^{Con}. This result suggests that when an estimate of the actual macroeconomic shock during the forecast year is removed from the forecasts, segment information is more predictive than consolidated information. The reader can interpret this finding in at least two ways. One interpretation is that adjusting the forecast for macroeconomic events removes exogenous shocks which add to the test statistics noise and reduce the power of the test of the true difference between forecasts. Alternatively, if the shocks are not exogenous in nature, then the results may suggest that consolidated information can be used to better predict macroeconomic changes than segment information.

5. Conclusions

This study compares the predictive ability of both operating (industry) segment and supplemental (geographic) segment disclosures based on earnings forecast models that 1) use only IND and GEO disclosure information or 2) use *alternative* industry

[44] $DIFF\_APE_{i,t+1}^{H2a}$ is significantly positive at the ten percent level indicating that a segment forecast formulated using both IND and GEO segment sales information is more accurate than a segment forecast formulated using only IND segment information. However, overall inferences are similar since $DIFF\_APE_{i,t+1}^{H2b}$ indicates that the combined forecast is no more accurate than using only GEO segment information and tests of H1 reveal no significant differences between IND and GEO forecasts.

and geographic information in combination with the IND or GEO segment disclosures. The results provide some evidence to suggest that IND disclosures can be more predictive than GEO disclosures. However, this result is dependent upon accurate predictions (perfect forecasts) of *alternative* industry sales growth information being incorporated into the forecast. If the prediction of *alternative* information is no more accurate than the prior year industry sales growth (ex-ante scenario), I find no evidence to suggest that earnings forecasts are more accurate when developed using GEO or IND information. Consistent with prior research comparing segment based forecasts to consolidated forecasts, I provide some evidence to suggest that GEO and IND disclosures are more predictive of future earnings than consolidated information alone. However, whereas GEO disclosures are only more predictive when using only GEO disclosure sales information, IND disclosures are only more predictive when forecasters are able to accurately predict *alternative* industry growth information (perfect forecast assumption).

This study adds to the segment reporting literature examining the usefulness and limitations of segment *earnings* information. I find some evidence to suggest that under the current SFAS 131 disclosure requirements, more accurate earnings forecasts can be generated using segment sales information as opposed to segment earnings information. Understanding the benefits and potential limitations of the management approach to segment reporting under SFAS 131 is important to users. This study suggests that the FASB's decision to no longer require firms to report segment earnings information in their supplemental segment disclosures under SFAS 131, has not affected the disclosures' usefulness in predicting earnings. The evidence is

consistent with more recent research suggesting that analysts forecast errors are no more accurate for MNCs voluntarily disclosing GEO segment earnings in the post-SFAS 131 period (Hope et al., 2006a).

This study also provides evidence to suggest that the predictive benefits of incorporating *alternative* information differ across disclosure types. If accurate predictions of *alternative* industry sales growth information can be made, combining it with IND disclosure sales information can generate more accurate earnings forecasts than those generated using only the information provided in the IND disclosure. In contrast, I find no evidence to suggest that combining accurate predictions of *alternative* NGDP and exchange rate information with the GEO sales information can generate more accurate forecasts of earnings than those generated using only the GEO information.

Finally, this study adds to the segment reporting literature relating firm characteristics to the usefulness of segment information. Prior research has limited its investigation to the relation between firm characteristics and the predictability of one type of segment disclosure (industry or geographic) to the cross-section of firms. In contrast, I test whether firm characteristics can explain when one segment disclosure type has more predictive ability relative to the other segment disclosure type reported by the same MNC. This study suggests that the usefulness of segment information in predicting future earnings is positively related to the variance in sales growth across the reported segments. However, I find no evidence to suggest that the difference in the number of segments or the percentage of foreign operations are associated with the differential predictive ability of GEO or IND sales information.

My findings should be beneficial to users and preparers of financial statement information. An understanding of the characteristics and components that relate to more predictive segment disclosures can benefit investors and analysts by providing more accurate inputs in their valuation models. Finally, a better understanding of the predictive ability of segment information can aid standard setters in assessing the costs and benefits of increasing/decreasing both operating and supplemental segment disclosure information. SFAS 131 no longer requires earnings information to be disclosed for supplemental (geographic) segment information in the annual report, and information for these segments are not required for interim periods. My results suggest that these policy choices may not harm the overall disclosure environment of MNCs, at least in terms of the predictive ability of earnings.

Appendix A: Segment reporting environment under SFAS 131 versus SFAS 14

A-1 Reported Segments

SFAS 14 required segment disclosures along 'industry segment' lines. An "industry segment," as defined by SFAS No. 14, was "a component of an enterprise engaged in providing a product or service or a group of related products and services primarily to unaffiliated customers . . . for a profit." (SFAS 14, paragraph 10.a) SFAS 14 required a firm to report its revenues, operating profit (loss), and identifiable assets which are required to be reconciled to the consolidated amounts in the financial statements for *both* industry and geographic segments. In addition, SFAS 14 required the same information to be reported by 'geographic areas' which were defined as either individual countries or groups of countries and were left to be determined by the firm (see SFAS 14, paragraph 34). In contrast, SFAS 131 requires businesses to report financial information primarily on the basis of 'operating segments'. Under SFAS 131, a 'management approach' is adopted whereby an operating segment is a component of a business, for which separate financial information is available, that management regularly evaluates in deciding how to allocate resources and assess performance (SFAS 131, paragraph 10) Therefore, a company could define its primary operating segments as 'industry' or 'geographic' segments under SFAS 131. Supplemental 'enterprise-wide' information is also required to be disclosed which includes geographic or industry segment information if this is not reported in the primary operating segment information. Under SFAS 131 most firms report their primary operating segments based on industry segments (Herrman and Thomas, 2000) and

therefore are only required to disclose geographic information as supplemental 'enterprise-wide' disclosures. Under SFAS 131, this disclosure requires that firms report only revenues and long-lived assets for all individual foreign countries, if material, and by domestic country and all other foreign countries combined at a minimum. Note that although SFAS 131 no longer requires a profit or loss measure to be reported for firms reporting primary operating segments by industry, the new standard does place a greater emphasis on the reporting of country rather than region specific information than does SFAS 14.

