



ADVANCES IN ACCOUNTING

VOLUME 20

PHILIP M. J. RECKERS

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THE EFFECTS OF POST-BANKRUPTCY FINANCING ON GOING CONCERN REPORTING

Lawrence J. Abbott, Susan Parker and Gary F. Peters

ABSTRACT

We examine whether auditors appear to use information related to client debtor-in-possession (DIP) financing in the going concern decision. DIP financing consists of post-bankruptcy financing which is positively associated with bankruptcy emergence. Statement on Auditing Standards No. 59 (SAS 59) directs auditors' attention to debt restructuring to mitigate financial distress. Accordingly, we hypothesize that auditors interpret DIP financing as a mitigating factor and are thus less likely to modify the audit opinions of firms receiving DIP financing. We find that auditors are less likely to issue a modification for clients receiving DIP financing, consistent with auditors treating its receipt as a mitigating factor in the going concern decision.

INTRODUCTION

Statement on Auditing Standards No. 59 (SAS 59, [AICPA, 1988](#)) requires auditors to modify their audit opinions when there is substantial doubt as to the client's ability to continue as a going concern for 12 months past the balance sheet date. However, SAS 59 does not explicitly define the term going concern, rather it provides auditors with guidance in determining whether the going concern

assumption is satisfied. Consequently, the decision to modify the audit opinion of a financially stressed company involves considering a great deal of relevant information and exercising professional judgment. Given the complexity of the modification decision, previous research has extensively explored what types of information auditors use in the going concern decision. This stream of research has generally focused on the auditor's use of information that is publicly available at the audit report date in the modification decision (Behn et al., 2001; Chen & Church, 1992; Menon & Schwartz, 1987; Mutchler, 1986).

In this paper, we examine whether the auditor's going concern modification decision reflects *private* (i.e. non-publicly disclosed) information regarding *post-bankruptcy declaration* client financing. SAS 59 specifically directs the auditors' attention to management's plan to remain a going concern twelve months past the balance sheet date and the likelihood those plans will be successful. Mutchler (1985) further notes the modification decision should reflect the auditor's access to inside information related to management's plans concerning firm survival. One potentially important source of private information relates to the probability the client will obtain debtor-in-possession (DIP) financing. DIP financing consists of post-bankruptcy, "superpriority" loans that have been found to be positively associated with bankruptcy emergence (Elayan & Meyer, 2001). Although DIP-related information is not made public until after the bankruptcy declaration, auditors may have private information regarding the probability of its procurement (Lennox, 1999). Furthermore, an unmodified opinion under SAS 59 is allowed if, in the auditor's view, DIP financing ultimately assists in the firm's survival. As such, we hypothesize that the going concern modification is negatively associated with the client's receipt of DIP financing.

We test our hypothesis in a sample of 124 financially stressed firms declaring bankruptcy between 1991 and 1997. Consistent with prior research, we construct a dichotomous audit reporting measure based upon whether the auditor issued a going concern modification for firms subsequently declaring bankruptcy. As predicted, we find a significant negative relation between the going concern issuance and the procurement of DIP financing. This result remains robust to the inclusion of a publicly-available, management-disclosed financing plan variable as per Behn et al. (2001).

Our study contributes to the literature by documenting a significant relation between post-audit report date information and the going concern decision. In so doing, we extend Mutchler et al. (1997) who posit that positive, post-bankruptcy news could be associated with a reduced likelihood of receiving a going concern opinion, but did not find support for this hypothesis. Our results also suggest that auditors consider financing plans that are not necessarily disclosed nor publicly available at the audit report date during their going concern reporting deliberations.

The remainder of the paper is organized as follows. The next section reviews prior research and develops our hypotheses, followed by a discussion of sample selection and research methodology. The following section presents our univariate and multivariate results, followed by conclusions in the final section.

PRIOR RESEARCH AND HYPOTHESES DEVELOPMENT

Prior Research

As part of every audit engagement, SAS 59 requires auditors to assess a client's ability to continue as a going concern for the twelve-month period following the balance sheet date. Per SAS 59, auditors are also specifically directed to assess management's plans to mitigate financial distress. SAS 59 also provides guidance as to what information to consider when determining whether to modify the audit report. Given the complexity of the going concern decision, prior research has extensively examined what types of information auditors may use in determining whether to modify their audit opinions (see [Chen & Church, 1992](#) for a review).

In terms of information used by auditors in their going concern decisions, prior research has generally focused on publicly available information, such as financial condition, size and loan default status. For example, [McKeown et al. \(1991\)](#) find that modified opinions are less likely when the probability of bankruptcy is lower, when the reporting lag is shorter, and when the client is larger. In his discussion of these results, [Bell \(1991\)](#) suggests the potential importance of non-financial ratio contrary information and mitigating factor items. For example, a mitigating factor such as an impending stock offering or the winning of a large sales contract might explain why an auditor did not modify their opinion of a subsequently bankrupt company.

Using the arguments advanced by [Bell \(1991\)](#), [Behn et al. \(2001\)](#) investigate whether information disclosed by management in the management discussion and analysis (MD&A), 10-K, or annual report impacts the auditor's modification decision. [Bell \(1991\)](#) and [Behn et al. \(2001\)](#) contend that since SAS 59 specifically directs the auditor to assess management's plans to mitigate financial distress, disclosures about such plans may provide information about the auditor's going concern modification process. [Behn et al. \(2001\)](#) find that auditors' going concern reporting decisions are strongly linked to publicly available mitigating information relative to certain management plans. In particular, the authors find that publicly disclosed plans to issue equity and to borrow additional funds from existing credit lines are strongly associated with the issuance of an unmodified opinion. These

results suggest that auditors specifically consider management's plans to alleviate financial stress when determining whether to modify their audit report. A common link in both the prior research and the findings of [Behn et al. \(2001\)](#) is examining the impact of publicly-available, audit report date information on the auditor's modification decision.

In contrast to much of the prior literature, [Mutchler et al. \(1997\)](#) suggest that additional information regarding the auditor's going concern modification decision may be found using *post-audit report date* information. [Mutchler et al. \(1997\)](#) posit that while information on ratio and debt-related indicators is readily available in the financial statements, it is much more difficult to identify mitigating factors that auditors might use in reaching going concern opinion decisions. Further, while audit workpapers might well contain this information, their confidential nature precludes researchers from obtaining and using this type of information in their analyses. [Mutchler et al. \(1997\)](#) state that while the auditor's opinion could not have been influenced by such post-audit report date news, the opinion may have been influenced by the auditor's expectations about the events contained in these reports.

To address this possibility, [Mutchler et al. \(1997\)](#) use a post-audit report date variable obtained from an objective reference source, namely, the *Wall Street Journal*. All potentially relevant news items (other than earnings reports or similar regular events) with any possible implication with respect to the company's ability to meet its obligations were classified into one of 82 predetermined categories. The authors then surveyed the opinions of 14 experienced, senior level or above, auditors to more broadly categorize such news items into a more tenable set of variables. [Mutchler et al. \(1997\)](#) eventually arrive at three post-audit report date categories: Mild positive, mild negative and extreme negative. However, [Mutchler et al. \(1997\)](#) do not find support for any of the three "post-report date news" variables. The authors attribute their lack of findings to several potential sources: measurement error in their variable; auditor conservatism; or a failure of auditors to use this information in their going concern decision. [Mutchler et al. \(1997\)](#) conclude that "other measurements may prove to be more fruitful for the (post-audit report date) mitigating factor items."

Debtor-In-Possession Financing

Debtor-in-possession (DIP) financing is court-approved financing for a bankrupt firm under Chapter 11 protection. [Altman \(1992\)](#) highlights the incidence of DIP financing by documenting the issuance of over \$5 billion in DIP loans during 1990–1991. Such financing is made possible by "automatic stay" provisions of

bankruptcy law and the ability of the court to grant superpriority status to the DIP lender. The automatic stay is activated only when a firm files for Chapter 11 protection. Under the automatic stay, the contractual and legal rights of a *pre-petition* lender are not enforceable unless permitted by the court. Superpriority status debt is post-petition debt of a higher priority than pre-petition unsecured debt. For firms that are in bankruptcy, the provision of DIP financing allows them to continue operations.

