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A NEW PERSPECTIVE ON A FUNDAMENTAL DEBATE: A MULTILEVEL APPROACH TO INDUSTRY, CORPORATE, AND BUSINESS UNIT EFFECTS

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We utilized a multilevel approach to both estimate the relative importance of industry, corporate, and business segment effects on firm performance, as well as to demonstrate how it enables the investigation of specific strategic factors within each class of effects. Our results confirmed previous findings suggesting that although business segment effects carry the most relative importance, industry and corporate effects are also important. Among the findings regarding specific factors, we found that industry concentration and munificence, as well as the resource environment provided by corporate parents, impact performance. These findings suggest that investigators should consider both industry and corporate environments when examining performance.

INTRODUCTION

Fundamentally, strategic management researchers seek to understand the determinants of firm performance. These determinants have importance both theoretically and practically. Theoretically, industrial economic and strategic management researchers have sought to support alternative views on the principal sources of firm performance differences (industries for the former and corporations and business units for the latter). This concern has led to a debate in the literature about the relative importance of industry, corporate, and business unit effects on firm performance. Since the seminal studies of Schmalensee (1985) and Rumelt (1991) on this issue, several scholars have entered the debate (Adner and Helfat, 2003; Bowman and Helfat, 2001; Brush and Bromiley, 1997; Brush, Bromiley, and Hendrickx, 1999; Chang and Singh, 2000; McGahan and Porter, 1997, 2002; Roquebert, Phillips, and Westfall, 1996). From a practical standpoint, the identification of the factors which most substantially contribute to firm performance would enable managers to focus their attention on influential factors rather than peripheral ones.

Despite the vast attention this line of inquiry has received, however, this literature offers varying conclusions about the relative contribution of each effect to firm performance (see Bowman and Helfat, 2001, for a comprehensive review). The

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equivocal nature of the evidence to date has been attributed by previous scholars to characteristics of the methodologies generally employed by studies in this research stream: variance components analysis (VCA) and analysis of variance (ANOVA) (Bowman and Helfat, 2001; Brush and Bromiley, 1997; Brush *et al*., 1999; McGahan and Porter, 2002). Although researchers have identified various issues specific to either of these methods, including the lack of reliability in the case of VCA (Brush and Bromiley, 1997) and the sequential ordering of effects in ANOVA (McGahan and Porter, 1997), both techniques assume that effects are generated independently, an assumption that does not appear to be met by the underlying theory or data (Bowman and Helfat, 2001; McGahan and Porter, 1997, 2002), and breaches of which may produce biased estimation (Brush *et al*., 1999). Addressing the relationships between effects thus remains one of the major issues confronting research in this line of inquiry (McGahan and Porter, 2002). Bowman and Helfat (2001) pointed to a second fundamental issue inherent in this past research. Specifically, both techniques only capture categorical effects (i.e., industry, corporate and business unit effects as a whole) and do not examine specific strategic factors within each effect. Identifying specific strategic factors within each class of effect that impact performance would not only provide an understanding of the impact that strategy has on performance (Bowman and Helfat, 2001), but would also have clear practical implications for managers. Thus, among other issues, the need to address the relation between industry, corporate, and business effects and to examine the influence of specific strategic factors on performance has led to a call for new approaches which can help advance this stream of research (Bowman and Helfat, 2001; Brush *et al*., 1999; McGahan and Porter, 2002).

In this paper, we offer the multilevel methodology of Hierarchical Linear Modeling (HLM; Bryk and Raudenbush, 1992; Raudenbush *et al*., 2000) as just such an approach. HLM represents an approach to analyzing data that attempts to address the non-independence between effects, and it also provides an effective means for the investigation of specific strategic factors within each class of effect. Moreover, although several multilevel statistical techniques and software packages are available (e.g., Goldstein, 1995; Rasbash and Woodhouse, 1995), the relative ease of use and accessibility of HLM (Hofmann, 1997) makes it attractive for strategic management researchers and practitioners. As such, the contribution of this paper and the research it reports is twofold. First, we used HLM to provide an assessment of the long-running debate as to the relative importance of industry, corporate, and business unit effects in a manner which more fully incorporates the non-independence between effects than previous methods. Our results find magnitudes of effects similar to previous studies using ANOVA (McGahan and Porter, 1997, 2002; Rumelt, 1991), and thus help to bring some closure to this debate. Business effects are by far of the greatest relative importance to firm performance, while both industry and corporate effects are of a lesser magnitude and of similar importance to each other. Additionally, our approach not only confirms the relation between industry and corporate effects (McGahan and Porter, 2002), but also estimates the size of this relationship. Second, we perform an exploratory analysis of a selection of specific strategic factors within each class of effect. This analysis demonstrates both how HLM can be used to examine the effect that strategy has on performance as well as its potential usefulness for practitioners. We performed both analyses utilizing a comprehensive sample of industries, corporations, and business segments covering the years 1984–99.

BACKGROUND

The fundamental debate driving research in this literature centers on the degree to which performance varies across business units, corporations and/or industries. From a classical viewpoint, the firm is envisioned as a single-business entity whose performance is fundamentally a function of the structural factors of the industry (i.e., seller concentration and barriers to entry; Bain, 1968) in which the firm competes. This viewpoint implies that the most pertinent variance occurs across industries and that industry effects are of primary importance to understanding performance. The 'managerial' (Schmalensee, 1985: 342) or 'business strategy' (Rumelt, 1991: 169) perspective, in contrast, emphasizes diversity in firms' capabilities and strategic approaches as the major determinant of the dispersion in profitability across firms. Thus, this latter perspective implies that variance in performance across firms is not solely the result of industry structural factors, but rather business unit (Rumelt, 1991; McGahan and Porter, 1997) and corporate (Adner and Helfat, 2003; Bowman and Helfat, 2001; Brush and Bromiley, 1997) characteristics are the most relevant to explaining firm performance.

A great deal of research has been devoted to discovering the relative importance of industry, corporate, and business unit factors in the determination of performance, but the results remain equivocal. As Table 1 shows,[1] past research presents industry effects that range from 4 percent (Rumelt, 1991) to 18.7 percent (McGahan and Porter, 1997), and corporate effects that range from 1.6 percent (Rumelt, 1991) to 17.9 percent (Roquebert *et al*., 1996). Results with regard to business unit effects also vary across studies, ranging from 31.7 percent (business segments; McGahan and Porter, 1997) to 44.2 percent (Rumelt, 1991). These variations in findings have largely been attributed to issues with the analytical techniques used to conduct this research—VCA and ANOVA (see Bowman and Helfat, 2001, for a comprehensive review; also McGahan and Porter, 2002). Although studies utilizing VCA (Schmalensee, 1985; Rumelt, 1991; McGahan and Porter, 1997) provided a crucial step forward in developing our understanding of the 'general importance of industry, corporate, and business effects on firm performance' (McGahan and Porter, 2002: 835), VCA has since been found to have several limitations, including issues surrounding interpretation, power and reliability (Bowman and Helfat, 2001; Brush and Bromiley, 1997; Brush *et al*., 1999). For example, Brush and Bromiley (1997) discovered that VCA parameter estimates vary considerably across Monte Carlo simulations with the same true parameters. The inconsistencies across previous VCA results, as shown in the first three columns in Table 1, are suggestive of the unreliability of the VCA analytic technique. Given these limitations with the VCA, recent research in this area has tended to rely more upon ANOVA (e.g., Adner and Helfat, 2003; McGahan and Porter, 2002), and as the last three columns of Table 1 indicate, ANOVA appears to produce more stable results than does VCA.

[1] Because this literature is comprehensively reviewed elsewhere (Bowman and Helfat, 2001; Brush *et al*., 1999; McGahan and Porter, 2002), for comparability purposes we focus here (and in Table 1) only upon a selection of studies which examine business unit ROA as a dependent variable.