As a general quantitative rule, both SFAS 14 and SFAS 131, indicate that a company should separately identify segments if a segment's revenues, operating profit, or assets were 10% or more of all the segments' revenues, operating profits, or assets, respectively (See SFAS 14, paragraph 15 and SFAS 131, paragraph 18).

A-2 Segment Information disclosed

SFAS 131 changes the quantity and type of information to be disclosed for each segment. SFAS 131 requires that a company report assets and a measure of profit or loss for each operating segment. SFAS 131 defines neither segment profit (loss) nor assets. Instead, management report these and other items based on how they operate their business. Essentially, the profit measure and certain segment revenue and expense items should be reported if evaluated by the chief operating decision maker. These include revenues, interest income, interest expense, depreciation, depletion and amortization, unusual items, equity in net income of equity method investees, income

taxes, extraordinary items, and significant non-cash items other than depreciation, depletion, and amortization (SFAS 131, paragraph 27). In contrast, SFAS 14 specifically defined segment operating profit to be revenues less all operating expenses, which included depreciation and amortization. Firms are required to allocate operating expenses that were not directly traceable to a particular segment on a reasonable basis among the segments that benefit from the incurred expenses (see SFAS 14, paragraph 10.d).

A-3 Segment Information required in Interim Reports

SFAS 14 did not require segment reporting in interim financial statements. Under SFAS 131, firms must now include interim information for each of its *primary* operating segments. This information includes, revenues, a measure of segment profit or loss, and material changes in segment assets since the last annual report. No secondary 'enterprise wide' information need be reported in interim periods.

Appendix B: Incorporating Alternative information into earnings forecasts

B-1 Country Classification

Under SFAS 131, many firms report geographic segments that define broader areas than a single country. Consistent with Balakrishnan et al (1990) and Behn et al (2002) I identify specific countries where the MNC's operations are focused utilizing the following:

i. reference to specific countries in the financial statement notes, management discussion and analysis, or the introductory annual report material

ii. reference to properties owned or operated as disclosed in the 10-k list of significant subsidiaries disclosed in the 10-k

Relative dollar NGDP is then used to allocate sales to the specific countries identified within the segment region disclosed. The relative weight of each country's NGDP determines the percentage of the segment sales amount that is considered to be earned within that country. This method of allocation introduces a source of measurement error. However, every effort is made to extract as much information from the public disclosures as possible in order to minimize the error.

B-2 Calculation of NGDP and exchange rates

The calculation of NGDP is determined as follows:

$$E(\Delta NGDP^{c}_{t+1}) = [1 + E(\Delta RGDP^{c}_{t+1})][1 + E(\Delta INF^{c}_{t+1})] - 1 \quad (9)$$

Where:

$E(\Delta NGDP^{c}_{t+1})$ is the expected rate of change in nominal GDP in country *c* for period *t* to *t+1*; $E(\Delta RGDP^{c}_{t+1})$ is the expected rate of change in real GDP in country *c* for period *t* to *t+1*; and $E(\Delta INF^{c}_{t+1})$ is the expected rate of change in the price level in country *c* for period *t* to *t+1*.

Since the perfect forecast assumption is used, all expectations are the actual changes in the period for each macroeconomic variable.[45] As an alternative, a random walk forecast of both industry sales growth and NGDP growth rates are adopted.

Unlike IND information, GEO information can be used to identify and incorporate each reported country's exchange rate information into the earnings forecast. IND information identifies only a US or global exchange rate for MNCs. Balakrishnan et al (1990) suggest that it is this ability to incorporate additional *alternative* information that makes GEO information more likely to provide accurate forecasts of consolidated earnings than consolidated information alone. I adopt the perfect forecast assumption and incorporate actual changes in exchange rates into the earnings forecast in a similar manner as both Balakrishnan et al (1990) and Behn et al (2002). As an additional analysis, I incorporate expected forecasts of exchange rates

[45] Once this assumption is relaxed $E(\Delta NGDP^{c}_{t+1})$ is based on a random walk approach. Prior GEO disclosure research (Balakrishnan et al, 1990; Behn et al, 2002) use published forecasts from various sources as expectations of NGDP. However doing so would bias my comparison since forecasts of industry sales are no longer available after 2002 in *Industry Outlook*.

based on the random walk approach which has been shown to perform as well as other models (Meese and Rogoff, 1983; Callan et al, 1985; Chin and Frankel, 1994). Although Evans and Lyons (2002) suggest that order flow information on currency transactions is a better predictor of future exchange rates than the macroeconomic determinant models in the past, obtaining this information for all years and all countries in my sample is not feasible. In addition, since I calculate perfect forecast exchange rates, it is likely that the forecast accuracy of exchange rates estimates of forecasters with access to order flow data for currency exchanges falls somewhere in-between my perfect forecast and random walk forecast of one-year-ahead exchange rates.

B-3 Industry growth rate calculations

Industry sales growth information is obtained from shipment sales information compiled by the U.S. department of Commerce and separate Industry Trade Organizations. These industry growth measures are attached to a firm's reported IND segment by matching the North American Industry Classification System (NAICS) code to that listed in the Compustat segment database for the firm segment. If the NAICS code reported by the MNC is broader than the growth rates obtained from more specific NAICS industry details, I develop a combined growth rate based on the weighted sum of the industry shipment sales growth rates that fall within the broader NAICS code disclosed by the company. For example, if the MNC reports NAICS code 442 (Furniture and home furnishing stores) I combine shipment sales growth rates for more specific NAICS industries 4421 (Furniture stores) and 4422 (Home furnishing

stores) based on the sum of both industries reported growth rates weighted by the size of shipment sales within those industries at the beginning of the year.