DIP financing has recently received increased academic attention. Elayan and Meyer (2001) find that obtaining DIP financing is associated with a reduced probability of liquidation, as well as shorter time spent under bankruptcy proceedings. Perhaps most importantly, Elayan and Meyer (2001) and Dahiya et al. (2000) find that the DIP financing is associated with a higher likelihood of successful emergence from bankruptcy. Finally, Dhillon et al. (1998) document that the announcement of DIP financing is associated with significantly positive stock price movements, after controlling for other variables contained in the publicly available financial statements. The findings of Dhillon et al. (1998) imply that DIP financing provides new information *beyond that already contained in the previous set of audit report date financial statements*.¹

Dhillon et al. (1998), Dahiya et al. (2000) and Elayan and Meyer (2001) all suggest that DIP announcements transmit positive information regarding the firm's underlying financial soundness. In providing a rationale behind such evidence, Dahiya et al. (2000) argue that even though DIP lenders enjoy superpriority status, DIP financing is not risk free. Thus, the DIP lender must assess the company's ability to repay the DIP loans. Consequently, the authors argue if DIP lenders provide a larger informational role and are active screening and/or monitoring agents, DIP financed firms should exhibit better bankruptcy emergence rates and shorter reorganization periods. The results of Dahiya et al. (2000), Dhillon et al. (1998) and Elayan and Meyer (2001) all support such arguments. These findings also suggest the possibility that DIP financing may be an important post-audit report date mitigating factor.

Regulatory Environment

SAS 59 states the auditor has a responsibility to evaluate every client's going concern status for one year into the future. In doing so, the standard guides auditors to obtain information about management's plans. When evaluating management's plans to deal with financial stress, "the auditor should identify those elements that are particularly significant to overcoming the adverse effects of conditions and events and should plan and perform auditing procedures to obtain evidential

matter about them.” Given the evidence, the auditor should then consider whether it is likely that any adverse affects will be mitigated for a reasonable period of time and that such plans can be effectively implemented.

Realizing that each going decision contains unique, firm-specific circumstances and characteristics, SAS 59 allows for considerable auditor judgment and flexibility. Given this, SAS 59 does not provide an explicit going concern definition.² Nor does it explicitly require the auditor to issue a going concern modification for firms declaring bankruptcy.³ However, paragraph 1 of SAS 59 provides examples of conditions that fail to meet the going concern assumption. It states:

Ordinarily, information that significantly contradicts the going concern assumption relates to the entity’s ability to continue to meet its obligations as they become due without substantial disposition of assets outside the ordinary course of business, restructuring of debt, externally forced revisions of its operations, or similar actions.

Application of this guidance is left to the auditor’s professional judgment and evaluation of the firm’s ability to maintain going concern status over the following 12 months. SAS 59 states that “the auditor’s (going concern) consideration should be based on knowledge of the entity, its business and its management.” Ellingsen et al. (1989, pp. 25–26) illustrate this point:

At first glance the meaning of going concern may seem simple – an entity either continues operation or it does not. Yet this simple distinction may not be an adequate basis for determining the effect on the audit report. For example, is an entity that has filed for reorganization under Chapter 11 but that expects to maintain operations a going concern? . . . The answer to (this question) is maybe. Auditors must use judgment in considering all the particulars about the entity’s ability to continue as a going concern.

SAS 59 contains an inconsistency with respect to the auditor’s interpretation of debt restructuring, underscoring the importance of auditor judgment. In particular, paragraph 1’s reference to *restructuring of debt*, suggests that a firm’s need for DIP financing could be construed as fitting the definition of a firm failing the going concern assumption. On the other hand, paragraph 7 provides an alternative interpretation of DIP financing as an example of debt restructuring that might be considered a mitigating factor. Thus, the auditor is left with the responsibility of evaluating how DIP financing (in conjunction with the client’s condition and management’s plans) will affect the likelihood of the client maintaining going concern status over the following 12 months.

Hypothesis

The results of Elayan and Meyer (2001), Dahiya et al. (2000) and Dhillon et al. (1998) suggest that: (1) the decision to extend DIP financing is made by an informed

party; (2) the decision to extend DIP financing is a signal (beyond that contained in the audit report date financial statements) regarding the viability of the firm's management, business plans and/or economic prospects to maintain going concern status over the twelve-month period after the balance sheet date; and (3) DIP financing could be an important, post-audit report date mitigating factor for auditors in their going concern decision.

However, in order for DIP financing to be a post-audit report date mitigating factor, three conditions must be satisfied. First, the auditor must recognize the positive impact of DIP financing on the continuance of normal business operations. Second, the auditor must have private, non-publicly available information regarding the client's likelihood of obtaining that DIP financing. While it is likely that auditors are familiar with the positive aspects of DIP financing on bankruptcy emergence, it remains an empirical question the degree to which auditors know the probability of a client obtaining this financing. Nonetheless, [Mutchler \(1986\)](#) and [Lennox \(1999\)](#) argue that auditors are expected to possess private information regarding management plans that allows them to form expectations regarding the likelihood of success and to use that information in the going concern decision. Third, the auditor's going concern decision must focus on the entity's ability to maintain going concern status twelve months following the balance sheet date, as opposed to the entity's ability avoid bankruptcy.⁴ Thus, the auditor must evaluate how DIP financing (in conjunction with the client's condition and management's plan) will affect the likelihood of the client maintaining going concern status for the twelve-month period following the balance sheet date. Accordingly, this leads to our hypothesis (stated in alternative form):

H(a). The occurrence of post-bankruptcy, debtor-in-possession financing is negatively associated with the receipt of a going concern opinion.

RESEARCH METHODOLOGY

Sample Selection

We identify bankrupt firms and their bankruptcy petition filing dates from three sources: (1) Prentice-Hall's *Capital Adjustments* (1991–1992 addenda); (2) Predicast's *F&S Index of Corporate Changes*; and (3) the LEXIS-NEXIS database. We limit our sample period to 1991–1997 for two reasons. First, by restricting our sample period to only those post-1990 bankruptcies, the adoption of SAS 59 will have been completed. Second, it allows us to control for impact of audit committees on the going concern modification decision. In particular, while the

NYSE and NASDAQ have required its registrants to have an audit committee since 1978 and 1989, respectively, the AMEX started its audit committee requirement in 1991.

Consistent with prior research, we deleted companies that had already filed for bankruptcy at the time of the audit report. We further required proxy statements be available for the period covering the last financial statements, in order to examine audit committee composition. Finally, consistent with prior research, we deleted companies in the banking, other financial, and real estate sectors, as well as utilities, because such companies have unique financial and regulatory characteristics. Complete data were obtained for 129 companies declaring bankruptcy within one year of the financial statement date for which a Big 6 audit report was issued.

McKeown et al. (1991) and Hopwood et al. (1994) highlight the importance of separately analyzing stressed and non-stressed companies in the context of examining the association between going concern modifications and subsequent bankruptcies. Hopwood et al. (1994, p. 412) note that auditors do not generally issue going concern modified audit opinions for non-stressed companies that suddenly fail, and since “non-stressed, bankrupt companies are likely to have experienced management fraud leading to misstated financial statements . . . investigations of auditors’ going concern opinion decisions should be conducted on samples that have been partitioned into stressed and non-stressed categories.”

Following Mutchler (1985), Hopwood et al. (1994) and, most recently, Geiger and Raghunandan (2001, 2002), we define a company as stressed if it exhibited at least one of the following stress signals: (1) negative working capital; (2) a loss from operations in any of the three years prior to bankruptcy; (3) negative retained earnings in any of the three years prior to bankruptcy; and (4) a bottom line loss in any of the three years prior to bankruptcy. Of the 129 initial firms, 5 firms were classified as non-stressed. None of these 5 firms received DIP financing and, consistent with Geiger and Raghunandan (2001), none of these firms received a going concern modification.⁵ The remaining 124 firms comprise our final sample.

Sample selection results are summarized in Table 1. In terms of industry membership, Panel A of Table 1 provides frequency data for 11 focus industries. These focus industries are based upon groupings of two-digit SIC codes per Franz et al. (1998). One industry, Retailing and Wholesaling, is disproportionately large, which may be due to the inherent operating risk involved with ownership of a large amounts of inventory. Per Panel B of Table 1, there is also a predominance of later period observations, due primarily to data availability. Finally per Panel C of Table 1, observations are distributed fairly evenly amongst the Big 6, with KPMG having the greatest number of observations (24) and Coopers & Lybrand the fewest (17).

Table 1. Sample Selection Results for 124 Financially Stressed Firms Filing for Bankruptcy Between 1991 and 1997.