Table 1. Results of previous studies assessing industry, corporate, and business unit effects[a]

	VCA			ANOVA		
	Rumelt (1991)[c]	McGahan and Porter (1997)[d]	Roquebert *et al*. (1996)[e]	Rumelt (1991)[f]	McGahan and Porter (1997)[g]	McGahan and Porter (1997)[h]
Source of data	FTC	Compustat	Compustat	FTC	Compustat	Compustat
Years covered	1974–77	1981–94	1985–91	1974–77	1981–94	1981–94
Sectoral coverage	Manuf.	All	Manuf.	Manuf.	All	All
No. of observations	10,866	58,132	16,596	10,866	58,132	58,132
% of total variance						
Year	0.1	2.4	0.4	0.1	0.3	0.3
Business unit[b]	44.2	31.7	37.1	41.4	35.1	34.9
Corporation	1.6	4.3	17.9	11.6	9.1	11.9
Industry	4.0	18.7	10.2	9.8	9.4	6.8
Industry–year covariance	5.3	N/A	2.3	6.8	N/A	N/A
Corporate–industry covariance	−0.0	−5.5	N/A	N/A	N/A	N/A
Error	44.8	48.4	32.0	30.4	46.1	46.1

[a] We focus here only upon studies which used business unit ROA as the dependent variable for comparability purposes.
[b] Business unit here refers to businesses, whether measured via business unit (FTC) or business segment data (Compustat).
[c] Results for sample B.
[d] Results for whole sample.
[e] Results for average across all samples
[f] Results of fixed-effects ANOVA for sample B, in which effects were added in the sequence of year, corporate parent, industry, business unit, and industry–year.
[g] Results of nested ANOVA where effects were added in the sequence of year, industry, corporate parent, and business unit.
[h] Results of nested ANOVA where effects were added in the sequence of year, corporate parent, industry, and business unit.

Two aspects of the ANOVA technique, however, have kept researchers from drawing definitive conclusions. First, because the order in which effects are entered into the statistical modeling may have a significant impact on the results found (Bowman and Helfat, 2001; Brush *et al.*, 1999), ANOVA presents difficulties for conclusively identifying the size of effects. Second, and more importantly, ANOVA (as does VCA) assumes independence between effects (Bowman and Helfat, 2001; Brush and Bromiley, 1997), an assumption thought not to be met (McGahan and Porter, 1997, 2002). As McGahan and Porter (2002: 838) assert, the 'strong covariance between industry and corporate-parent effects reported in McGahan and Porter (1997) suggests flaws in the assumptions required under both [VCA and ANOVA] approaches.' The study by McGahan and Porter (2002) thus employed a simultaneous ANOVA approach which takes a step toward incorporating the non-independence between effects. Although their 'study allocates the jointly determined variance between industry and corporate-parent effects,' however, the simultaneous ANOVA 'technique does not identify the structural relationships which may exist among industry and business-specific effects, and among corporate-parent and business-specific effects' (McGahan and Porter, 2002: 849). Thus, this inability of VCA and ANOVA to incorporate the relationships thought to exist between effects have in part led McGahan and Porter (2002: 850) to contend that 'while there are ways to continue to learn from this research, its limits suggest that the time has come to explore whole new approaches.'

Bowman and Helfat (2001) identified an additional characteristic common to both VCA and ANOVA which tends to inhibit progress in this line of research: VCA and ANOVA estimates of the relative sizes of industry, corporate, and business unit effects do not enable inferences about the importance of *strategy*. Because both techniques use dummy variables to estimate the size of each effect, estimates tend to represent the upper bounds of each class of effect, and thus most certainly reflect in part 'difficult-to-change and idiosyncratic factors unrelated to strategy' (Bowman and Helfat, 2001: 5). Such estimates certainly have shed some light on the relative impact of effects, as they demonstrate consistently the predominance of business effects. They have also contributed to the resulting focal debate about whether corporate effects have any impact at all (Rumelt, 1991; Schmalensee, 1985), matter a great deal (Bowman and Helfat, 2001; Brush and Bromiley, 1997), or whether both corporate and industry effects are important (McGahan and Porter, 2002). But, in order to truly understand the effect of strategy on performance, an understanding of the specific industry, corporate, and business unit strategic factors associated with superior performance must be the ultimate conceptual and practical goal (Bowman and Helfat, 2001)—and thus the next step in this line of research.

HLM presents an approach which is able to help address both of these issues. Specifically, HLM offers an alternative analytical technique for examining the relative size of industry, corporate, and business unit effects in a manner that attempts to address the lack of independence among these levels—an analysis to which we first turn. HLM also allows for the examination of specific strategic factors within each class of effect (i.e., industry, corporate, business), thus providing an effective means for research in this line of inquiry to move forward. We demonstrate this latter capacity through an exploratory investigation of a set of specific strategic factors following our analysis of the relative importance of effects.

AN ALTERNATIVE ASSESSMENT OF THE RELATIVE IMPORTANCE OF EFFECTS

The multilevel nature of firm performance variance

Rumelt (1991: 171) noted that 'both industries and corporations are considered to be sets of business-units,' and theory suggests that business units are nested, or 'embedded' (Granovetter, 1985), within both corporations and industries. Also, corporate hierarchies replace the market as a coordination mechanism across businesses when market governance is inefficient at attenuating opportunism (Williamson, 1975), or when corporate governance proves more efficient than markets given economies of scope (Teece, 1980, 1982). Similarly, although economic theory often treats business units as atomistic players, businesses are not truly thought to be independent from industries either, as reciprocal influence exists between industry conditions and firm conduct (Porter, 1980, 1991; Henderson and Mitchell, 1997). Corporations are not cleanly nested within industries (i.e., multi-business corporations), however, and industries are certainly not embedded within corporations. At the same time, though, corporations and industries are not independent of each other (McGahan and Porter, 2002: 838) as 'the covariance between industry and corporate-parent effects is potentially important because, for example, a diversified firm may be more likely to expand into particular types of industries.' Thus, industry, corporate, and business unit effects are not independent. Firm performance varies across industries, corporations, and businesses, and theory suggests that these 'levels' of variance are related in a nested manner such that business performance is cross-nested within corporations as well as industries.

This cross-nested structure of business performance variance, however, also includes performance variance across time. In other words, in explaining performance, *transient* (i.e., varying over time) effects must be distinguished from *stable* (i.e., time-invariant) effects (Rumelt, 1991). Accordingly, most studies investigating the relative size of industry, corporate, and business effects have incorporated variance over time into their analyses, and have tried to capture year effects, or the 'general impact of macroeconomic fluctuations in business activity' (McGahan and Porter, 2002: 839; McGahan and Porter, 1997; Roquebert *et al*., 1996; Rumelt, 1991). Some researchers have also attempted to examine transient industry effects (e.g., Rumelt, 1991; Roquebert *et al*., 1996) or the persistence of incremental industry, corporate, and business-specific effects (McGahan and Porter, 1999).

In sum, firm performance varies across time, between businesses, between corporations, and between industries, and the relationships between these levels are of a nested nature—observations across time are nested within businesses, and businesses are cross-nested within both corporations and industries. Given this theoretical context, we now employ the cross-nesting multilevel technique presented by Raudenbush (1993), which utilizes HLM (Bryk and Raudenbush, 1992), to empirically examine the relative importance of industry, corporate, and business unit effects.

Data and sample

All data for the following analyses were obtained from the Compustat segments database, which identifies the corporations, as well as the primary and secondary industries, in which business units operate. We followed previous research to define business units, corporations and industries: similar to previous studies in this research stream that have relied upon Compustat (e.g., McGahan and Porter, 1997, 2002), we used *business segments* in lieu of business units; *corporate* or *corporate-parent* denotes a company that operates one or more business segments (e.g., Rumelt, 1991) and were assigned to each business segment as reported in Compustat; and, a business segment's *Industry* membership was based upon its primary 4-digit SIC code reported in Compustat (e.g., McGahan and Porter, 1997, 2002). Annual business segment performance was calculated as the ratio of operating income to identifiable assets expressed as a percentage value (ROA, hereafter) (e.g., McGahan and Porter, 1997, 2002).

Our total initial sample consisted of 227,240 observations of yearly individual business segment performance for the years 1980–99. We then screened the data following the criteria and steps reported by McGahan and Porter (1997). From our original total, we dropped: 3891 records that did not contain a primary SIC designation; 300 business segments with a primary SIC code in the 9000s ('not elsewhere classified,' 'non-classifiable establishments,' and 'government, excluding finance'); 27,299 records designated as 'depository institutions' (following McGahan and Porter's, 1997, reasoning that these institutions' returns are not comparable with those of other industries); 65,565 business segments for having assets and/or sales of less than \$10 million; 8226 business segments for which our data contained only one observation; and 3280 business segments that were the only business segment in their industry in a given year. Although not discussed in McGahan and Porter (1997), we treated business segments which changed industries (identified by their primary SIC code) during the observation period as new business segments for every industry they entered. After our initial screening, we performed two additional steps. First, to meet the specifications of the statistical technique (i.e., for inferences to be made, the data must be a random sample and not the population), we chose a stratified random sample of 85 of the 850 industries in the original sample.[2] Second, the years 1980–83 were dropped from the analysis as data were no longer available for several of the specific strategic factors that we explored for these years. All of these steps yielded a final sample for the following analyses of 10,633 observations of business segment ROA across time for the years 1984–99, 2055 business segments, 1512 corporations, and 76 industries.