Appendix C: Earnings forecasts generated using segment sales and earnings disclosure information

The information set used in forecasting can be broadened by incorporating segment earnings information into the mechanical model. In equation form, the one-year-ahead consolidated earnings forecast is constructed as follows:

$$E(X_{t+1}^{cons} \mid seg) = \sum_{j=1}^{J} E\left(X_{j,t+1}^{seg}\right) \qquad \textit{Model B}$$

Where

$E\left(X_{j,t+1}^{seg}\right) = E\left(S_{j,t+1}^{seg}\right) * \left(X_{j,t}^{seg} / S_{j,t}^{seg}\right)$

$X_{j,t}^{seg}$ is earnings in segment j in period *t,*

$E\left(S_{j,t+1}^{seg}\right) = \left[1 + E\left(GWTH_{j,t+1}^{seg}\right)\right] * S_{j,t}^{seg}$, and all other elements are as described earlier.

I apply the algorithms developed by Berger and Hann (2003) when constructing the consolidated earnings forecast to differentiate between profitable and unprofitable segments. Assuming that growth in segment sales increases profits as well as losses is unreasonable, and the following algorithms are adopted to incorporate these differences into the forecast:

If $X_{j,t}^{seg} > 0$, then $E\left(X_{j,t+1}^{seg}\right) = E\left(S_{j,t+1}^{seg}\right) * \left(X_{j,t}^{seg} / S_{j,t}^{seg}\right)$

If $X_{j,t}^{seg} < 0$, and $E\left(GWTH_{j,t+1}^{seg}\right) > 0$, then $E\left(X_{j,t+1}^{seg}\right) = X_{j,t}^{seg} + \left|X_{j,t}^{seg}\right| * \left[E\left(S_{j,t+1}^{seg}\right)/S_{j,t}^{seg} - 1\right]$

If $X_{j,t}^{seg} < 0$, and $E\left(GWTH_{j,t+1}^{seg}\right) < 0$, then $E\left(X_{j,t+1}^{seg}\right) = X_{j,t}^{seg} - \left|X_{j,t}^{seg}\right| * \left[1 - E\left(S_{j,t+1}^{seg}\right)/S_{j,t}^{seg}\right]$

Model B develops the initial individual segment sales forecasts in the same manner as *Model A*. However, the model then applies individual segment profit margins rather than consolidated profit margins to the sales forecast. The disclosure of earnings for both segment types is no longer mandatory for firms after the implementation of SFAS 131, and most firms no longer report GEO earnings (Herrmann and Thomas, 2000). This significantly reduces the sample size for these tests. However, foreign pretax income information provided by MNCs in their tax footnotes can be used as an alternative to segment earnings information. This allows the calculation of a domestic profit margin and an overall foreign profit margin. The domestic profit margin is attached to US geographic segments and the foreign profit margin is attached to each foreign segment disclosed. Foreign pretax profit margins are incorporated in the same manner as segment profit margins in *Model B*. However, the following additional adjustment is made to all foreign $X_{j,t}^{seg}$ for those firms with total foreign pre-tax losses since foreign profit levels rather than foreign profit margins are required for loss segments. The adjustment apportions the pretax loss to each foreign segment based on the relative size of the foreign segment sales to total foreign sales for the MNC:

$$X_{j,t}^{seg} = X_t^{for} * \left(S_{j,t}^{seg} / S_t^{for}\right) \tag{10}$$

Where, X_t^{for} is foreign pre tax earnings in year *t*, S_t^{for} is total foreign sales in year *t*, and other variables are as described earlier.

Incorporating domestic and foreign pretax income adds error to earnings forecast generated for MNCs with greater than two geographic segments. However, the forecast benefits from the inclusion of finer firm-specific earnings information than consolidated earnings. In addition, the sample size is not reduced to only voluntary disclosers of geographic earnings information which carries with it issues of reduced statistical power of the test and the potential for a self selection bias. Finally, as discussed earlier, incorporating earnings information relaxes the mechanical relation between $DIFF\_APE_{i,t+1}^{H1}$ and $D\_VarGrowth_{i,t}$.

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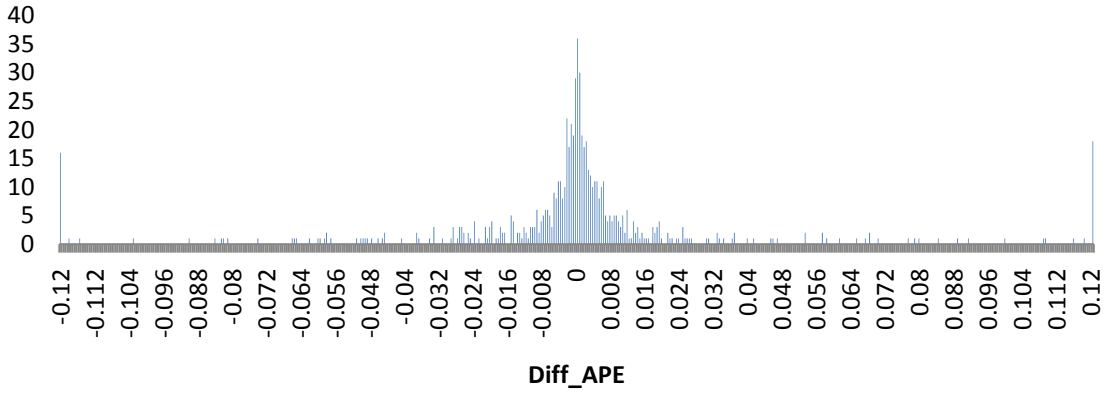
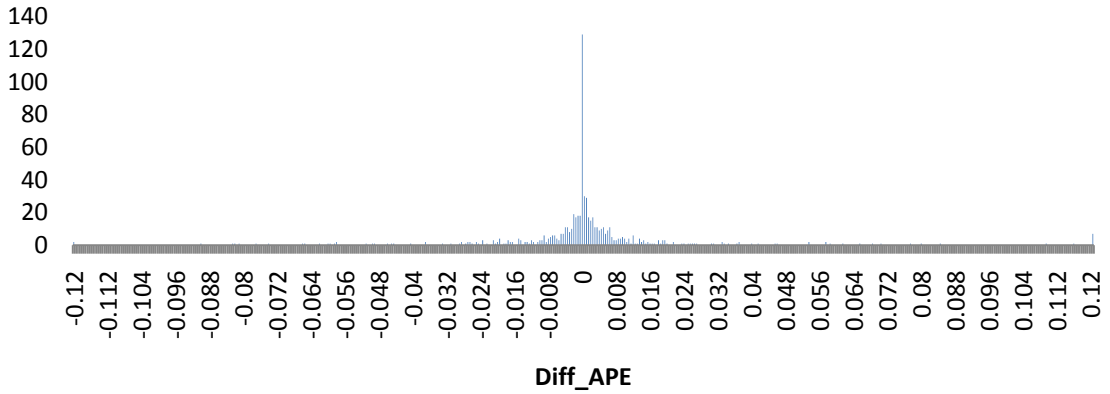
Figure 1: Full, winsorized, and truncated distributions of Diff_APE[H1]