Panel A: Distribution of Observations by Focus Industry

Focus Industry	Related Two-Digit SIC Codes	Number of Observations
Construction	15–17	3
Consumer products & food	20–33	19
Energy	10–14, 46, 49	14
Financial services	60–64, 67	0
Information & communication	78, 79, 84	11
Manufacturing	34–39	29
Personal services, healthcare	72, 80, 83	5
Professional/commercial services, education	75, 76, 82, 87, 89	4
Real estate	65, 70	1
Retail and wholesale	50–59	30
Transportation	40–42, 44, 45, 47	7
All other	1, 2, 7, 8, 99	1
		124

Panel B: Distribution of Observations by Year

Year	Number of Observations
1991	5
1992	16
1993	12
1994	11
1995	17
1996	22
1997	41
	124

Panel C: Distribution of Observations by Auditor

Auditor	Number of Observations
Arthur Andersen	21
Coopers & Lybrand	17
Deloitte & Touche	22
Ernst & Young	21
KPMG Peat Marwick	24
Price Waterhouse	19
	124

Regression Model

Consistent with prior research (Behn et al., 2001; Carcello et al., 1995; Chen & Church, 1992; Raghunandan & Rama, 1995), a multivariate logistic regression framework is employed to investigate our research question. The logistic regression model used to estimate the coefficients is given below:

$$\begin{aligned} GC = & \alpha + \beta_1 \text{DEBTPOSS} + \beta_2 \text{BANKPRED} + \beta_3 \text{BORROW} \\ & + \beta_4 \text{CHNGECR} + \beta_5 \text{RECURLOS} + \beta_6 \text{DEFAULT} + \beta_7 \text{CR} \\ & + \beta_8 \text{LTDTA} + \beta_9 \text{LOG(SALES)} + \beta_{10} \text{EARLY} + \beta_{11} \text{BANKLAG} \\ & + \beta_{12} \text{REPLAG} + \beta_{13} \text{ACENOGREY} + \varepsilon \end{aligned}$$

where

GC = Going concern modified report (1 if yes, else 0).

DEBTPOSS = 1 if auditee has received debtor-in-possession financing; 0 else.

BANKPRED = Bankruptcy prediction scored calculated using Hopwood et al. (1994) regression coefficients and seven financial ratios.

BORROW = 1 if auditee has stated plans to borrow money; 0 else.

CHNGECR = One-year change in the current ratio.

RECURLOS = 1 if auditee has two consecutive years of operating losses, 0 else.

DEFAULT = Default status at time of audit report (1 if in default, else 0).

CR = Current Ratio.

LTDTA = Long term debt (including current portion), scaled by total assets.

LOG(SALES) = Natural log of client sales (in millions).

EARLY = If in early portion of sample period (1 if in 1991–1992, 0 else).

BANKLAG = Number of days between bankruptcy date and audit report date.

REPLAG = Number of days between fiscal year-end and audit report date.

ACNOGREY = Composition of audit committee (1 if audit committee comprised entirely of independent, non-employee directors, 0 else).

Test Variables

DEBTPOSS is a dichotomous variable equal to 1 if a firm receives debtor-in-possession (DIP) financing between the years 1991 and 1997, 0 else. This information is obtained from annual reports entitled the *Bankruptcy Yearbook and Almanac* (New Generation Research). This database includes financial and reorganization information on major public firms that file for Chapter 11.

Control Variables

BANKRPRED represents the probability of bankruptcy. It is calculated based upon the regression coefficients found in Hopwood et al. (1994). The

Hopwood et al. (1994) regression model uses a set of financial ratios, as well as the natural log of firm sales. The ratios used to calculate this measure are net income/total assets, current assets/total assets, current assets/current liabilities, cash/total assets, current assets/sales and long-term debt/total assets.⁶ We expect a positive relation between this variable and our dependent variable, as firms with a higher probability of bankruptcy are more likely to be liquidated.

BORROW is a discrete (0, 1) variable given a value of 1 if the company publicly discloses a plan (and demonstrates the ability) to borrow – without having to declare bankruptcy. Management plans are indicated by a comment in the MD&A that existing bank lines of credit (LC) or other approved debt instruments were considered: (1) sufficient or adequate and would be used; or (2) available if needed to fund anticipated cash needs. Typical disclosure of plans to borrow are “the company believes that internally generated cash and borrowings will be adequate to finance continue operations” and “cash flow from operations will be supplemented by further utilization of available credit lines.” This variable definition comes directly from Behn et al. (2001). We expect a negative relation between this variable and the receipt of a going concern opinion as these plans may serve to mitigate future financial stress.

Raghunandan and Rama (1995) find that auditors are more likely to modify their opinions if the firm has experienced recurring losses from operations. To control for this, we use a dichotomous variable, RECURLOS coded 1 for firms with negative income from operations in the current and prior year, 0 else.

DEFAULT is used as an explanatory variable as auditors are more likely to modify their opinions for firms defaulting on debt obligations (Chen & Church, 1992). Similarly, auditors may be more likely to issue going concern modifications for clients with significant liquidity issues (Raghunandan & Rama, 1995). Consistent with Raghunandan and Rama (1995), variables used to proxy for these non-default liquidity measures include the current ratio (CR) and long-term debt (including current portion) to total assets (LTDTA). As auditors are more reluctant to modify the opinions of larger clients due to fee pressures (McKeown et al., 1991), the natural log of total firms sales (SALES) is also used as a control variable.

SAS 59 became effective December 31st, 1989. Raghunandan and Rama (1995) find evidence suggesting that auditors were initially very concerned about the legal ramifications and heightened “expectations gap” arising from this standard – especially in the period immediately following its adoption. We control for this with a dichotomous variable, EARLY, coded 1 for audit opinions covering years 1991–1992, 0 otherwise.

We also include two time lag variables, BANKLAG and REPLAG, in our analysis. BANKLAG, the time lag between the audit opinion date and bankruptcy date, is included as auditors may find it more difficult to distinguish failing and

surviving companies in shorter time frames (Citron & Taffler, 1992; McKeown et al., 1991; Mutchler et al., 1997). REPLAG, the time lag between the client year-end and the audit report date, is included as prior research has shown that auditors give modified opinions more often the longer the lag between a client's fiscal year-end and the audit opinion date (McKeown et al., 1991).

Recent studies suggest that audit committees comprised of independent directors enhance the independence of the external auditor. Carcello and Neal (2000) find a negative relationship between the percentage of independent audit committee directors and the likelihood of auditor switches for a sample of firms receiving initial going concern modifications. The authors interpret this as evidence that independent audit committees reduce an auditor's cost of issuing a modified audit opinion. Our measure of audit committee composition, ACENOGREY, is coded 1 for audit committees comprised entirely of outside, independent directors, 0 otherwise. We expect a positive relation between ACNOGREY and an auditor's propensity to modify their opinions.

RESULTS

Descriptive and Univariate Statistics

Table 2 presents descriptive statistics for our dependent and independent variables. Consistent with prior research, slightly more than half of our observations (53%) received a modified opinion prior to bankruptcy. While this rate is higher than prior studies, this percentage is consistent with the Big 6/8 propensity to modify per Mutchler et al. (1997). The majority of our companies (over 60%) had experienced two consecutive years of operating losses. Perhaps surprisingly, the majority (66%) of bankrupt firms had audit committees comprised entirely of independent directors. Finally, a significant percentage of our sample (28%) received DIP financing.

Table 3 provides Mann-Whitney tests for differences between firms receiving modified versus unmodified opinions, as well as for differences between firms receiving DIP financing and those firms that did not receive DIP financing (non-DIP firms). Several results merit further discussion. First, firms receiving unmodified opinions were much more likely to have obtained DIP financing. This provides univariate evidence consistent with our hypothesis. Second, we find statistically significant differences (all in the predicted direction) for all of our other explanatory variables except LTDTA and ACNOGREY.

In terms of univariate differences between DIP firms and non-DIP firms, we note that DIP firms were much less likely to receive a going concern modification. Interestingly, we find that DIP firms were *less likely* to disclose plans to rely upon

Table 2. Descriptive Statistics.