Analysis and results

The HLM analysis involved the estimation of a series of equations which nest observations of business segment ROA across time within business units, and cross-nests business segments within both corporations and industries.[3] First, an unconditional (no predictors) three-level model is estimated. This model partitions the variation in business segment ROA as it is allocated across time, business segments, and corporations. At the first level of analysis, business segment ROA at each time period is modeled as a function of business segment mean ROA plus a random error:

$$Y_{tij} = \pi_{0ij} + e_{tij} \tag{1a}$$

where the indices t, i, and j denote time, business segments, and corporations, respectively and there are

$t = 1, 2, \ldots, T_{ij}$ time periods within business segment i in corporation j;
$i = 1, 2, \ldots, I_j$ business segments within corporation j; and
$j = 1, 2, \ldots, J$ corporations

and Y_{tij} is the business segment ROA at time t in business segment i in corporation j; π_{0ij} is the mean ROA (across time) of business segment i in corporation j; and the time-level random error, which represents variance *across time*, is captured by e_{tij}. The model assumes that e_{tij} is distributed normally, with a mean of zero and variance of σ^2, and thus variance across time is represented by σ^2. This variance is only assumed to be uniform among the observations within each of the i business segments.

At the second level of analysis, the business segment mean ROA over time, π_{0ij}, is simultaneously modeled as an outcome varying randomly around some corporation mean:

$$\pi_{0ij} = \beta_{00j} + r_{ij} \tag{1b}$$

where β_{00j} is the mean ROA of the business segments in corporation j; and this level models its own random *between-business* residual, r_{ij}, which represents between-business variance. It is assumed that r_{ij} is normally distributed, with a mean of zero and variance of τ_π, so between-business variance is represented by τ_π. The model only assumes that this variability is common across business segments within each of the j corporations.

At the third level of analysis, the intercept of the business-level model, β_{00j}, is simultaneously modeled as an outcome varying randomly around a grand mean:

$$\beta_{00j} = \gamma_{000} + \mu_j \tag{1c}$$

This level examines *between-corporation* variance, where γ_{000} represents the grand mean of business segment ROA, and this level also has its own random *between-corporation* residual, μ_j. Here it is assumed that μ_j is normally distributed with mean zero and variance τ_β; thus between-corporation variance is represented by τ_β.

The cross-nesting of industry effects on business segment performance is estimated by incorporating these effects at the business level of analysis as

[2] This stratification ensured that the industries contained in the sample were representative of the population. The following results with respect to the relative importance of effects are robust to two additional random samplings.

[3] Although 'hierarchical' and 'nested' are commonly used terms in the ANOVA methodology, their meaning is somewhat different there from their meaning in HLM. In ANOVA, 'hierarchical' and 'nested' refer to the examination of the sequential incremental improvement in the fit of the statistical model (i.e., changes in R^2 associated with each categorical effect) utilizing a Type I sums of squares approach (i.e., including variation that is unique to the effect in question, accounting only for the effects that precede it in the model). In other words, effects in ANOVA are referred to as 'nested' because the results of the statistical analysis are dependent upon the effects preceding them, which are analyzed through a stepwise ('hierarchical') regression process. In contrast, 'nesting' and 'hierarchical' in HLM refer to the recognition of a relationship between effects—in HLM, effects have an embedded, or 'nested', relationship in the sense of 'belonging within,' or 'being a member of.' 'Hierarchical' in HLM refers to its simultaneous estimation of the hierarchy of the phenomena's levels of analysis, which partitions variance between these levels (i.e., each has its own residual—see Equations 1a–c) and uses a 'direct solution' in its Type III sums of squares approach (significance tests include variation that is unique to an effect after adjusting for all other effects that are included in the model, regardless of the level of analysis).

shown in Equation 2:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(\text{Year})_{tij} + e_{tij} \tag{2}$$
$$\pi_{0ij} = \beta_{00j} + \beta_{01j}(\text{Industry})_{ij} + r_{ij}$$
$$\beta_{00j} = \gamma_{000} + \mu_j$$

where β_{01j} represents the effect of industry membership on mean business segment ROA (i.e., stable industry effects), where Industry is a matrix of dummy variables capturing the industry membership of business segment i in corporation j; and β_{00j} now is the mean ROA of the business segments in corporation j adjusted for industry effects. Year effects may also be estimated through their incorporation at the time level of analysis as shown in Equation 2, where π_{1ij} represents year effects (i.e., the impact of macroeconomic fluctuations in business activity), where Year is a matrix of dummy variables coded for each of the years included in the study for each business segment i in corporation j; and π_{0ij} now represents mean business segment ROA (across time) for business segment i in corporation j adjusted for year effects. Y_{tij}, e_{tij}, r_{ij}, γ_{000}, μ_j are all as described above.

The unconditional model (Equations 1a through 1c) and Equation 2 are used to examine the amount of variance attributable to each type of effect. First, the unconditional modeling partitions the total variance in performance into three components: across time, σ^2; between business segments, τ_π; and between corporations, τ_β, and a chi-squared test is used to determine whether there is significant variance across business segments and across corporations. The amount of total variance attributable to each level is calculated as follows: $\sigma^2/(\sigma^2 + \tau_\pi + \tau_\beta)$ is the proportion of variance across time; $\tau_\pi/(\sigma^2 + \tau_\pi + \tau_\beta)$ is the proportion of variance between business segments; and $\tau_\beta/(\sigma^2 + \tau_\pi + \tau_\beta)$ is the proportion of variance between corporations. The results of the estimation of the unconditional model for the current data are reported in the top panel of Table 2. The proportion of total variance in business segment ROA which occurs across time is 48.6 percent, variance between business segments is 40.2 percent ($p < 0.001$), and variance between corporations is 11.2 percent ($p < 0.001$).

Second, the total variance explained by year effects is calculated by first entering these effects at the time level in Equation 2 (i.e., a reduced Equation 2—without the industry effects), and comparing the time-level variance estimated in this reduced model of Equation 2 with that estimated in the unconditional model. As reported in the middle panel of Table 2, year effects account for 0.8 percent of the total variance in business

Table 2. HLM estimations of variance

	Variance estimate	d.f.	χ^2	p-value
Unconditional model				
Level 1 variance (across time), e_{tij}	0.01669			
Level 2 variance (between business-segments), r_{ij}	0.01379	543	5392.63	0.000
Level 3 variance (between corporations), u_j	0.00383	1511	1940.00	0.000
Percentage of total variance across time	48.6%			
Percentage of total variance between business segments	40.2%			
Percentage of total variance between corporations	11.2%			
Model incorporating year effects at Level 1				
Level 1 variance (across time), e_{tij}	0.01642			
Level 2 variance (between business-segments), r_{ij}	0.01 400	543	5402.50	0.000
Level 3 variance (between corporations), u_j	0.00 398	1511	1948.50	0.000
Total variance explained by year effects	0.8%			
Model incorporating year effects at Level 1 and industry effects at Level 2				
Level 1 variance (across time), e_{tij}	0.01645			
Level 2 variance (between business-segments), r_{ij}	0.01 276	473	5733.24	0.000
Level 3 variance (between corporations), u_j	0.00 257	1511	1822.05	0.000
Total variance explained by industry effects	7.6%			

segment ROA (calculated as $[\sigma^2_{\text{unconditional model}} - \sigma^2_{\text{reduced model of Equation 2}}]/[\sigma^2 + \tau_\pi + \tau_\beta]_{\text{unconditional model}}$).

Third, as can be seen in Equation 2, the cross-nesting of industry effects involves the introduction of these effects at the business level, and may potentially account for both between-business and between-corporate variance (since as explained above, the intercept at the business level, β_{00j}, which is also modeled as the outcome at the corporate level, represents mean ROA of the business segments in corporation j, adjusted for industry effects). Thus, industry effects are calculated through examining the reduction of variance at the business and corporate levels as a proportion of total variance that occurs when industry effects are included. This is done by comparing the estimation of the complete model of Equation 2 (as reported in the bottom panel of Table 2) with the previous estimation of the reduced model of Equation 2 used to estimate year effects (middle panel of Table 2). Industry effects account for 7.6 percent of the total variance in business segment ROA (calculated as $[\tau_{\pi\ \text{reduced Equation 2}} - \tau_{\pi\ \text{complete Equation 2}}]/[\sigma^2 + \tau_\pi + \tau_\beta]_{\text{reduced Equation 2}}$).