Full Sample Histogram:



Winsorized Sample Histogram:



Truncated Sample Histogram:

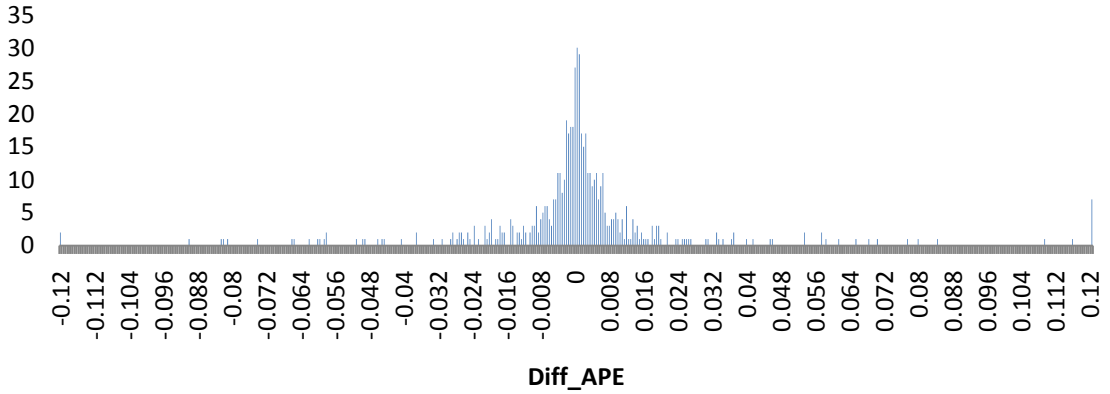


Table 1
Determination of final sample.

	Number of Firm/Years
MNCs disclosing data for at least two industry sales segments and two geographic sales segments during the years 1999 through 2004.[a]	2,352
Less: MNCs operating primarily in financial or utilities industries	(330)
Less: MNCs reporting geographic segments for operating segments	(297)
Less: two-segment MNCs with one non-specific geographic/industry segment	(540)
Less: MNCs with operating losses	(246)
Less: MNCs missing necessary Compustat data	(52)
Less: MNCs with cash paid for acquisitions scaled by total assets > 10% and any identified acquisitions that start new segments in the year prior to the forecast year.	(215)
Maximum firm-year observations	675
Less: MNCs with APE^{ind} or APE^{geo} >100 percent	103
Truncated sample observations	572

Table 2
Descriptive Statistics –Absolute and Signed Percentage Forecast Errors generated using Segment Sales Disclosure Information

	Full Sample	Winsorized sample	Truncated sample	Full Sample Signed Percentage Forecast Error	Winsorized Signed Percentage Forecast Error	Truncated Signed Percentage Forecast Error
	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)
$APE_{i,t+1}^{geo}$	0.7841 (0.2086)	0.3521 (0.2086)	**0.2354** ***(0.1608)***	0.1631 (-0.0471)	-0.0048 (-0.0471)	-0.0423 (-0.0574)
$APE_{i,t+1}^{ind}$	0.7862 (0.2125)	0.3524 (0.2125)	0.2368 (0.1645)	0.1610 (-0.0488)	-0.0060 (-0.0488)	-0.0436 (-0.0592)
$APE_{i,t+1}^{comb}$	0.7848 ***(0.2082)***	0.3523 ***(0.2082)***	0.2357 (0.1633)	0.1621 (-0.0451)	-0.0053 (-0.0451)	-0.0429 (-0.0561)
$APE_{i,t+1}^{RW}$	**0.6845** (0.2234)	**0.3515** (0.2234)	0.2454 (0.1821)	0.0376 (-0.1043)	-0.0721 (-0.1043)	-0.1102 (-0.1104)
N	675	675	572	675	675	572

$APE_{i,t+1}^{geo}$ ($APE_{i,t+1}^{ind}$) [$APE_{i,t+1}^{comb}$] is the absolute percentage forecast error for one year ahead operating income generated using geographic (industry) segment sales information and a consolidated profit margin. Growth expectations are based on the prior year segment sales growth ($APE^{Model\ A}$).
$APE_{i,t+1}^{RW}$ is the Absolute forecast error for one year ahead operating income generated using consolidated operating income and assuming a random walk process.
$APE_{i,t+1}^{PC}$ is the Absolute forecast error for one year ahead operating income generated using consolidated sales, a consolidated percentage change in prior year consolidated sales growth and a consolidated profit margin.