Variable Name	Mean	Median	Standard Deviation
GC	0.5322	1.0	0.5007
DEBTPOSS	0.2792	0.0	0.4479
BANKPRED	0.5319	0.4899	0.4214
BORROW	0.3171	0.0	0.4672
CHNGECR	-0.6361	-0.2016	2.3029
RECURLOS	0.6098	1.0	0.4898
DEFAULT	0.3548	0.0	0.4804
CR	1.4412	1.0651	1.4506
LTDTA	0.2562	0.1384	0.3368
SALES (millions)	420.7853	124.6498	805.9678
EARLY	0.1693	0.0	0.3766
BANKLAG	188.2095	189.0	89.9982
REPLAG	85.0248	75.0	70.8608
ACNOGREY	0.6694	1.0	0.4723

Note: GC: Going concern modified report (1 if yes, else 0); DEBTPOSS: 1 auditee has received debtor-in-possession financing; 0 else; BANKPRED: Bankruptcy probability calculated using [Hopwood et al. \(1994\)](#) regression coefficient and seven financial ratios; BORROW: Discrete (0, 1) variable given a value of 1 if the company publicly discloses a plan to borrow money – without having to declare bankruptcy; 0 else (per [Behn et al., 2001](#)); CHNGECR: One-year change in the current ratio; RECURLOS: 1 if auditee has two consecutive years of operating losses, 0 else; DEFAULT: Default status at time of audit report (1 if in default, else 0); CR: Current Ratio; LTDTA: Long term debt (including current portion), scaled by total assets; SALES: Client sales; EARLY: If in early portion of sample period (1 if in 1991–1992, 0 else); BANKLAG: Number of days between bankruptcy date and audit report date; REPLAG: Number of days between fiscal year-end and audit report date; ACNOGREY: Composition of audit committee (1 if audit committee comprised entirely of independent, non-employee directors, 0 else).

internally generated funds and use *existing or approved* lines of credit to finance current operations. This suggests that our BORROW variable may be proxying for additional liquidity at the time of the audit report date. This additional potential for drawing down existing lines of credit likely aids management in satisfying trade creditors and avoiding or forestalling bankruptcy. In contrast, DIP financing likely arises only after management has exhausted all previously approved or existing lines of credit because of the costs associated with declaring bankruptcy ([Mutchler, 1985](#)). This suggests that our DEBTPOSS and BORROW variables represent two mutually exclusive strategies for dealing with financial stress and or bankruptcy. Consistent with [Elayan and Meyer \(2001\)](#) and others, larger firms were more likely to obtain DIP financing. Finally, consistent with the notion that DIP lending is not entirely risk-free, those firms in default were less likely to obtain DIP financing.

Table 3. Univariate Tests.

Variable Name	Firms with Qualified Opinion Mean	Firms with Unqualified Opinion Mean	Mann-Whitney Statistic	Firms with DIP Financing Mean	Firms without DIP Mean	Mann-Whitney Statistic
GC	1.0000	0.0000	na	0.2941	0.6222	12.8 ^{***}
DEBTPOSS	0.1515	0.4138	11.5 ^{***}	1.000	0.000	na
BANKPRED	0.5783	0.1822	34.6 ^{***}	0.4715	0.5387	0.8
BORROW	0.1846	0.4655	12.1 ^{***}	0.2058	0.3595	4.4 ^{**}
CHNGECR	−1.0368	−0.1870	4.3 ^{**}	−0.1475	−0.7919	1.8
RECURLOS	0.6923	0.5172	4.1 ^{**}	0.4911	0.5241	1.1
DEFAULT	0.5839	0.0893	44.5 ^{***}	0.2048	0.4111	4.2 ^{**}
CR	0.9631	1.985	17.4 ^{***}	1.6777	1.3719	1.2
LTDTA	0.2951	0.2705	0.8	0.2915	0.2427	0.5
SALES (mils)	297.1692	561.4644	3.3 [*]	350.1779	612.7751	3.6 [*]
EARLY	0.2576	0.0689	5.9 ^{**}	0.1514	0.1815	0.9
BANKLAG	158.3333	221.6379	17.9 ^{***}	185.1555	184.0476	0.1
REPLAG	98.5454	69.6379	5.3 ^{**}	88.5000	87.4888	0.3
ACNOGREY	0.6212	0.7241	1.3	0.6196	0.6888	0.6
Observations	66	58		34	90	

Note: GC: Going concern modified report (1 if yes, else 0); DEBTPOSS: 1 auditee has received debtor-in-possession financing; 0 else; BANKPRED: Bankruptcy probability calculated using [Hopwood et al. \(1994\)](#) regression coefficients and seven financial ratios; BORROW: Discrete (0, 1) variable given a value of 1 if the company publicly discloses a plan to borrow money – without having to declare bankruptcy; 0 else (per [Behn et al., 2001](#)); CHNGECR: One-year change in the current ratio; RECURLOS: 1 if auditee has two consecutive years of operating losses, 0 else; DEFAULT: Default status at time of audit report (1 if in default, else 0); CR: Current Ratio; LTDTA: Long term debt (including current portion), scaled by total assets; SALES: Client sales; EARLY: If in early portion of sample period (1 if in 1991–1992, 0 else); BANKLAG: Number of days between bankruptcy date and audit report date; REPLAG: Number of days between fiscal year-end and audit report date; ACNOGREY: Composition of audit committee (1 if audit committee comprised entirely of independent, non-employee directors, 0 else).

^{*} $p < 0.10$.

^{**} $p < 0.05$.

^{***} $p < 0.01$.

Multivariate Results

Table 4 presents logit regression results. Our DEBTPOSS variable is negative and significant at the 5% level (one-tailed), consistent with our hypothesis. All of the other coefficient estimates are in the predicted direction and are statistically

Table 4. Logistic Regression Results.

$$\begin{aligned} \text{GC} = & \alpha + \beta_1 \text{DEBTPOSS} + \beta_2 \text{BANKPRED} + \beta_3 \text{BORROW} \\ & + \beta_4 \text{CHNGECR} + \beta_5 \text{RECURLOS} + \beta_6 \text{DEFAULT} + \beta_7 \text{CR} \\ & + \beta_8 \text{LTDTA} + \beta_9 \text{LOG(SALES)} + \beta_{10} \text{EARLY} + \beta_{11} \text{BANKLAG} \\ & + \beta_{12} \text{REPLAG} + \beta_{13} \text{ACNOGREY} + \varepsilon \end{aligned}$$

Variable	Expected Sign	Parameter Estimate	Wald χ^2
Intercept		2.8056	2.4023
DEBTPOSS	–	–0.9576	4.3321**
BANKPRED	+	2.1568	6.9621***
BORROW	–	–1.1883	3.1468**
CHNGECR	–	–0.3453	2.0955*
RECURLOS	+	0.5038	2.5822*
DEFAULT	+	1.6877	7.3966***
CR	–	–0.2941	1.9881*
LTDTA	+	0.7174	0.5962
LOG(SALES)	–	–0.2699	7.0498***
EARLY	+	2.0499	3.9442**
BANKLAG	–	–0.0135	8.8317***
REPLAG	+	0.0018	0.3453
ACNOGREY	+	–0.9406	1.9223

Notes: Model $\chi^2 = 73.423^{***}$; Pseudo- $R^2 = 0.59$.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; based on one-tailed tests, two-tailed if coefficient is not in predicted direction.

GC: Going concern modified report (1 if yes, else 0); DEBTPOSS: 1 auditee has received debtor-in-possession financing; 0 else; BANKPRED: Bankruptcy probability calculated using Hopwood et al. (1994) regression coefficients and seven financial ratios; BORROW: Discrete (0, 1) variable given a value of 1 if the company publicly discloses a plan to borrow money – without having to declare bankruptcy; 0 else (per Behn et al., 2001); CHNGECR: One-year change in the current ratio; RECURLOS: 1 if auditee has two consecutive years of operating losses, 0 else; DEFAULT: Default status at time of audit report (1 if in default, else 0); CR: Current Ratio; LTDTA: Long term debt (including current portion), scaled by total assets; LOG(SALES): Natural log of client sales (in millions); EARLY: If in early portion of sample period (1 if in 1991–1992, 0 else); BANKLAG: Number of days between bankruptcy date and audit report date; REPLAG: Number of days between fiscal year-end and audit report date; ACNOGREY: Composition of audit committee (1 if audit committee comprised entirely of independent, non-employee directors, 0 else).

significant, with the exception of LTDA, REPLAG and ACNOGREY. The coefficient estimates for LTDTA and REPLAG are statistically insignificant and in the predicted direction, whereas for ACNOGREY it is insignificant and opposite the predicted direction.

To determine the potential impact of correlations amongst the explanatory variables on our regression results, we calculate variance inflation (VIF) scores and the condition index. VIF scores revealed no problems with multicollinearity (all scores < 2). The calculated condition index was 9.45. According to [Belsley et al. \(1980\)](#), a condition index of 5–10 indicates weak dependencies and a condition index of 30–100 indicates moderate-to-strong relations among the independent variables. Therefore, it appears that multicollinearity is not a problem.