Finally, business segment and corporate effects are then calculated by adjusting the between-business segments variance and the between-corporations variance estimated in the unconditional model by the industry and year effects estimated by Equation 2. Business segment effects are estimated to be 36.6 percent, calculated by reducing the total amount of variance attributable between business segments estimated in the unconditional model by the amount of this variance explained by industry effects. Corporate effects are estimated to be 7.2 percent, again calculated by reducing the total amount of variance attributable between corporations estimated in the unconditional model by the amount of this variance explained by industry effects. Similarly, the amount of variance attributable across time after accounting for year effects was calculated by reducing the total amount of variance attributable across time estimated in the unconditional model by the amount of this variance explained by year effects.

Column 1 of Table 3 summarizes the final results of our HLM estimation of the percentage of total variance in business segment ROA attributable to each effect. A comparison of our results with previous studies using ANOVA, also presented in Table 3, reveals several points. First, it is clear that stable business segment effects consistently account for more variance than do stable industry or corporate effects. Our results, for example, suggest that just over one third of the total variance in business segment ROA occurs between businesses (36.6%)—and this result, as Table 3 shows, is very similar to previous findings of studies using ANOVA. Our findings also suggest that the proportion of total variance explained by stable differences across corporations and industries are very similar to each other (7.2 percent and 7.6 percent, respectively), a result generally similar to previous findings (see Table 3). Following the recommendation of Brush and Bromiley (1997) (see also Brush *et al.*, 1999: 539–541), we examined the relative importance of these effects based upon the square roots of the estimated variances. The percentages attributable to each effect based upon these square roots are reported for our analysis in parentheses in column 1 of Table 3, and these results show that the relative importance for corporate and industry effects are 13.9 percent and 14.3 percent, respectively, yielding a corporate-to-industry ratio of 0.97 : 1 (i.e., corporate and industry effects are of approximately the same relative importance). As Table 3 also shows, the relative importance of business segment effects is 31.3 percent, and comparing this to corporate and industry effects suggests ratios of 2.25 : 1 and 2.19 : 1, respectively. In other words, it appears that the relative importance of business segment effects is approximately twice as great as that of either corporate or industry effects. In general, then, given the consistency between our findings and those of previous studies using ANOVA, it appears that stable industry and corporate effects are of similar relative importance, but that this importance is far outweighed by stable business segment effects.

Second, one of the benefits of the cross-nesting approach is that it sheds light on the covariance, or relation, between these effects, an issue of great importance in this research stream (McGahan and Porter, 1997, 2002; Rumelt, 1991). As discussed above, the 7.6 percent of the total variance in business segment ROA accounted for by stable industry effects is a combination of variance explained both between businesses as well as between corporations. A comparison of the results from the estimations of the reduced and

Table 3. Comparison of final HLM results with selected previous studies[a]

	Final HLM Results[c]	McGahan and Porter (2002)[d]	McGahan and Porter (1997)[e]	Rumelt (1991)[f]
Source of data	Compustat	Compustat	Compustat	FTC
Years covered	1984–99	1981–94	1981–94	1974–77
Sectoral coverage	All	All	All	Manuf.
No. of observations	10,633	72,742	58,132	10,866
% of total variance				
Year	0.8 (4.6)	0.8	0.3	0.1
Industry	7.6 (14.3)	9.6	9.4	10.3
Corporation	7.2 (13.9)	12.0	9.1	10.9
Business segment[b]	36.6 (31.3)	37.7	35.1	41.3
Time	47.8 (35.8)			
Error		39.9	46.1	37.4

[a] Given the unreliability issues associated with VCA (Brush and Bromiley, 1997), we only compare our results to studies which have used ANOVA on the dependent variable of business unit ROA. Because the study by McGahan and Porter (2002) only reported results where effects were sequentially ordered as year, industry, corporate parent, and business unit, the results of the McGahan and Porter (1997) and Rumelt (1991) studies reflect the same sequence. Table 1 contains the results reflecting the alternative sequencing for the Rumelt (1991) and McGahan and Porter (1997) studies (i.e., year, corporate parent, industry, and business unit).
[b] We use business segment to refer to businesses, whether measured via business unit (FTC; Rumelt, 1991) or business segment data (Compustat; current study; McGahan and Porter, 1997, 2002).
[c] Because the relative importance of effects is not linearly related to the percentage of variance explained, Brush and Bromiley (1997) recommend using the square roots of the variance estimates when evaluating relative importance. Thus, in addition to reporting the percentage of the total variance attributable to each effect (which is reported for all studies), for our study we also report in parentheses the percentages attributable to each effect based upon the square roots of the estimated variances (see Brush *et al.*, 1999: 539–540).
[d] Results of nested ANOVA in which effects were added in the sequence of year, industry, corporate parent, and business unit.
[e] Results of nested ANOVA where effects were added in the sequence of year, industry, corporate parent, and business unit.
[f] Results of fixed effects ANOVA on sample B, where effects were added in the sequence of year, industry, industry–year, corporate parent, and business unit. The industry–year effect was 7.1, and is included here as part of Error.

complete models of Equation 2 (reported in the middle and bottom panels of Table 2, respectively) suggests that 3.6 percent of the total variance explained by industry effects occurs at the between-business segments level,[4] and the other 4 percent of the total variance accounted for by industry effects is attributable to between corporations. Thus, these results not only confirm previous scholars' contentions (McGahan and Porter, 1997, 2002; Rumelt, 1991) that industry and corporate effects do indeed co-vary, but they also suggest that the effect that stable industry factors have on business performance occurs both through affecting between-business and between-corporate differences.

Third, our findings regarding the impact of macroeconomic fluctuation in business activity, as captured by year effects, are also consistent with previous research, accounting for a very small proportion of the total variance (0.8%, see Table 3). Our results also suggest, however, that a substantial amount of the total variance in business-segment ROA (47.8%) occurs across time. Indeed, as the results in Table 3 suggest, this time effect is of similar relative magnitude to that of stable business segment effects (35.8% vs. 31.3%, or a time-to-business segment ratio of 1.14 : 1). As Table 3 also shows, the proportion of variance

[4] By comparing the middle and bottom panels of Table 2, the amount of variance attributable to each level can be calculated as follows: because the amount of the total variance attributable between business segments is 40.2 percent and industry effects explain 8.9 percent of this variance between business segments ($[\tau_{\pi \text{ reduced Equation 2}} - \tau_{\pi \text{ complete Equation 2}}]/\tau_{\pi \text{ reduced Equation 2}}$), they explain 3.6 percent of the total variance (0.402*0.089). Likewise, since industry effects explain 35.4 percent of between-corporate variance ($[\tau_{\beta \text{ reduced Equation 2}} - \tau_{\beta \text{ complete Equation 2}}]/\tau_{\beta \text{ reduced Equation 2}}$), this accounts for 4 percent of the total variance (0.112*0.354).

attributable across time is similar in size to that of the 'error' reported by previous studies. That this previously reported 'error' represents variance across time was well established in previous research—Rumelt recognized that, although the error terms in his analyses 'have been named error, they may equally well be thought of as year-to-year variations' (Rumelt, 1991: 173). But, because research in this literature has consistently treated this variance across time as 'error,' the performance variance potentially attributable to transient factors has essentially been relegated to 'unexplained variance' and hence a relatively neglected part of analyses. For example, Adner and Helfat (2003: 1012) argue that 'the omission of the time-varying dimension of the corporate effect hampers our ability to fully understand the effect of corporate strategy' and find that corporate downsizing decisions over time have an effect on performance. The HLM approach, by explicitly recognizing variance across time as such, helps to refocus attention to the fact that this residual may potentially be explained by factors that vary over time. In the next section, we demonstrate how HLM can be used to examine several specific time-varying factors that may potentially explain performance variance over time.