Table 3
Descriptive Statistics by Quintiles of the difference in Geographic Absolute Percentage Forecast Errors less Industry Absolute Percentage Forecast Errors ($Diff\_APE_{i,t+1}^{H1}$)

	$Diff\_APE_{i,t+1}^{H1}$						
Variable	**Average (Median)**		**Quintile 1**	**Quintile 2**	**Quintile 3**	**Quintile 4**	**Quintile 5**
$Diff\_APE_{i,t+1}^{H1}$	0.0011 (0.0001)		-0.0248 (-0.0174)	-0.0031 (-0.0026)	0.0002 (0.0001)	0.0035 (0.0033)	0.0297 (0.0154)
$APE_{i,t+1}^{ind}$	0.2375 (0.1645)		0.1994 (0.1296)	0.2109 (0.1374)	0.2495 (0.1359)	0.2435 (0.1739)	0.2801 (0.2221)
$APE_{i,t+1}^{geo}$	0.2350 (0.1608)		0.2262 (0.1589)	0.2140 (0.1400)	0.2493 (0.1357)	0.2400 (0.1703)	0.2475 (0.1917)
Assets	3804.46 (932.77)		2863.32 (689.72)	5485.95 (1701.06)	3453.85 (1242.36)	3494.25 (758.85)	3728.33 (686.50)
MVE	5376.98 (1073.96)		3488.41 (830.89)	8076.79 (1463.33)	4818.67 (1199.50)	5277.74 (1023.32)	5118.53 (736.66)
Sales	3521.81 (1006.24)		3019.55 (817.91)	4554.26 (1445.82)	3251.38 (1235.31)	3278.74 (947.65)	3507.38 (767.57)
EPS	1.17 (1.03)		1.16 (1.04)	1.38 (1.29)	1.09 (0.85)	1.17 (1.03)	1.03 (0.87)
Forpct	0.3693 (0.3645)		0.3791 (0.3299)	0.3686 (0.3791)	0.3513 (0.3474)	0.3600 (0.3741)	0.3850 (0.3609)
D_Seg	0.74 (1.00)	#	0.90 (1.00)	0.44 (1.00)	0.65 (1.00)	0.61 (1.00)	1.07 (1.00)
D_VarGrowth	0.0040 (0.0011)	#	-0.0006 (-0.0024)	-0.0024 (-0.0010)	0.0011 (0.0002)	0.0046 (0.0031)	0.0200 (0.0109)
No. of firms	307		95	100	96	98	94
No. of firm years	572		114	114	114	115	115

$Diff\_APE_{i,t+1}^{H1}$ is the average of the difference in each MNC's forecast generated using IND information and its forecast generated using GEO information ($APE_{i,t+1}^{ind} - APE_{i,t+1}^{geo}$); $APE_{i,t+1}^{seg}$ are as described in Table 2; Assets is total assets in millions (Compustat item Data6); MVE is Market Value of Equity in millions at the fiscal year end (Compustat item Data25 * Data199); Sales is Net Sales in millions (Compustat item Data12); EPS is Basic Earnings per Share excluding extraordinary items (Compustat item Data58); ForPct is the percentage of foreign sales to total sales for each firm-year; D_Seg is the difference between the number of geographic segments disclosed and the number of industry segments disclosed by the MNC; D_VarGrowth is a measure of the difference in the variance in segment sales growth within industry (Ind_VarGrowth) and geographic (Geo_VarGrowth) disclosures.
# Indicates significance at the 1% level.

Table 4
Difference in Absolute Percentage Forecast Errors generated using only Segment Sales Disclosure information ($Diff\_APE^{Model\ A}$)- Tests of H1, H2, and Benchmark Tests

Mean Difference Test	Non-Parametric tests		Paired T-Test	
Sample	Full Sample		Winsorized	Truncated
	Wilcoxon	Sign		
Panel A-Tests of H1:				
$Diff\_APE^{H1}$: $APE^{ind} - APE^{geo}$	+	+	0.0010 (0.94)	0.0011 (1.05)
Panel B- Tests of H2:				
$Diff\_APE^{H2a}$: $APE^{ind} - APE^{comb}$	+	+	0.0008 (1.35)	0.0010 (1.57)
$Diff\_APE^{H2b}$: $APE^{geo} - APE^{comb}$	+	-	-0.0002 (-0.38)	-0.0002 (-0.70)
Panel C- Benchmark tests:				
$Diff\_APE^{BM1}$: $APE^{geo} - APE^{con}$	+	- *	0.0015 (0.73)	-0.0001 (-0.05)
$Diff\_APE^{BM2}$: $APE^{ind} - APE^{con}$	+	-	0.0006 (0.90)	-0.0013 (-0.73)
$Diff\_APE^{BM3}$: $APE^{comb} - APE^{con}$	+	- *	0.0008 (0.87)	-0.0011 (-0.66)
N	675	675	675	573-576

$Diff\_APE^{H1}$ is the average difference in each MNC's forecast generated using industry segment information and its forecast using geographic segment information ($APE^{ind} - APE^{geo}$)
$Diff\_APE^{H2a}$ is the average difference in each MNC's forecast generated using industry segment information and its forecast using both industry and geographic segment information ($APE^{ind} - APE^{comb}$)
$Diff\_APE^{H2b}$ is the average difference in each MNC's forecast generated using geographic segment information and its forecast using both geographic and industry segment information ($APE^{geo} - APE^{comb}$)
$Diff\_APE^{BM\cdot}$ is the average difference in each MNC's forecast generated using industry, geographic, or both industry and geographic segment information and its most accurate forecast using consolidated information generated using a random walk (RW) or percentage change (PC) model ($APE^{geo} - APE^{con}$, $APE^{ind} - APE^{con}$, $APE^{comb} - APE^{con}$)
Segment based APEs are generated based on segment sales information and a consolidated profit margin (*Model A*)
Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).
Winsorized, and truncated sample results are provided for paired t-tests.
The Winsorized sample winsorises all absolute forecast errors greater than 100%.