Sensitivity Analysis

We also conducted sensitivity analyses for other potentially correlated, omitted explanatory variables. We conducted our regressions with a dichotomous variable for firms that disclosed plans to place equity in order to finance continuing operations. Similar to [Behn et al. \(2001\)](#), this was a rare occurrence (less than 8% of our sample firms). Unlike [Behn et al. \(2001\)](#), this variable was insignificant in both univariate and multivariate tests.⁷ Including a variable designating firms receiving a prior year going concern opinion ([Raghunandan & Rama, 1995](#)) also did not qualitatively impact our results either. Two other variables found in the prior literature, operating cash flow scaled by total liabilities and net income before taxes scaled by total sales, were also included in our regressions. Inclusion of these variables (either separately or in the aggregate) did not qualitatively impact the results reported in [Table 4](#), nor were the coefficient estimates for these variables statistically significant at conventional levels. Finally, inclusion of alternative variables proxying for the degree of financial distress – the [Altman \(1982\)](#) and [Zmijewski \(1984\)](#) Z-scores – did not materially alter our results reported in [Table 4](#).

We also investigated the impact of time, industry and auditor on our results. [Geiger and Raghunandan \(2001\)](#) find that auditors were less likely to modify their opinions after the Private Litigation Securities Reform Act of 1995. We conducted our tests with a variable coded one for years after 1995, 0 else. This variable did not exhibit a significant relation with the likelihood of issuing a going concern in either a univariate or multivariate setting.⁸ Our results were also not materially affected by the inclusion of auditor-specific nor industry-specific dummy variables.⁹ Finally, our results were qualitatively unchanged after including an auditor tenure variable ([Geiger & Raghunandan, 2002](#)). The coefficient estimate for the auditor tenure variable was not statistically significant in either a univariate or multivariate setting.

Discussion of Results

The results of [Table 4](#) and the robustness of those results suggest that DIP financing is significantly, negatively associated with receiving a going concern modification. This supports our contention that auditors are aware of the positive impact of DIP financing on post-bankruptcy emergence and are likely to possess private information about the likelihood of obtaining such financing. Note that a bankruptcy declaration is a necessary precondition for receiving DIP financing. Consequently, our sample selection criteria that eliminates firms that already declared bankruptcy systematically eliminates any DIP firm that would have disclosed these plans in their 10-Ks or annual reports.¹⁰

Our results suggest that many of the questions posed by the DIP lender are similar in spirit to those asked by the auditor when determining the going concern modification. The prospective DIP lender and auditor both must assess the viability of management's plans, the business entity and its prospects and management itself. Both the auditor and DIP lender have economic repercussions to their decisions, as well. In terms of the DIP lender, (s)he faces some risk of loss if the borrower fails to reorganize successfully, as the eventual liquidation may not generate sufficient value to pay off the DIP lender. Should the borrower liquidate, the administrative expenses ("burial expenses" in trade parlance) of the firm will rank above DIP loans in terms of priority status. In terms of the auditor, (s)he faces possible litigation, as well as loss of reputational capital should a firm eventually liquidate and not receive a going concern opinion prior to that liquidation. As such, it appears logical that the decision to extend DIP financing would be positively associated with the decision to issue an unmodified opinion. Both are signals of the economic viability of the firm, the firm's economic prospects and management's plans to mitigate financial stress.¹¹

SUMMARY AND CONCLUSIONS

SAS 59 guides auditors to obtain information about management's plans when making a going concern decision. The auditor should then consider whether it is likely that the plans can be effectively implemented and that any adverse conditions will be mitigated for a reasonable period. For firms facing adverse financial conditions an important determinant of survival is their liquidity or intent and ability to obtain additional capital ([Behn et al., 2001](#)). We note that debtor-in-possession (DIP) financing is designed to allow a firm to continue operations and has been found to be an important determinant of successful (and timely) bankruptcy emergence. Thus, we investigate whether DIPs or the conditions

surrounding them represent important mitigating factors within the going concern decision.

We find that auditors are less likely to issue a going concern modification for clients who later announce the receipt of DIP financing. Our evidence is consistent with auditors treating the receipt of DIP financing as a post-audit report mitigating factor in the going concern decision. Our results are consistent with [Mutchler et al. \(1997\)](#) who posit that positive, post-bankruptcy news could be associated with a reduced likelihood of receiving a going concern opinion, but did not find support for their hypothesis.

In terms of the study's limitations, we acknowledge that we cannot rule out the possibility that auditors are influenced by an omitted variable, correlated with both the receipt of DIP financing and the probability of firm survival. Moreover, an alternative interpretation of our findings is that it is not necessarily the DIP plan, per se, that the auditors are considering. DIP financing could represent a confirmatory vote of confidence of a firm's future economic prospects on the part of an informed party, namely, the DIP lender. This can act as a non-financial statement signal of superior economic strength vis-à-vis the non-DIP firms. As such, it is the signal, rather than the plan itself, that the auditors are considering in determining whether to modify their opinions. In turn, this signal could still be correlated with an omitted variable that has yet to be documented in current or prior research.

The going concern decision continues to be of interest because of the significant consequences, to both auditor and client, attached to both falsely identifying a company as a going concern and failing to provide a "warning" of client collapse. For example, the Auditing Standards Board formed a committee in 1999 aimed at revising SAS 59 to improve auditor performance. Among other considerations, the committee's deliberations focused on the types of conditions or events that should trigger the requirement to disclose information about an entity's financial health ([AICPA, 2000](#)).

Likewise, the SEC recently called upon professional oversight bodies to revisit the area of going concern decisions. Specifically, the SEC called upon the FASB, Public Oversight Board, and Auditing Standards Board to better define the going concern concept and clarify that management, not the auditor, has the primary responsibility to assess whether the entity has the ability to remain a going concern ([SEC, 2001](#)). The evidence provided herein suggests that DIP financing may be considered by the auditor to be a mitigating factor and that it is management who must convince not only the auditor, but also the DIP lender, in obtaining such financing.

Given the room for professional judgment provided by SAS 59 and the ongoing regulatory attention surrounding going concern reporting, we believe that the area

still leaves unresolved research questions. In particular, our results suggest that a management plan that includes bankruptcy, but allows for bankruptcy emergence, could be considered a mitigating factor in the auditor's modification decision. This is consistent with the auditor focusing on the firm's ability to remain a going concern twelve months following the balance sheet date, rather than on the firm's ability to avert bankruptcy. Such an interpretation may be somewhat at odds with prior research (and perhaps the ASB's original intentions as well), which generally assumes that an unmodified opinion for a subsequently bankrupt company constitutes an "audit failure." A logical extension of this study would survey audit partners to explore their interpretation of DIP financing and other circumstances that require the auditor to simultaneously evaluate both paragraph 1 and 7 of SAS 59. Such research could potentially shed light on the efficacy of SAS 59 in achieving the ASB's intentions regarding going concern reporting.

NOTES

1. Behn et al. (2001) examine the relation between client borrowing capacity and the going concern modification. Our study differs from theirs in two ways. First, because the receipt of DIP financing is not publicly disclosed until after the bankruptcy petition is filed, it is not included among the borrowing plans examined by Behn et al., who focus on the availability and adequacy of credit facilities in place. Second, the Behn et al., sample is comprised of distressed, but not necessarily bankrupt firms.

2. Much of the following discussion is drawn from comments provided by an anonymous reviewer, to whom we are gratefully indebted.

3. SAS 59 does not specifically include bankruptcy as a non-going concern condition. Bankruptcy may have been excluded from the standard since bankruptcy can reflect a strategic response to alleviate detrimental business conditions outside of normal business operations. For example, at the time of the SAS 59 deliberations, Continental Airlines declared bankruptcy in an effort to break union agreements. Members of the Auditing Standards Board anticipated that more situations such as this were likely to occur (albeit rarely) and that this made filing for bankruptcy an inadequate target for what is not a going concern. We would like to thank an anonymous reviewer for providing insight into the original deliberation process.

4. Comments received during informal discussions with partners representing each of Big 4 and several regional audit firms are consistent with this focus. In particular, these partners indicated that should DIP financing assist a firm in "keeping its doors open for the next twelve months past the balance sheet date," it would be a consideration in the going concern modification decision. The partners also stated that much of the information used in the going concern decision was, indeed, private at the time of the audit report. It should be noted, however, that the partners universally endorsed the flexibility and professional judgment afforded under SAS 59. Furthermore, these partners stated SAS 59 allowed them to better tailor their decisions by incorporating unique, firm-specific circumstances into their deliberations.

5. In terms of the overall percentage of non-stressed firms, our results are consistent with Geiger and Raghunandan (2001), who find that of a total of 383 bankruptcies, 18 were non-stressed firms.