Before turning to the next analysis, however, one additional issue warrants discussion. Although theoretically it would be just as reasonable to have industries enter the estimation as depicted in Equation 1c and corporations enter the estimation as shown in Equation 2, cross-nested estimation (Lindley and Smith, 1972; Raudenbush, 1993) requires that the cross-nesting factor with the larger n (in this case corporations, $n = 1512$) be incorporated through Equation 1c with the cross-nesting factor with the smaller n (in this case industries, $n = 76$) entering the estimation as in Equation 2. The implication of this is that while the present approach captures the theoretically cross-nested nature of the phenomena, and methodologically its partitioning of variance to that attributable across time, between businesses and between corporations recognizes the non-independence between these particular effects, a separate residual term for industries is not estimated. In other words, despite the direct examination of the relationship between industries and businesses in HLM just discussed, an assumption that industry effects are generated independently from business effects is still somewhat present,[5] because industry effects enter the estimation as a categorical variable in the regression. Thus, one limitation of this approach is that the non-independence between business segment and industry effects is not fully incorporated.

Given this limitation, we estimated an alternative unconditional model where business segments are nested directly within industries in an attempt to assess the impact that this assumption violation has on the results. In other words, we estimated an unconditional model similar to Equations 1a–c above, but with industries (instead of corporations) modeled in Equation 1c, offering an assessment of the magnitude of industry effects with their non-independence to business segments incorporated. The results of this alternative specification are

[5] The robust standard errors automatically generated by HLM, a result of a generalized estimating equations analysis (GEE), should adequately account for any departure from the independence assumptions of the variance–covariance matrix (Raudenbush *et al.*, 2000) presented by the incorporation of industry effects into the regression. The limitation of the cross-nested HLM approach in the current study then is that the non-independence between industry and business effects is not directly incorporated into the estimation—an issue we now attempt to examine.

Table 4. Results of the estimation with business segments nested within industries

	Variance estimate	d.f.	χ^2	p-value
Unconditional model				
Level 1 variance (across time), e_{tij}	0.01576			
Level 2 variance (between business-segments), r_{ij}	0.01 489	1984	6620.64	0.000
Level 3 variance (between industries), u_j	0.00 244	70	261.85	0.000
Percentage of total variance across time	47.6%			
Percentage of total variance between business-segments	45.0%			
Percentage of total variance between industries	7.4%			

reported in Table 4. As Table 4 shows, the proportion of the total variance in business segment ROA attributable to between industries in this alternative estimation is 7.4 percent ($p < 0.001$) (compared to 7.6% in our original estimation). While this is a rather imperfect assessment—a more perfect one would also incorporate corporate effects, but this is not possible methodologically as industry and corporate effects cannot be interchanged in the cross-nested modeling (as discussed above)—the results of this alternative estimation are suggestive of the robustness of the cross-nested modeling despite its inability to directly incorporate the non-independence between business segment and industry effects.

Beyond providing an alternative assessment of the long-running debate about the relative importance of industry, corporate, and business unit effects, perhaps more importantly HLM offers strategic management researchers the ability to examine specific strategic factors within each class of effects which may determine business-segment performance—and therefore whether and how *strategy* matters. We now turn to a demonstration of how HLM can be utilized for such inquiries.

USING HLM TO EXAMINE SPECIFIC STRATEGIC FACTORS

Our intent in performing the following analysis is to demonstrate how a multilevel approach can be used to examine specific strategic factors at their appropriate levels of analysis, whether they are industry, corporate or business unit characteristics. As such, the following analysis is purposefully exploratory in nature. In the tradition of this research stream, our intention is not one of hypothesis testing but instead to examine how the method can be utilized to assess the effects that specific strategic factors have on business unit performance (e.g., Schmalensee, 1985; Rumelt, 1991; McGahan and Porter, 1997). As such, our selection of factors to examine was primarily guided by issues within this literature. For one, our results above, in combination with previous evidence in this research stream (e.g., McGahan and Porter, 2002), suggest that the industries and corporate parents in which business segments are embedded serve as environments which affect business segment profitability. Thus, we selected several theoretically relevant factors representing industry and corporate environmental characteristics. Second, a major issue in this research stream has centered upon whether there are performance differences between multibusiness and single-business corporations (Bowman and Helfat, 2001), and thus we also examine this question. Data were collected from the Compustat database on all measures for the industries, corporations, and business segments used in the preceding analysis, and thus also reflect the years 1984–99.

Measures

To represent industry factors, we measured seller concentration, capital intensity, munificence, and dynamism. The seller concentration and barriers to entry present in an industry are both associated with reduced competition and higher profitability (Bain, 1968; Porter, 1980). *Industry Concentration* (*indCR4*) was measured as the four-firm concentration ratio in each industry for each year, a commonly used measure of concentration in industrial economic studies (Hay and Morris, 1979). *Industry Capital Intensity* (*indCAP*) is commonly used in industrial organizational economics as a measure of the barriers to entry existing in an industry (Bain, 1968) and was measured as the average of the ratio of the net value of property, plant and equipment to net sales (Hay and Morris, 1979) across all firms in each industry for each year. *Industry Munificence* (*indMUN*), which reflects environments' capacity to support growth given an abundance of resources (Dess and Beard, 1984), is thought to be positively related to profitability as competition tends to be more relaxed in high-growth industries than in slow-growth, or more mature, industries (Caves, 1977; Porter, 1980). It was calculated for each year by first regressing the annual average sales in each industry over the 5 years which contained the focal year as a midpoint (i.e., industry munificence for 1995 is based on the regression of sales for the years 1993–97). The regression slope coefficient obtained from this regression was then divided by the mean value of the sales for those years (to adjust for absolute industry size) (Dess and Beard, 1984). *Industry Dynamism* (*indDYN*) reflects the instability or volatility present in the industry environment (Dess and Beard, 1984) and has been found to be negatively associated with firm performance (Keats and Hitt, 1988). It was measured as the dispersion about the regression line estimated in the regressions used in arriving at the munificence variable just described, by dividing the standard error of the regression slope coefficient by the mean value of sales (Dess and Beard, 1984).

To somewhat parallel the industry environment factors we included, we measured the following corporate strategic factors: corporate capital intensity, corporate resource availability, and the instability of corporate resource availability. *Corporate Capital Intensity* (*crpCAP*), which may have a negative impact on business segment performance as it constitutes potential structural inertia (Hannan and Freeman, 1977), was measured for each corporation in each year as the ratio of the net value of property, plant, and equipment to net sales. Business segment performance should also be greatly affected by the resource abundance/scarcity afforded them by their parent corporations, as corporate parents with abundant resources are better able to absorb a substantial share of the potential variability in the business unit's environment (Cyert and March, 1963). Thus, *Corporate Resource Availability* (*crpSLACK*) was measured as the ratio of working capital to net sales (Bourgeois, 1981) for each year and is expected to be positively related to profitability. The instability of the resources provided by corporate parents, or *Corporate Resource Variability* (*crpSLACKVAR*), expected to be negatively associated with profitability, was calculated as the coefficient of variation across the years included in the study for each corporation in the corporate resource availability measure just described. Since the number of years included differs across corporations, and such differences may adversely affect conventional calculations of the coefficient of variation, we followed the procedure outlined in Bedeian and Mossholder (2000) designed to adjust for such differences.

In order to examine the impact that multibusiness corporations have on performance, we measured *Corporate Diversification* with a categorical variable (*crpMvsS*) which distinguished multi-business corporations (dummy = 1) from single-business corporations (dummy = 0), where multi-business corporations were defined as those corporations which operated two or more business segments at any point in time during the study period. In total, 58 percent of the corporations in our sample operated multiple businesses at some point during the study period, and nearly one quarter of these multi-business corporations operated only a single business for at least part of the study period.

Finally, we included a measure of *Business Segment Size* (*bsSIZE*), calculated by taking the natural log of business segment net sales for each year, as firm size is a standard measure included in most examinations of the determinants of firm performance.

Analysis and results

The initial step of our examination of whether these strategic factors are associated with business segment performance involved the determination of the appropriate level of aggregation for each variable. In other words, it was first necessary to determine whether each specific factor should most appropriately enter the analysis as a transient factor (i.e., observations of the variable in each year entering the estimation to potentially explain performance across time), a stable factor (i.e., the average of the observations over time of the variable entering the estimation to potentially explain cross-sectional variance between corporations or business segments), or both (which is possible in HLM; Hoffman, Griffin, and Gavin, 2000). This was accomplished through intra-class correlation (ICC) analyses, which allow the investigator to determine whether aggregation of variables is justified (James, 1982; Bliese, 2000). In the current case, an ICC(1) analysis is used to examine the amount of variance in each measure which occurs across time (i.e., potential to have *transient effects*) as well as that which occurs in a cross-sectional manner (i.e., potential to have *stable effects*), and HLM provides a significance test of this cross-sectional variance. An ICC(2) analysis then estimates the reliability of the aggregate measure (Bryk and Raudenbush, 1992; Bliese, 2000).