The truncated sample omits all absolute forecast errors greater than 100%.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 5
Difference in Absolute Percentage Forecast Errors - Tests of segment forecast models generated using segment sales and earnings disclosure information versus models using only segment sales information

	Non-Parametric tests		Paired T-Tests	
	Wilcoxon	Sign	Winsorized	Truncated
$Diff\_APE^{H3}$: $\text{APE}^{Model\ B} - \text{APE}^{ModelA}$	+ ***	+	0.0138 (3.53)***	0.0091 (2.72)***
N	675	675	675	562

$Diff\_APE^{H3}$ is the average difference in each MNC's forecast generated using IND segment sales disclosure information and its forecast generated using IND segment sales and earnings information ($\text{APE}^{Model\ B} - \text{APE}^{ModelA}$)
Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).
Winsorized, and truncated sample results are provided for paired t-tests.
The Winsorized sample winsorises all absolute forecast errors greater than 100%.
The truncated sample omits all absolute forecast errors greater than 100%.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 6a
Difference in Absolute Percentage Forecast Errors generated using 'Perfect Forecast' external growth information in addition to segment sales information - Tests of H1, H2, and prior benchmarks

	Non-Parametric tests		Paired T-Test	
Sample	Full Sample		Winsorized	Truncated
	Wilcoxon	Sign		
Panel A-Tests of H1:				
$Diff\_APE^{H1}$: $APE^{ind} - APE^{geo}$	- ***	- ***	-0.0230 (-3.64)***	-0.0263 (-3.57)***
Panel B- Tests of H2:				
$Diff\_APE^{H2a}$: $APE^{ind} - APE^{comb}$	- ***	- ***	-0.0094 (-2.74***	-0.0109 (-2.72)***
$Diff\_APE^{H2b}$: $APE^{geo} - APE^{comb}$	+ ***	+ ***	0.0140 (4.43)***	0.0158 (4.34)***
N	196	196	196	167
Panel C- Benchmark tests:				
$Diff\_APE^{BM1}$: $APE^{geo} - APE^{con}$	+	-	-0.0016 (1.00)	-0.0021 (-1.16)
N	502	502	502	435
$Diff\_APE^{BM2}$: $APE^{ind} - APE^{con}$	- **	-	-0.0178 (-3.17)***	-0.0207 (-3.16)***
N	210	210	210	167
$Diff\_APE^{BM3}$: APE^{comb} - APE^{con}	- **	-	-0.0084 (2.74)***	-0.0090 (-2.75)***
N	196	196	196	167

$Diff\_APE^{H1}$ is the average difference in each MNC's forecast generated using industry segment disclosure information and its forecast using geographic segment information ($APE^{ind} - APE^{geo}$)
$Diff\_APE^{H2a}$ is the average difference in each MNC's forecast generated using industry segment information and its forecast using both industry and geographic segment information ($APE^{ind} - APE^{comb}$)
$Diff\_APE^{H2b}$ is the average difference in each MNC's forecast generated using geographic segment information and its forecast using both geographic and industry segment information ($APE^{geo} - APE^{comb}$)
$Diff\_APE^{BM\cdot}$ is the average difference in each MNC's forecast generated using industry, geographic, or both industry and geographic segment information and its most accurate forecast using consolidated

information generated using a random walk (RW) or percentage change (PC) model ($APE^{geo} - APE^{con}$, $APE^{ind} - APE^{con}$, $APE^{comb} - APE^{con}$)
Segment based APEs are generated using external information (IND information includes actual percent changes in industry shipment sales information. GEO information includes actual percent changes in NGDP and exchange rate for countries disclosed), segment sales disclosures, and a consolidated profit margin.
Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).
Winsorized, and truncated sample results are provided for paired t-tests.
The Winsorized sample winsorises all absolute forecast errors greater than 100%.
The truncated sample omits all absolute forecast errors greater than 100%.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 6b
Difference in Absolute Percentage Forecast Errors using ex-ante external growth information in addition to segment sales information - Tests of H1, H2, and prior benchmarks

	Non-Parametric tests		Paired T-Test	
Sample	Full Sample		Winsorized	Truncated
	Wilcoxon	Sign		
Panel A-Tests of H1:				
$Diff\_APE^{H1}$: $APE^{ind} - APE^{geo}$	-	-	0.0081 (1.44)	0.0089 (1.35)
Panel B- Tests of H2:				
$Diff\_APE^{H2a}$: $APE^{ind} - APE^{comb}$	+	-	0.0066 (2.36)**	0.0079 (2.43)***
$Diff\_APE^{H2b}$: $APE^{geo} - APE^{comb}$	+	+	-0.0008 (-0.28)	-0.0009 (-0.28)
N	272	272	272	232
Panel C- Benchmark tests:				
$Diff\_APE^{BM1}$: $APE^{geo} - APE^{con}$	+	-	0.0017 (0.85)	0.0015 (0.71)
N	503	503	503	435
$Diff\_APE^{BM2}$: $APE^{ind} - APE^{con}$	+ **	+	0.0151 (2.97)***	0.0156 (2.66)***
N	298	298	298	232
$Diff\_APE^{BM3}$: $APE^{comb} - APE^{con}$	+ ***	+	0.0088 (2.68)***	0.0090 (2.41)**
N	272	272	272	232

$Diff\_APE^{H1}$ is the average difference in each MNC's forecast generated using industry segment disclosure information and its forecast using geographic segment information ($APE^{ind} - APE^{geo}$)
$Diff\_APE^{H2a}$ is the average difference in each MNC's forecast generated using industry segment information and its forecast using both industry and geographic segment information ($APE^{ind} - APE^{comb}$)
$Diff\_APE^{H2b}$ is the average difference in each MNC's forecast generated using geographic segment information and its forecast using both geographic and industry segment information ($APE^{geo} - APE^{comb}$)
$Diff\_APE^{BM\cdot}$ is the average difference in each MNC's forecast generated using industry, geographic, or both industry and geographic segment information and its most accurate forecast using consolidated information generated using a random walk (RW) or percentage change (PC) model ($APE^{geo} - APE^{con}$, $APE^{ind} - APE^{con}$, $APE^{comb} - APE^{con}$)
Segment based APEs are generated using external information (IND information includes actual percent changes in industry shipment sales information. GEO information includes actual percent changes in