6. As noted in Geiger and Raghunandan (2001, 2002) the Hopwood et al. (1994, Table 3) study provides the coefficients for the various financial ratios. However, both papers (Geiger & Raghunandan, 2001, 2002) note that the intercept term for Hopwood et al. (1994, Table 3) is incorrect. This was corroborated via discussion with one of the authors of the Geiger and Raghunandan papers. The corrected intercept term used in this paper to calculate the probability of bankruptcy is 5.565, as opposed to the -7.322 per Hopwood et al. (1994). After multiplying the various financial ratios by the coefficients a Z-score was determined. The probability of bankruptcy was then calculated as: $(\exp(Z))/(1 - \exp(Z))$ as per Hopwood et al. (1994).

7. Behn et al. (2001) acknowledge that their results for this particular variable “should be interpreted with caution” due to the infrequency of observations.

8. Geiger and Raghunandan (2001) study a similar sample period as our 1991–1997. However, their sample includes companies audited by non-Big 6 firms, nor did they impose the data restrictions in this study. More specifically, we require a firm file a proxy statement in order to investigate the impact of audit committee characteristics on the going concern modification decision. Consequently, we would assert our samples are different and may explain our lack of findings for this variable.

9. We used industry-specific intercepts per the focus industry classification scheme found in Table 1 (per Franz et al., 1998).

10. In order to ensure that the auditors’ information was indeed private (i.e. not publicly available), we searched the *Wall Street Journal* Index and company 8-Ks for pre-audit report date news that may have suggested a likelihood of obtaining DIP financing. Less than 5% of our sample firms disclosed such publicly available news in either the print media or in their 8-Ks. Inclusion of a dummy variable to designate these firms did not qualitatively impact the results of Table 4.

11. Furthermore, to the extent that auditors focus on the firm’s ability to maintain operations over the following 12 months, rather than liquidating, we should also find that DIP firms have a lower rate of subsequent liquidation. Consistent with this we find that in tests (not reported) our DIP sample firms exhibit a statistically significant higher survivorship rate (78%) than non-DIP firms (58%). This difference is significant at $p < 0.05$. However, this does not preclude a going concern modification for a firm receiving DIP financing. In fact we find that approximately 29% of the DIP firms received a going concern modification.

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A TIME-SERIES APPROACH TO MEASURING THE DECLINE IN QUARTERLY EARNINGS PERSISTENCE

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ABSTRACT

Although prior research documents an inter-temporal decline in earnings relevance for equity investors, precise evidence has not been collected on why the decline has occurred. We document a substantial decline in the persistence of quarterly accounting earnings over a 35-year period for a sample of New York Stock Exchange firms. Our findings hold regardless of whether firms are in industries with dramatic increases in spending on information technology through time or not. Further, neither ex ante measures of expected economic change (changes in barriers-to-entry and product type) nor an ex post measure of economic change (quarterly sales persistence) decline inter-temporally for our sample firms.

INTRODUCTION

In this paper, we provide evidence of a substantial decline in the *persistence* of quarterly accounting earnings over the extensive time period of 1967 to 2001

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(i.e. 35 years). This evidence relates to the question of *why* researchers are able to document an inter-temporal decline in the relevance of earnings to equity investors by showing either declining earnings response coefficients (Lev & Zarowin, 1999) or declining R^2 (Brown, Lo & Lys, 1999; Chang, 1998; Collins, Maydew & Weiss, 1997; Francis & Schipper, 1999; Lev & Zarowin, 1999) in regressions of returns on earnings.¹ Earnings response coefficients are increasing in earnings persistence (Collins & Kothari, 1989); however, a decline in the earnings response coefficient (or in R^2 for a regression of returns on earnings) does not necessarily imply a decline in earnings persistence, since other determinants of earnings relevance can change through time. These other determinants include growth and equity discount rates (Collins & Kothari, 1989), lead-lag relations between returns and earnings (Collins, Kothari, Shanken & Sloan, 1994; Warfield & Wild, 1992), and disclosure activity (Healy, Hutton & Palepu, 1999). To begin the explanation of why earnings relevance has declined, we isolate a single, albeit important, determinant of earnings relevance, quarterly earnings persistence, and document its substantial inter-temporal decline.

The decline in earnings persistence is of considerable interest to standard-setters, accountants, and auditors who have been challenged to change the financial accounting measurement and reporting model in a way that creates greater benefits for the investment public. This challenge is prompted by criticism that information contained in financial statements (and the attestation thereof) has “lost relevance” for investor decision-making. The current financial reporting model has been attacked on two fronts. First, professional business publications and policy makers are concerned that companies have increased their propensity to manage earnings (Greenberg, 1998), to select accounting principles with weak economic relevance, and to burden earnings with transitory charges. In other words, changes in accounting measurement practices (as a whole) have been cited as causes of a decline in financial statement relevance. Second, the transition to a “new economy” where unrecorded (“knowledge”) assets dominate has also been cited as a key factor in relevance decline. For example, Lev and Zarowin (1999) provide compelling evidence that change, caused primarily by knowledge-created barriers-to-entry, is a driving force behind the decline in relevance.

In crafting standards to improve earnings relevance, policy makers must understand the source of relevance decline. For example, a standard to improve the timeliness of accounting data may not have much of an effect on earnings relevance if noise (i.e. lack of persistence) is a major factor in relevance decline. In fact, Collins et al. (1994) argue that such a standard could increase management discretion and add noise. Similarly, standards aimed at noise reduction may remove management’s discretion to incorporate beliefs about the future into current accounting earnings, and thus damage the predictive value of earnings.

Such a standard might actually serve to reduce relevance if noise was not the reason for relevance decline in the first place.

Our study is designed explicitly to isolate a single component of relevance, persistence, and capture it directly from accounting data for the purpose of documenting earnings relevance decline. We are the first to use comprehensive ARIMA time-series modeling to identify model structures, measure *quarterly* earnings persistence, and document its inter-temporal decline. Our approach is consistent with other studies that use parameter values of ARIMA models as proxies for earnings persistence when linking such proxies to the degree to which unexpected earnings translate into unexpected returns. Assuming an autoregressive earnings process, [Kormendi and Lipe \(1987\)](#) and [Easton and Zmijewski \(1989\)](#) provide theoretical and empirical links between persistence and the degree to which unexpected annual earnings translate into unexpected returns. As discussed by [Collins and Kothari \(1989\)](#), persistence factors are derived in the two aforementioned papers, as well as by [Miller and Rock \(1985\)](#) and [Beaver, Lambert and Morse \(1980\)](#), using alternative *assumed* ARIMA specifications. Our study differs from previous work in three very important respects. First, instead of assuming an ARIMA quarterly earnings model specification, we use statistical goodness-of-fit criteria to identify quarterly earnings model structures and derive earnings persistence factors from these structures. Second, we measure firm-specific proxies for persistence that show considerable variability across firms rather than employing a cross-sectional design like [Fama and French \(2000\)](#). The latter study, while allowing for year and/or industry-specific estimates of persistence, does not permit firm-specific variability. Third, while [Collins et al. \(1997\)](#) document a decline in relevance of “bottom line” earnings which include non-recurring items such as discontinued operations, extraordinary gains and losses, and cumulative effects of accounting changes, we document a decline in quarterly earnings persistence using a metric for quarterly earnings (i.e. quarterly net income before extraordinary items) that excludes such non-recurring items. [Collins et al. \(1997\)](#) largely attribute the relevance decline they observe to the increasing presence of those non-recurring items in earnings. Cross-sectional methodologies like [Collins et al. \(1997\)](#) and [Fama and French \(2000\)](#), among others, offer the power of huge sample sizes while incurring the cost of suppressing firm-specific variability in earnings persistence. Our research design presents us with some interesting tradeoffs. Specifically, the benefit of measuring earnings persistence on a firm-specific basis is achieved at a cost of sample-size reduction (relative to cross-sectional approaches) due to the 35-year time-series data requirement necessary to measure our persistence proxy on a firm-specific basis.² This approach allows us to provide an important triangulation of extant research findings on earnings persistence work that has consistently used a cross-sectional approach.

The current study is also the first earnings relevance decline study executed in the *quarterly* domain. This allows us to formally incorporate seasonality effects into the proxy for earnings persistence, which is not possible in annual work. Specifically, both quarter-to-quarter (i.e. adjacent) and quarter-by-quarter (i.e. seasonal) effects are captured in our persistence proxies. Brown (1993), among others, discusses how forecast accuracy is enhanced and measurement error is minimized when quarterly earnings expectation models are used instead of annual ones. Quarterly reporting is a long-established practice in the United States, and it represents the most timely, *ex post* accounting explicitly sanctioned by policy makers.