The results of our ICC analyses are presented in Table 5. Although the cross-sectional variance is significant for all variables, the ICC(1) and ICC(2) analyses suggest that an aggregation of the *Industry Capital Intensity* and *Industry Munificence* variables is not warranted. The results of the ICC(1) analyses show that only 8.4 percent and 10.8 percent of the variance in these variables (respectively) occurs between industries, which remains quite small (Bliese, 2000). Furthermore, the reliability (ICC(2)) of the aggregate measures is also relatively low (0.595 and 0.66, respectively). Put differently, these two industry factors

Table 5. Intra-class correlations (ICC) of relevant variables

Variable	Variance across time	Cross-sectional variance	ICC(1)	ICC(2)
Industry Capital Intensity (indCAP)	10.980	1.010***	0.084	0.595
Industry Concentration (indCR4)	0.012	0.032***	0.721	0.976
Industry Munificence (indMUN)	0.024	0.003***	0.108	0.660
Industry Dynamism (indDYN)	0.002	0.001***	0.391	0.912
Corporate Capital Intensity (crpCAP)	0.098	0.585***	0.857	0.959
Corporate Resource Availability (crpSLACK)	0.071	0.227***	0.761	0.927
Business Segment Size (bsSIZE)	0.181	2.436***	0.931	0.977

*** $p < 0.001$; all variance parameter estimates based upon chi-square distribution.

are best treated as transient factors because they vary significantly over time (91.6% and 89.2% of variance is over time, respectively), and thus stand most likely to explain variance in business segment performance which occurs over time. The ICC analyses suggest that the aggregation of all other variables are warranted, however, and thus may enter the analysis as stable effects. The vast majority of the variance in *Corporate Capital Intensity* occurs between corporations (85.7%) and that of *Business Segment Size* occurs between business segments (93.1%), which suggests these two variables are best treated as stable effects. For the variables of *Industry Concentration, Industry Dynamism*, and *Corporate Resource Availability*, a relatively large degree of variance occurs both between aggregate units (industries, corporations) and across time, suggesting that these may be treated either as transient factors, stable factors, or both.

We then used HLM to examine these strategic factors by incorporating them as predictors into the unconditional model presented in Equations 1a–c above.[6] The ICC analyses reported above guided the decision as to which level of analysis each specific factor initially entered into the specification and, given the exploratory nature of this study, the following fully specified model reflects that which best fit the data:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(indCAP)_{tij} + \pi_{2ij}(indMUN)_{tij} + \pi_{3ij}(indDYN)_{tij} + \pi_{4ij}(crpSLACK)_{tij} + e_{tij} \quad (3a)$$

$$\pi_{0ij} = \beta_{00j} + \beta_{01j}(bsSIZE)_{ij} + \beta_{02j}(indCR4)_{ij} + \beta_{03j}(indDYN)_{ij} + r_{ij} \quad (3b)$$

$$\pi_{1ij} = \beta_{10j} + r_{1ij} \quad (3b_1)$$

$$\pi_{2ij} = \beta_{20j} \quad (3b_2)$$

$$\pi_{3ij} = \beta_{30j} \quad (3b_3)$$

$$\pi_{4ij} = \beta_{40j} + r_{4ij} \quad (3b_4)$$

$$\beta_{00j} = \gamma_{000} + \gamma_{001}(crpCAP)_j + \gamma_{002}(crpSLACKVAR)_j + \gamma_{001}(crpMvsS)_j + \mu_j \quad (3c)$$

$$\beta_{01j} = \gamma_{010} \quad (3c_1)$$

$$\beta_{02j} = \gamma_{010} \quad (3c_2)$$

$$\beta_{03j} = \gamma_{010} \quad (3c_3)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (3c_4)$$

$$\beta_{20j} = \gamma_{100} \quad (3c_5)$$

$$\beta_{30j} = \gamma_{100} \quad (3c_6)$$

In this modeling, business segment ROA at time t for business segment i in corporation j (Y_{tij}) is regressed upon the time-varying predictors *Industry Capital Intensity, Industry Munificence, Industry Dynamism*, and *Corporate Resource Availability*. All of these time-level relationships were grand-mean centered (see Hofmann and Gavin, 1998), and thus the intercept of Equation 3a, π_{0ij},

[6] It is important to reiterate here that, theoretically, business segments are nested within both corporations and industries, and that the manner in which corporations and industries are modeled for this and the previous analysis is a function of the methodology (i.e., n's of each respective class of effects). Thus, while this model specification was the most appropriate given the structure of our data (both corporate and industry factors), it is worth noting that future research with different focuses may more appropriately be modeled with industry as the level 3 equation (i.e., Equation 3c). For instance, such a modeling may be more appropriate for research focused solely upon examining the effect that industry conditions have on firm performance.

now represents mean ROA across time for business segment i in corporation j, adjusted for the effect of the time-varying predictors. π_{0ij} is modeled simultaneously as the outcome in Equation 3b, and is regressed on the stable effects expected to explain between-business variance: *Business Segment Size, Industry Concentration*, and *Industry Dynamism*. The intercept of Equation 3b, β_{00j}, thus now represents the mean ROA of all business segments in corporation j adjusted for these predictors (again, given grand-mean centering). Equation 3c simultaneously models β_{00j} as a dependent variable regressed on the stable effects expected to influence between-corporation variance: *Corporate Capital Intensity, Corporate Resource Variability*, and *Corporate Diversification*. The intercept at this final level of analysis, γ_{000}, represents the grand mean of business segment performance. As before, each level of analysis has its own unique random error term: e_{tij} represents the *across-time* residual; r_{ij} the *between-business* residual; and μ_j the *between-corporation* residual.

As these equations show, HLM also models the slopes of the relationships at the time and business segment levels as outcome variables at the higher levels of analysis (Equations $3b_1-3b_4$) and $3c_1-3c_6$). HLM incorporates a test to determine whether these relationships vary randomly across higher-level units, and the modelings in Equations $3a-c_6$ reflect the results that best fit the model. As reported in the bottom panel of Table 6 (*Variance Components*), the effect across time that industry capital intensity (*indCAP)* has on business segment ROA significantly varies across business segments as well as across corporations (both at $p < 0.001$) and thus Equations $3b_1$ and $3c_4$ were modeled with a random variance term. The relationship across time between corporate resource availability (*crpSLACK)* and business segment ROA also varies significantly ($p < 0.001$) across business segments, and likewise Equation $3b_4$ was modeled to include a residual. Because none of the other slopes were found to vary randomly, however, no random variance is included in their modeling in Equations

Table 6. HLM estimates of the effect of specific strategic variables on business unit ROA

Model	1	2	3	4
Time level				
Intercept	0.086*** (0.003)	0.086*** (0.003)	0.069*** (0.005)	0.069*** (0.005)
indCAP	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.001* (0.000)
indMUN	0.005 (0.013)	0.009 (0.014)	0.009 (0.014)	0.009 (0.014)
indDYN	0.052 (0.051)	0.105 (0.060)	0.108 (0.060)	0.105 (0.060)
crpSLACK	0.032*** (0.009)	0.041*** (0.008)	0.041*** (0.009)	0.041*** (0.009)
Business level				
bsSIZE		0.021*** (0.002)	0.017*** (0.002)	0.018*** (0.002)
indCR4		0.158** (0.050)	0.135** (0.050)	0.134** (0.050)
indDYN		−0.269* (0.108)	−0.238* (0.112)	−0.237* (0.112)
Corporate level				
crpCAP			−0.010 (0.006)	−0.009 (0.006)
crpSLACKVAR			−0.940* (0.474)	−0.932* (0.470)
crpMvsS			0.026*** (0.006)	0.026*** (0.006)
indCAPINT Slope				
bsSIZE				0.001*** (0.000)
Variance components				
Level 1, e_{tij}	0.0162	0.0163	0.0163	0.0163
Level 2, r_{ij}	0.0136***	0.0130***	0.0129***	0.0129***
indCAP slope, r_{1ij}	0.0000***	0.0000***	0.0000***	0.0000***
crpSLACK slope, r_{4ij}	0.1068***	0.0084***	0.0077***	0.0073***
Level 3, μ_j	0.0036***	0.0029***	0.0028***	0.0028***
indCAP slope, μ_{10j}	0.0000***	0.0000***	0.0000***	0.0000***
LR ratio (χ^2)	−9953.28***	−10052.82***	−10094.23***	−10095.68***

Significant at *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$: two-tailed tests.
Robust standard errors in parentheses.