NGDP and exchange rate for countries disclosed), segment sales disclosures, and a consolidated profit margin.
Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).
Winsorized, and truncated sample results are provided for paired t-tests.
The Winsorized sample winsorises all absolute forecast errors greater than 100%.
The truncated sample omits all absolute forecast errors greater than 100%.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 6c
Difference in Absolute Percentage Forecast Errors- Tests of forecast models using only segment disclosure information versus forecast models using additional external information

	Non-Parametric tests		Paired T-Test	
	Wilcoxon	Sign	Winsorized	Truncated
Panel A: Sales Forecast vs. External Perfect forecast				
$Diff\_APE^{ind\_pf}$: $APE^{int} - APE^{ext\_pf}$	+ ***	+ **	0.029 (3.23)**	0.0201 (2.62)***
N	210	210	210	175
$Diff\_APE^{geo\_pf}$: $APE^{int} - APE^{ext\_pf}$	+	-	0.0024 (0.54)	-0.0032 (-0.71)
N	502	502	502	425
Panel B: Sales Forecast vs. External Ex-ante forecast				
$Diff\_APE^{ind\_ea}$: $APE^{int} - APE^{ext\_ea}$	+	-	-0.0013 (-0.20)	-0.0109 (-1.78)*
N	298	298	298	246
$Diff\_APE^{geo\_ea}$: $APE^{int} - APE^{ext\_ea}$	-	- *	-0.0006 (-0.13)	-0.0072 (-1.47)
N	503	503	503	426

$Diff\_APE^{ind}$ is difference in each MNC's forecast generated using only IND disclosure information (APE^{int}) and its forecast generated using IND disclosure information and external industry shipment sales information. ($APE^{ext\cdot}$). External forecasts are either based on perfect forecasts or ex-ante forecasts of the industry shipment sales information

$Diff\_APE^{geo}$ is difference in each MNC's forecast generated using only GEO disclosure information (APE^{int}) and its forecast generated using GEO disclosure information and external country specific NGDP and exchange rate information. ($APE^{ext\cdot}$). External forecasts are either based on perfect forecasts (APE^{ext_pf}) or ex-ante forecasts (APE^{ext_ea}) of the country specific information.

Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).

Winsorized, and truncated sample results are provided for paired t-tests.

The Winsorized sample winsorises all absolute forecast errors greater than 100%.

The truncated sample omits all absolute forecast errors greater than 100%.

*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 7
Pearson Correlations for Firm Characteristics Regression for truncated sample (N=572)

	$R\_Diff\_APE^{H1}$	*R_D_Seg*	*R_ForPct*
$R\_Diff\_APE^{H1}$	1		
R_D_Seg	0.0470 (0.2614)	1	
R_ForPct	-0.0157 (0.7074)	0.2509 (0.0001)	1

$R\_Diff\_APE^{H1}$ is a rank variable of difference in each MNC's forecast generated using IND information and its forecast generated using GEO information ($APE^{ind} - APE^{geo}$). The variable is transformed into a rank based on the simple rank divided by the number of sample observations minus one.
D_Seg is a rank variable of the difference between the number of geographic segments disclosed and the number of industry segments disclosed by the MNC. The variable is transformed into a rank based on the simple rank divided by the number of sample observations minus one.
R_ForPct is a rank variable of the percentage of foreign sales to total sales for each firm-year. The variable is transformed into a rank based on the simple rank divided by the number of sample observations minus one.

Table 8
Firm Characteristics Regression for Truncated sample using ranked variables

$$R\_Diff\_APE^{H1}_{i,t+1} = \alpha_0 + \beta_1 D\_Seg_{i,t} + \beta_2 R\_ForPct_{i,t} + \varepsilon_{i,t}$$

Intercept			0.5005 (15.96)	***
D_Seg			0.0236 (0.54)	
R_ForPct			-0.0270 (-0.62)	
N			572	
Adj. R Square			-0.0026	

$R\_Diff\_APE^{H1}$ is a rank variable of difference in each MNC's forecast generated using IND information and its forecast generated using GEO information ($APE^{ind} - APE^{geo}$).
R_D_Seg is a rank variable of the difference between the number of geographic segments disclosed and the number of industry segments disclosed by the MNC.
R_ForPct is a rank variable of the percentage of foreign sales to total sales for each firm-year.
All variables are transformed into a rank variable based on the simple rank divided by the number of sample observations minus one.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 9
Proportional analysis of the difference in the IND and GEO variance of segment growth ($D\_VarGrowth_{i,t}$) and the difference in IND and GEO APEs ($Diff\_APE^{H1}_{i,t+1}$)

Panel A: 2X2 Cell proportions

	$Diff\_APE^{H1}_{i,t+1}$ - Ind forecast error < Geo forecast error	$Diff\_APE^{H1}_{i,t+1}$ + Geo forecast error < Ind forecast error	Total
$D\_VarGrowth_{i,t}$- Ind variance > Geo variance	146 [Π_{ind}=59.8%]	98 [(1-Π_{ind})=40.2%]	244
$D\_VarGrowth_{i,t}$ + Geo variance > Ind Variance	128 [(1-Π_{geo})=39.0%]	200 [Π_{geo}=61.0%]	328
Total	274	298	572

Panel B: Tests of proportion and differences in proportion

H4c:	Z- Statistic	P-value
Π_{ind}=50%	3.17	0.0001
Π_{geo}=50%	4.06	0.0001
Π_{geo} + Π_{ind}=50%	5.20	0.0001

$Diff\_APE^{H1}$ is the average of the difference in each MNC's forecast generated using IND information and its forecast generated using GEO information ($APE^{ind} - APE^{geo}$).
D_VarGrowth is a measure of the difference in the variance in segment sales growth within industry and geographic disclosures.
Π_{ind} is the proportion of MNCs that have larger variance in IND growth than variance in GEO growth and have a more accurate IND forecast than GEO forecast.
Π_{geo} is the proportion of MNCs that have larger variance in GEO growth than variance in IND growth and have a more accurate GEO forecast than IND forecast.