We specifically employ three subperiods: 1967–1978 ($n = 172$), 1979–1990 ($n = 172$), and 1991–2001 ($n = 97$) in our data analysis. A necessary byproduct of such extensive time-series modeling across such long windows of time (i.e. 1967–2001) is a sample dominated by long-lived, stable firms that continue to derive profits from both tangible assets and long-established, sustainable, competitive advantages. These types of firms still represent a substantial portion of the U.S. economy. While we concur with the position that policy makers may need to promulgate new measurement and disclosure standards to cope with the rapidly changing economy (e.g. increases in unrecorded knowledge assets), evidence on why earnings relevance has declined for firms represented in our sample is extremely relevant to those who question whether financial accounting measurement practices have taken “a turn for the worse” through time. Our research methods employ a sophisticated time-series modeling approach that is especially appropriate for analyzing such issues.

Our sample contains some firms for which information technology spending has increased through time. As predicted by theory, both quarterly earnings and sales persistence are higher in the presence of the barriers-to-entry created by information technology-related “knowledge” assets for these firms; however, our findings pertaining to the decline of quarterly earnings persistence hold regardless of whether firms are in industries with dramatic increases in spending on information technology through time or not. Further, *ex ante* measures of expected economic change (i.e. expenditures to create barriers-to-entry, and product type) are inter-temporally invariant in our sample, and we find that a key *ex post* measure of economic change, quarterly sales persistence, does not experience a decline through time for our sample firms. This finding is particularly important when viewed from the perspective that earnings series are more susceptible to manipulation than sales series.

The remainder of the paper is organized as follows. The next section describes the sample selection procedures, time-series models, the measures of earnings persistence, and the properties of time-series measures that allow isolation of the persistence effect. The following section presents results of our primary tests. We

continue our analysis with a section that identifies economic variables (both *ex ante* and *ex post*) that might change through time in a way that changes expected earnings persistence, and as a check on our main results, examines changes in the variables through time. Finally, the last section summarizes and concludes the paper.

SAMPLE SELECTION AND MEASURES OF PERSISTENCE

We analyzed three subsamples of calendar year-end, NYSE firms: 1967–1978 ($n = 172$), 1979–1990 ($n = 172$), and 1991–2001 ($n = 97$). Sample firms had uninterrupted time-series data for quarterly net income before extraordinary items and quarterly sales revenue from the first quarter 1967 to the fourth quarter 2001 on the quarterly COMPUSTAT tape and complete data for the measurement of control variables (described later). This provided three consecutive time series with 48 quarterly observations in the first two subperiods and 44 quarterly observations in the last subperiod. These data were used separately to estimate the autoregressive and seasonal moving-average parameters of the $(1, 0, 0) \times (0, 1, 1)$ ARIMA model suggested by [Brown and Rozeff \(1979\)](#).³

Since quarterly data are influenced by adjacent *and* seasonal autocorrelations, we adopted the $(1, 0, 0) \times (0, 1, 1)$ ARIMA structure popularized by [Brown and Rozeff \(1979\)](#) as the ARIMA time-series model for quarterly earnings (and for sales, as described later).⁴ In the appendix, we derive the quarterly persistence factor consistent with this ARIMA time-series model. The Brown-Rozeff persistence factor (PER_{BR}) may be represented as:

$$PER_{BR} = \left(\frac{\varphi}{1 + r - \varphi} + \frac{(1 + r)(1 - \Theta_4)}{(1 + r - \varphi)[(1 + r)^4 - 1]} \right) a_t \quad (1)$$

where: φ = first order autoregressive parameter; r = an appropriate discount or interest rate = 0.025;⁵ Θ_4 = seasonal moving average parameter, and a_t = current disturbance term or shock.

We test whether firm-specific, quarterly earnings persistence declines across the three aforementioned subperiods. Estimation of persistence in [Eq. \(1\)](#) requires choice of a specific ARIMA model and requires subperiod definition. We note that the Brown-Rozeff ARIMA model has a great deal of empirical support in the quarterly earnings predictive ability literature (e.g. [Bathke & Lorek, 1984](#); [Collins & Hopwood, 1980](#)), and subperiod definition is necessary for all relevance decline studies.

We also estimate another popular quarterly earnings ARIMA model that has received frequent use in the literature for persistence measurement, the $(1, 0, 0) \times (0, 1, 0)$ with drift ARIMA structure (Foster, 1977) to assess whether our empirical results are sensitive to model structure.⁶ The parameters estimated from this model can also be combined with valuation theory in a fashion analogous to that presented in the appendix for the Brown-Rozeff model to obtain the Foster model persistence factor (PER_F):

$$PER_F = \left(\frac{\varphi}{1 + r - \varphi} + \frac{(1 + r)}{(1 + r - \varphi)[(1 + r)^4 - 1]} \right) a_t \quad (2)$$

Our PER measures have several properties that are important in isolating the persistence effect from other determinants of the earnings response coefficient. First, ARIMA models are far less affected by growth (Collins & Kothari, 1989). Second, PER, as we compute it, does not vary based on changes in firm-specific discount rates. Third, Collins et al. (1994) and Warfield and Wild (1992) document that the earnings response coefficient is also related to lead-lag relations between returns and earnings. Our PER measure is long-run in nature and independent of the inter-temporal alignment of earnings and returns. Finally, Healy et al. (1999) document an association of earnings response coefficients with disclosure levels. Since we do not infer persistence from price/return relations, we need not employ stock market data that are influenced by disclosure level (among other things) to estimate PER.⁷

RESULTS

Table 1 provides descriptive statistics on our quarterly earnings persistence factors for each of the three subperiods. An examination of the distributions in Panel A shows that persistence factors derived from each of the ARIMA models vary considerably across firms (i.e. 0.34 to 409.56 for PER_{BR} measured across the 1967–1978 subperiod or 7.98 to 465.97 for PER_F measured across the 1991–2001 subperiod). Since our persistence factors evidence large values for many sample firms, we employ rank transformations for all tests. We note that quarterly earnings persistence factors are systematically lower in the second (i.e. 1979–1990) and third (i.e. 1991–2001) subperiods at the first quartile, the median, and the third quartile for both ARIMA models versus the first subperiod (i.e. 1967–1978). This finding is consistent with a permanent decline in quarterly earnings persistence in the latter two subperiods.⁸

Panel A of Table 2 reports statistical tests of the aforementioned inter-temporal decline in quarterly earnings persistence. Median persistence values are also

Table 1. Quarterly Earnings Persistence^a for Subperiods 1967–1978, 1979–1990, and 1991–2001.

	Minimum	25th Percentile	Median	75th Percentile	Maximum
Brown/Rozeff model					
PER _{BR} 1967–1978 ($n = 172$)	0.34	11.28	19.49	35.79	409.56
PER _{BR} 1979–1990 ($n = 172$)	0.36	4.14	7.77	16.39	474.22
PER _{BR} 1991–2001 ($n = 97$)	0.27	3.98	8.12	14.08	238.86
Foster model					
PER _F 1967–1978 ($n = 172$)	7.59	15.99	23.34	31.09	192.76
PER _F 1979–1990 ($n=172$)	7.17	10.87	13.84	21.32	268.25
PER _F 1991–2001 ($n = 97$)	7.98	10.72	13.85	18.74	465.97

^aPersistence in quarterly earnings derived from Brown-Rozeff (PER_{BR}) and Foster (PER_F) ARIMA models in text Eqs 1 and 2.

reported for each subperiod. K-Sample median tests provide evidence of whether the persistence distribution has shifted over time. Results are reported for the full sample (i.e. 172 firms for the first two subperiods and 97 firms for the last subperiod) and for an information technology partition of the data. This partition is based on the level of information technology spending evidenced by sample firms. [Francis and Schipper \(1999\)](#) discuss, but do not test, the idea that emergence of information technology as a productive asset may also be a contributor to earnings relevance decline. [Brynjolfsson, Malone, Gurbaxani and Kambil \(1994\)](#) document that information technology spending is nearly equal across economic sectors until shortly after 1979 when spending in sectors other than non-durable manufacturing and transportation and utilities increased dramatically through 1989. We partition our sample into those firms in information technology-intensive industries ($n = 63$) and those that are not ($n = 109$) in the first two subperiods. Similar partitioning in the third subperiod resulted in 44 information technology-intensive firms and 53 firms that are not, respectively.⁹ We expect higher persistence for this set of firms that has created competitive advantages via acquisition of knowledge assets (i.e. firms in information technology-intensive industries).

The evidence in Panel A of [Table 2](#) indicates that quarterly earnings persistence declined between the first subperiod (i.e. 1967–1978) and the latter two subperiods (i.e. 1979–1990 and 1991–2001) for both the Brown-Rozeff and Foster ARIMA models. Median earnings persistence factors measured using the Brown-Rozeff (Foster) ARIMA model are significantly different across subperiods ($p = 0.0001$ for both models) declining from 19.49 (23.34) in the earliest subperiod to 7.77 (13.84) in the 1979–1990 subperiod and to 8.12 (13.85) in the 1991–2001

Table 2. Significance Tests of Decline in Quarterly Earnings Persistence Through Time. (Table Entries are the Median Persistence in Quarterly Earnings^a.)