$3b_2, 3b_3, 3c_1-3c_3$, and $3c_5-3c_6$ (and they are not reported in Table 6).

This modeling allows for several types of analyses. First, HLM provides estimates of the effect that each strategic factor has on business segment ROA. Model 3 of Table 6 reports the results of our HLM estimations for the final fully specified model (Equations $3a-c_6$ above). The results of Model 3 suggest that one transient effect and several stable effects are associated with business segment ROA. With regard to transient effects, *crpSLACK* was the only time-varying factor found to have a significant relationship with business segment ROA, as it was positively related to business segment ROA over time ($p < 0.001$). None of the transient industry effects, *indCAP, indMUN, indDYN*, appears to significantly explain variance in performance over time. All three factors expected to explain between-business variance in business segment ROA were significant: *bsSIZE* and *indCR4* are both positively related ($p < 0.001$ and $p < 0.01$, respectively) to business segment ROA, while *indDYN* is negatively related ($p < 0.05$). Of the factors expected to explain between-corporate variance, the results suggest that variability in the resources available to business segments from their corporate parents (*crpSLACKVAR*) has a negative effect on business segment ROA ($p < 0.05$), while *crpCAP* is not significant. It also appears that business segment ROA is higher in multi-business corporations than in single-business corporations, as *crpMvsS* is positively related to business segment ROA ($p < 0.001$).

This last result points to another important benefit that HLM affords research investigating firm performance: the ability to examine the effect that operating multiple, vs. a single, business(es) has on firm performance, an area in need of continued research (Bowman and Helfat, 2001). Previous research in the industry, corporate, and firm effects stream which has included both single-business and multi-business corporations has constrained corporate effects to zero in any year that corporations operated only a single business. This constraint tends to mask corporate effects (Bowman and Helfat, 2001), however, because doing so does not allow for the inclusion of those years where multi-business corporations operate single businesses into the estimation of corporate effects. In other words, when single-business years are 'zeroed out,' mean corporate performance (upon which corporate effects are estimated) for corporations which operate multiple businesses in some years and single businesses in other years is estimated based only upon those years where multiple businesses are operated. Yet, the decision to operate only in a single business is presumably a corporate one, and that decision should be included in any corporate effect. As our sample suggests, corporations with a corporate strategy involving the operation of multiple businesses at times choose to operate in only one business. To exclude any such single-business years in the estimation of corporate means (as zeroing out corporate effects in single business years does) clearly underestimates corporate effects, while at the same time overestimating business effects. This issue led Bowman and Helfat (2001) to conclude that related research examining corporate effects should only include multi-business corporations, but McGahan and Porter (2002) argue that such a research protocol may also be problematic as their results suggest that excluding single-business corporations may also lead to spurious findings.

The variance partitioning in HLM, however, accommodates inclusion of both single- and multi-business firms, and thus resolves this issue. As Equations $3a-c_6$ show, business segment means are estimated based upon all observations across time within each business segment, and corporate means are estimated based upon all business segments that the corporation operated for all years included in the study period. Thus, instead of ignoring information (i.e., zeroing out those years where corporations operated only one business segment), HLM incorporates all of the information regarding corporate effects. Furthermore, by incorporating all of this information into its estimation (i.e., the partitioning of the total variance to that attributable across time, between businesses and between corporations), HLM allows for the examination of whether the operation of multiple businesses vs. a single business explains performance variance across corporations (Equation 3c).

Second, because HLM incorporates the partitioning of variance into its estimation, the amount of variance explained by the strategic factors can also be determined, both in total and at the relevant level of analysis. This is done through classical testing by comparing complete and reduced modeling. The results (not reported in Table 6) suggest that the transient strategic factors (*indCAP, indMUN, indDYN, crpSLACK*) explain 2.8 percent of the variance in business ROA over time, which is 1.4 percent of the total variance in business segment ROA. Stable strategic factors expected to explain between-business variance (*bsSIZE, indCR4, indDYN*) explain 4.2 percent of the between-business variance, or 1.7 percent of the total variance in business segment ROA. The stable strategic factors expected to explain between-corporate variance (*crpCAP, crpSLACKVAR, crpMvsS*) account for 4.1 percent of the between-corporate variance, or 0.4 percent of the total variance.

A third analysis, afforded by HLM's modeling of slopes as outcomes, is the investigation of whether specific factors explain the variance in the slopes which vary across higher-level units. For example, the relationship across time between the capital-intensive conditions in an industry (*indCAP*) and business segment ROA varies across business segments, and business segment size may account for some of the variance. In other words, business segment size may moderate the relationship across time between industry capital intensity and business segment ROA. Larger business segments are more apt to have the capital requirements to be successful in such industries than are smaller business segments. We examined this by incorporating *bsSIZE* into Equation $3b_1$. The results of this analysis are reported in Model 4 of Table 6, and show that *bsSIZE* significantly affects the relationship across time between *indCAP* and business segment ROA. This suggests that the effect that *indCAP* has on business segment ROA over time varies between business segments, and that *bsSIZE* helps to explain the variance in this effect (i.e., *bsSIZE* moderates the relationship between *indCAP* and business segment ROA).

Finally, HLM also allows for the examination of how alternative specifications of the variance–covariance matrix affect the results. For instance, because the analysis incorporates time series data, we reran the analyses correcting for serial correlation.[7] The corrected results for the final fully specified model (Model 3, Table 6) are reported in Table 7 (Model 3 corrected). These corrected results are similar to those found in the uncorrected estimation, with one exception: the results in Table 7 suggest that corporate capital intensity (*crpCAP)* has a significant negative effect on business segment ROA ($p < 0.05$), whereas in the uncorrected estimation corporate capital intensity was not significantly related to business segment ROA.

Table 7. HLM results corrected for serial correlation

	Model 3 corrected for serial correlation	
Time level		
Intercept	0.064***	(0.006)
indCAP	0.000	(0.000)
indMUN	0.001	(0.016)
indDYN	0.078	(0.053)
crpSLACK	0.013**	(0.005)
Business level		
bsSIZE	0.018***	(0.002)
indCR4	0.119*	(0.049)
indDYN	−0.245*	(0.110)
Corporate level		
crpCAP	−0.012*	(0.005)
crpSLACKVAR	−0.863**	(0.301)
crpMvsS	0.026**	(0.007)
Estimated rho	0.509	
Model Fit (χ^2)	780.83***	

Significant at *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; two-tailed tests.
Robust standard errors in parentheses.

DISCUSSION

The quest by strategic management researchers to discover the relative importance of industry, corporate, and business unit effects to successful firm performance has now gone on for nearly two decades. Conclusive results have been at least partially averted by characteristics of the statistical techniques previously employed in this line of research, and thus new approaches have been sought. Our examination of the relative importance of effects, in which we utilized the multilevel approach of HLM, presents an alternative assessment of this enduring and fundamental question which attempts to address the non-independence between these effects. We also demonstrated how HLM may be used to investigate the effect of specific strategic factors within each class of effects, and thus whether and how strategy may affect performance.

[7] Although serial correlation does not significantly affect results with regard to the relative importance of effects (McGahan and Porter, 2002), we did investigate what effect, if any, serial correlation has on the results of the current analysis incorporating specific factors.

With regard to the assessment of the relative importance of industry, corporate, and business unit effects, our results suggest that the relative importance of business unit effects far outweighs those of corporate or industry effects, and that these latter effects are of similar relative magnitude. Indeed, our findings suggest that the relative importance of corporate and industry effects are virtually the same (corporate to industry ratio of 0.97 : 1), and that the relative importance of business segment effects is more than twice that of corporate (ratio of 2.25 : 1) and industry effects (ratio of 2.19 : 1). Given their consistency with those of previous studies utilizing ANOVA, and because they recognize the cross-nested nature of performance variance, the current findings help to advance this stream of research and contribute to bringing some closure to this debate. Business-specific effects appear to have a large influence on performance, and both industry and corporate effects do indeed appear to be important and related to one another. This last point is clearly suggested by our results, as our analysis identified that industry effects affect both between-business segment variance as well as between-corporations variance. Our results also focus attention toward the substantial amount of the total variance in business segment performance which occurs across time, and thus may potentially be explained by factors that vary over time. Although the size of this latter finding is similar to the 'error' reported in previous studies, the variance in performance over time has been an aspect of performance variance relatively neglected in previous research (Adner and Helfat, 2003), perhaps precisely because this type of variance has been treated as 'error.'