Table 10
Difference in Absolute Forecast Errors after adjusting for mean reversion @ 80% of sample segment growth- Tests of H1, H2, and Benchmark Tests

Mean Difference Test	Non-Parametric tests		Paired T-Test	
Sample	Full Sample		Winsorized	Truncated
	Wilcoxon	Sign		
Panel A-Tests of H1:				
$Diff\_APE^{H1}$: $APE^{ind} - APE^{geo}$	-	+	-0.0005 (-0.57)	-0.0006 (-0.56)
Panel B- Tests of H2:				
$Diff\_APE^{H2a}$: $APE^{ind} - APE^{comb}$	-	+	-0.0001 (-0.19)	-0.0001 (-0.19)
$Diff\_APE^{H2b}$: $APE^{geo} - APE^{comb}$	+	-	0.0005 (0.90)	0.0005 (0.90)
Panel C- Benchmark tests:				
$Diff\_APE^{BM1}$: $APE^{geo} - APE^{con}$	-	-	-0.0004 (-0.40)	-0.0001 (-0.17)
$Diff\_APE^{BM2}$: $APE^{ind} - APE^{con}$	+	-	0.0002 (0.18)	0.0003 (0.29)
$Diff\_APE^{BM3}$: $APE^{comb} - APE^{con}$	+	-	-0.0003 (-0.33)	-0.0001 (-0.14)
N	675	675	675	587

$Diff\_APE^{H1}$ is the average difference in each MNC's forecast generated using industry segment disclosure information and its forecast using geographic segment information ($APE^{ind} - APE^{geo}$)
$Diff\_APE^{H2a}$ is the average difference in each MNC's forecast generated using industry segment information and its forecast using both industry and geographic segment information ($APE^{ind} - APE^{comb}$)
$Diff\_APE^{H2b}$ is the average difference in each MNC's forecast generated using geographic segment information and its forecast using both geographic and industry segment information ($APE^{geo} - APE^{comb}$)
$Diff\_APE^{BM\cdot}$ is the average difference in each MNC's forecast generated using industry, geographic, or both industry and geographic segment information and its most accurate forecast using consolidated information generated using a random walk (RW) or percentage change (PC) model ($APE^{geo} - APE^{con}$, $APE^{ind} - APE^{con}$, $APE^{comb} - APE^{con}$)
Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).
Segment based APEs are generated based on segment sales information and a consolidated profit margin (*Model A*)
All forecasts incorporating expected growth estimates include a mean reversion estimate which winsorizes all IND, GEO, or consolidated expected sales growth greater than the 80th percentile of each sample to equal the 80th percentile expected growth rate.

Winsorized, and truncated sample results are provided for paired t-tests.
The Winsorized sample winsorises all absolute forecast errors greater than 100%.
The truncated sample omits all absolute forecast errors greater than 100%.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 11
Difference in APEs after adjusting for macroeconomic shocks- Tests of H1, H2, and Benchmark tests

Mean Difference Test	Non-Parametric tests		Paired T-Test	
Sample	Full Sample		Winsorized	Truncated
	Wilcoxon	Sign		
Panel A-Tests of H1:				
$Diff\_APE^{H1}$: $APE^{ind} - APE^{geo}$	+	+	0.0012 (1.11)	0.0016 (1.26)
Panel B- Tests of H2:				
$Diff\_APE^{H2a}$: $APE^{ind} - APE^{comb}$	+	+ *	-0.0024 (-1.24)	0.0008 (1.09)
$Diff\_APE^{H2b}$: $APE^{geo} - APE^{comb}$	-	-	-0.0005 (-0.89)	-0.0006 (-0.90)
Panel C- Benchmark tests:				
$Diff\_APE^{BM1}$: $APE^{geo} - APE^{con}$	- *	- ***	-0.0076 (-1.54)	-0.0190 (-3.94)***
$Diff\_APE^{BM2}$: $APE^{ind} - APE^{con}$	- **	- ***	-0.0088 (-1.75)*	-0.0196 (-3.71)***
$Diff\_APE^{BM3}$: $APE^{comb} - APE^{con}$	- **	- ***	-0.0083 (-1.67)*	-0.0182 (-3.50)***
N	675	675	675	572

$Diff\_APE^{H1}$ is the average difference in each MNC's forecast generated using industry segment disclosure information and its forecast using geographic segment information ($APE^{ind} - APE^{geo}$)
$Diff\_APE^{H2a}$ is the average difference in each MNC's forecast generated using industry segment information and its forecast using both industry and geographic segment information ($APE^{ind} - APE^{comb}$)
$Diff\_APE^{H2b}$ is the average difference in each MNC's forecast generated using geographic segment information and its forecast using both geographic and industry segment information ($APE^{geo} - APE^{comb}$)
$Diff\_APE^{BM\cdot}$ is the average difference in each MNC's forecast generated using industry, geographic, or both industry and geographic segment information and its most accurate forecast using consolidated information generated using a random walk (RW) or percentage change (PC) model ($APE^{geo} - APE^{con}$, $APE^{ind} - APE^{con}$, $APE^{comb} - APE^{con}$)
Segment based APEs are generated based on segment sales information and a consolidated profit margin (*Model A*).
All test statistics are adjusted for an estimate of the annual macroeconomic shock experienced by all firms (See section 5.2.2).

Directional signs and significance are provided for the non-parametric Wilcoxon Signed Rank tests (Wilcoxon) and Fisher Sign tests (Sign).
Winsorized, and truncated sample results are provided for paired t-tests.
The Winsorized sample winsorises all absolute forecast errors greater than 100%.
The truncated sample omits all absolute forecast errors greater than 100%.
*/**/*** Indicates significance at the 10%, 5%, and 1% levels, respectively