Given these findings, the current study contributes at least two insights to research regarding the relative importance of industry, corporate, and business unit effects. First, conceptually and empirically it appears that the investigation of performance is perhaps best approached by focusing attention toward the business unit (i.e., the classical 'firm') and *treating both the corporate parent and industry in which a business unit is embedded as environments which affect business unit profitability*. The results obtained here, in conjunction with previous ANOVA studies, suggest that the structures imposed by both corporations or industries cannot be disregarded; yet at the same time, neither environment warrants primacy. Such a reframing of the problem would help to reconcile the long-standing debate within the field, and reinforces the suggestion that 'the careful study of how capabilities and competition mutually influence each other could be one of the next great opportunities for the field of strategy research' (Henderson and Mitchell, 1997: 6). Second, given our findings regarding the magnitude of the variance in business unit performance that occurs *across time*, future research should focus in particular on examining transient strategic factors. As our analysis of specific strategic factors demonstrated, such factors can potentially be industry, corporate or business-unit characteristics.

This leads to a second major contribution of our study: demonstrating how HLM may be used to examine the effect that specific strategic factors have on firm performance. This aspect of our research is important because it enabled us to better understand the potential impact that *strategy* has on firm performance (Bowman and Helfat, 2001), at the relevant level of analysis. We explored specific strategic factors at each level of analysis, and showed some of HLM's modeling capabilities (i.e., incorporation of specific strategic factors at the relevant level of analysis, modeling slopes as outcomes, alternative specifications of the variance–covariance matrix). Despite its intentional exploratory nature, the study's results yielded several insights.

First, the results of the ICC analyses should draw attention to the importance of examining the appropriate level of aggregation for the variables under investigation. In other words, ICC analysis can be used by strategic management researchers to determine whether industry, corporate, and/or business unit factors are best treated as transient or stable effects. This may be important for at least two reasons. The first reason is rather straightforward: if aggregation of a variable is not warranted (or more than warranted), then the variable will not explain variance at the higher level of aggregation (or lower level). For example, in the current study, a majority of the variance in industry munificence was across time, with relatively very little variance across industries. Although this may be a function of the way that the variable is calculated (regression coefficients of industry sales growth divided by mean industry sales; Dess and Beard, 1984), this was not true for industry dynamism, which was calculated in a similar manner. In any case, the

ICC analyses clearly identified that industry munificence—as well as industry capital intensity and corporate resource availability—was best modeled as potentially explaining variance in performance across time. In general, cross-level designs are fairly common in strategic management research (e.g., cross-sectional panel-data designs), and thus strategic management researchers performing such designs would benefit from incorporating such procedures. A second reason is that ICC analysis allows for the identification of those strategic factors which may potentially account for the vast amount of unexplained variance in performance which occurs over time. As we demonstrated in the current study, these may include corporate, industry or business unit factors.

Second, our findings with regard to the specific corporate and industry strategic factors we examined reinforce the view that when studying firm performance it may be important to consider both the corporate and industry environments in which firms are embedded. In terms of industry factors, our findings confirmed the results of previous research that industry concentration is positively related to profitability (Bain, 1968), and that industry dynamism is negatively related to performance (Keats and Hitt, 1988). Our findings also suggest, however, that the environment provided by corporate parents significantly affect the profitability of businesses. The results show that corporate parents which provide a resource rich environment positively influence firm performance, as suggested by theory (Bourgeois, 1981; Cyert and March, 1963). It also appears, however, that variability in such resources is negatively associated with business segment ROA, a finding very much in line with the effect that instability (i.e., dynamism) in the industry environment has on performance. Furthermore, it appears that capital-intensive corporate environments negatively affect firm performance, consistent with theoretical arguments for the inertial effects of such environments (Hannan and Freeman, 1977). These findings clearly suggest the importance of considering the impact of both industry and corporate environments on firm performance.

Finally, the HLM approach allows for the examination of whether there are performance differences between corporations operating multiple businesses and those which operate single businesses. Our findings suggest that multi-business corporations outperform single-business corporations. Given that the scope of the firm is one of the key corporate-level factors that theoretically affect profitability (Williamson, 1975; Rumelt, 1974), this finding tends to support the view that *corporate strategy does matter* (Bowman and Helfat, 2001). Because our measure of corporate diversification was rather coarse (dummy variable), we also examined the robustness of this finding to an alternative measure of corporate diversification. Though not reported previously, we reran the analysis of the final fully specified model (i.e., Equations 3a–c_6; Model 3, Table 6) incorporating the entropy measure of total diversification (see Palepu, 1985) in place of the categorical variable (*crpMvsS*), and it was also positively associated with business unit ROA ($p < 0.001$). The beneficial effect of corporate diversification appears to be a diminishing one, however, as consistent with previous research (Palich, Cardinal, and Miller, 2000) the inclusion of a curvilinear relationship of this variable was also significant ($p < 0.01$). In sum, as suggested by Bowman and Helfat (2001), the examination of specific strategic factors is necessary if we are to begin to understand whether strategy has an impact on performance. As demonstrated in the current study, HLM provided a potentially powerful avenue for future research in this area.

The findings of the current study, however, are subject to several limitations. First, although HLM may present a relative improvement over previous methods in terms of its incorporation of the non-independence between effects, it does so in a limited manner. As discussed above, the cross-nested methodology does not directly model the non-independence between business segments and industries. Although HLM automatically generates robust standard errors based upon generalized estimating equations analysis, which should indirectly correct for such a violation of the independence assumptions (Raudenbush *et al*., 2000), we also attempted to assess the robustness of the cross-nested modeling through an alternative model specification in which the non-independence between business segments and industries was directly admitted. Although imperfect, as corporate effects could not be cross-nested in this alternative specification, the results of the assessment were suggestive of the robustness of the cross-nested model to this assumption violation.

This leads to a second caveat. Theoretically, business segments are cross-nested within both corporations and industries (Rumelt, 1991) and, as discussed above, the manner in which corporations and industries were modeled in the present analyses was a function of the methodology (i.e., n's of each respective class of effects). Although this model specification was the most appropriate for the current inquiries, it represents only one possible way for future research to proceed. For instance, while the present cross-nested modeling was necessary for the inclusion of both corporate and industry factors, alternative specifications with industry incorporated at the third level of analysis (i.e., Equations 3c) may be more appropriate for future research focused solely upon questions pertaining to industry factors. In other words, although cross-nesting in HLM appears to be robust to violations of the independence assumption, this issue can be avoided if research is not interested in investigating factors from both environments simultaneously. Thus, because business segments are nested within both corporations and industries, and empirical evidence is accumulating (including the current results) to suggest the importance of each of these environments to firm performance, the HLM modeling utilized by future research is best determined by the specific phenomena under inquiry.

A third limitation, consistent with several previous studies in this research stream (McGahan and Porter, 1997, 2002; Roquebert *et al.*, 1996), is our reliance upon the Compustat database. One implication of this is that we utilize business segment data in lieu of business unit data. Business segment data imperfectly measure business unit characteristics, as business segments are defined by SIC codes, and thus business segment reporting may cover the activity of several business units (McGahan and Porter, 1997). A second issue is that SIC codes, with which industries are also identified, tend to be overly broad (McGahan and Porter, 1997) and research on managerial cognition suggests that SIC definitions of industries do not directly correspond to the way executives tend to define industries (Peteraf and Shanley, 1997). Both of these issues may lead to an underestimation of the importance of industry effects (McGahan and Porter, 1997). Finally, our reliance on the Compustat database severely limited our choice of theoretically relevant factors included in the study. The limitation this poses is perhaps most evident with regard to the scope of variables capturing business segment characteristics. While several industry and corporate parent factors were included, only one business segment factor was incorporated: business segment size (in addition, of course, to the dependent variable of business segment ROA). This is due to the limited availability of business segment variables reported in Compustat. Thus, future research would clearly benefit from alternative sources of data providing richer business unit data (McGahan and Porter, 2002).

In conclusion, although explaining firm performance remains difficult, it is likely most fruitful for future research to treat both industries and corporations in which businesses are embedded as environments that affect profitability. Our study has highlighted the cross-nested nature of firm performance, and that perhaps the most promising way for research to proceed in this area is in the investigation of the effect that strategy has on firm performance. This requires the identification of specific strategic factors, at each relevant level of analysis, which affect performance. In this study we have demonstrated the capability of HLM to provide researchers and practitioners with the technology for such investigations, whether the focus of the inquiry is upon stable or transient strategic factors.

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