Panel A: K-Sample Median Tests					
	1967–1978 Median	1979–1990 Median	1991–2001 Median	K-Sample Median Test	<i>p</i> -Value
Brown/Rozeff ARIMA model (PER _{BR})	19.49 (<i>n</i> = 172)	7.77 (<i>n</i> = 172)	8.12 (<i>n</i> = 97)	67.81	0.0001
Information technology- intensive ^b	23.30 (<i>n</i> = 63)	7.17 (<i>n</i> = 63)	8.81 (<i>n</i> = 44)	21.23	0.0001
Not information technology- intensive	18.28 (<i>n</i> = 109)	7.90 (<i>n</i> = 109)	6.85 (<i>n</i> = 53)	44.40	0.0001
Foster ARIMA model (PER _F)	23.34 (<i>n</i> = 172)	13.84 (<i>n</i> = 172)	13.85 (<i>n</i> = 97)	58.47	0.0001
Information technology- intensive ^b	24.31 (<i>n</i> = 63)	19.55 (<i>n</i> = 63)	15.77 (<i>n</i> = 44)	11.07	0.0001
Not information technology- intensive	23.06 (<i>n</i> = 109)	12.24 (<i>n</i> = 109)	12.15 (<i>n</i> = 53)	69.48	0.0001
Panel B: Mann-Whitney <i>U</i> -tests on Pairwise Comparisons (Entire Samples)					
Brown/Rozeff ARIMA Model (PER _{BR})		Foster ARIMA Model (PER _F)			
Paired Comparison	<i>p</i> -Value	Paired Comparison		<i>p</i> -Value	
1967–1978 vs. 1979–1990	0.0001	1967–1978 vs. 1979–1990		0.0001	
1967–1978 vs. 1991–2001	0.0001	1967–1978 vs. 1991–2001		0.0001	
1979–1990 vs. 1991–2001	0.818	1979–1990 vs. 1991–2001		0.680	
Panel C: Mann-Whitney <i>U</i> -tests on Pairwise Comparisons (Information Technology-Intensive)					
Brown/Rozeff ARIMA Model (PER _{BR})		Foster ARIMA Model (PER _F)			
Paired Comparison	<i>p</i> -Value	Paired Comparison		<i>p</i> -Value	
1967–1978 vs. 1979–1990	0.0001	1967–1978 vs. 1979–1990		0.0002	
1967–1978 vs. 1991–2001	0.0001	1967–1978 vs. 1991–2001		0.0009	
1979–1990 vs. 1991–2001	0.390	1979–1990 vs. 1991–2001		0.980	

Table 2. (Continued)Panel D: Mann-Whitney *U*-tests on Pairwise Comparisons (Not Information Technology-Intensive)

Brown/Rozeff ARIMA Model (PER _{BR})		Foster ARIMA Model (PER _F)	
Paired Comparison	<i>p</i> -Value	Paired Comparison	<i>p</i> -Value
1967–1978 vs. 1979–1990	0.0001	1967–1978 vs. 1979–1990	0.0001
1967–1978 vs. 1991–2001	0.0001	1967–1978 vs. 1991–2001	0.0001
1979–1990 vs. 1991–2001	0.320	1979–1990 vs. 1991–2001	0.310

^aPersistence in quarterly earnings derived from Brown-Rozeff (PER_{BR}) and Foster (PER_F) ARIMA models in text Eqs (1) and (2).

^bWe define utilities and transportation (4001, 4210, 4511, 4700, 4712, 4810, 4811, 4911, 4920, 4921, 4922) and non-durable goods producers as “not information technology-intensive.” These firms had a very small increase in spending on information technology after 1979 (Brynjolfsson et al., 1994). The sample sizes are 63 (109) for information technology-intensive (not information technology-intensive) firms for the first two subperiods and 44 (53) for the last subperiod.

subperiod.¹⁰ As expected, PER is higher for firms in information technology-intensive industries in both the 1967–1978 and the 1991–2001 subperiods for both models and also in the 1979–1990 subperiod for PER_F. In addition, the decline in earnings persistence across time is also observed for firms in industries that are not information-technology intensive.

Panel B of Table 2 presents Mann-Whitney *U*-tests on the pairwise comparisons across the entire sample, information technology-intensive firms, and not information technology-intensive firms. Across both models, the persistence factors in the first subperiod are significantly larger than the two more recent subperiods ($p = 0.0001$). Insignificant differences are reported for both models in paired comparisons of the persistence factors in the two most recent subperiods. Similar results are reported in panels C and D for information technology-intensive firms and not information technology-intensive firms.¹¹

Economic Change

Structural change in underlying economic characteristics of firms can affect earnings persistence even if accounting-related measurement processes do not. As noted earlier, data requirements for ARIMA modeling typically result in a sample of stable, older firms. However, to check whether economic stability is present in our sample, we calculated ex ante and ex post variables that are related to economic change and examined whether these variables changed over time for our sample firms.

Ex Ante Measures of Economic Change

We chose three variables that are theoretically linked to earnings persistence: size, barriers-to-entry, and product durability, to capture ex ante expected structural change in the underlying economic determinants of earnings persistence.¹²

Firm size can proxy for the stability of revenue growth (Scherer, 1973). Bathke, Lorek and Willinger (1989) document a positive relation between firm size and the first-order autoregressive parameter of ARIMA models for quarterly earnings developed by Foster (1977) and Brown and Rozeff (1979). Moreover, Baginski, Lorek and Willinger (1993) document a size effect on sample autocorrelation coefficients (SACFs) derived from annual earnings and sales. We proxied firm size by the log of the average market value of common equity measured in millions of dollars over the sample subperiods.

As suggested by Stigler (1963), Mueller (1977), and Kamerschen (1968), barriers-to-entry measure the ability of a given industrial output to be divided among incumbent firms and entrants into the industry. Higher barriers induce market share stability and higher autocorrelation of earnings and sales, while lower barriers invite entry and disrupt time-series properties. We measured barriers-to-entry using traditional industrial economics measures. Barriers are erected by product differentiation (e.g. advertising intensity), product innovations (e.g. research and development intensity), cost-efficient production (e.g. capital intensity), and the lower financial capital costs of debt, relative to equity, financing. Our barriers-to-entry variable is a sum of the average values of research and development expense, depreciation expense, interest expense, and advertising expense over the quarters in each subperiod, deflated by the average sales over the same subperiod (all measured in millions of dollars).

Darby (1972) and Zarnowitz (1972) provide empirical evidence in support of Friedman's (1955) view that permanent (transitory) income is related to the consumption of non-durable (durable) goods and services. We examined the *Survey of Current Business* published monthly by the U.S. Department of Commerce to ascertain whether the firm was classified as a durable or non-durable producer. Lack of firm-specific classification change between the three subperiods caused us to discard the product durability variable. Table 3 reports distributional data on two of the three economic determinants of persistence (product durability did not change and is excluded from the table).

Examination of the distributional data indicates that firm size increased over the three subperiods as one would expect with median logged values of average market value of equity (in millions) of 5.83, 6.85, and 8.16, respectively. However, the theoretical link between firm size and earnings persistence is positive, and earnings persistence decreased in our sample. Barriers-to-entry changed very little

Table 3. Descriptive Statistics on Economic Variables for Subperiods: 1967–1978 ($n = 172$), 1979–1990 ($n = 172$), and 1991–2001 ($n = 97$).

	Minimum	25th Percentile	Median	75th Percentile	Maximum
Firm size (SIZE) ^a					
1967–1978	2.99	4.85	5.83	6.92	10.59
1979–1990	2.54	5.95	6.85	7.60	11.04
1991–2001	4.40	7.15	8.16	9.19	12.36
Barriers-to-entry (BTE) ^b					
1967–1978	0.01	0.05	0.09	0.14	0.32
1979–1990	0.01	0.07	0.10	0.14	0.35
1991–2001	0.01	0.08	0.10	0.15	0.25

^aLog of average market value of equity measured in millions of dollars.

^bAverage values of research and development expense, depreciation expense, interest expense, and advertising expense, deflated by average sales (all variables measured in millions of dollars).

over the three subperiods. Given that product durability also did not change, we find no evidence that *ex ante* measures of economic change led to the earnings persistence decline through time.¹³

Ex Post Measure of Economic Change: Sales Persistence

Most arguments about the decline in utility of accounting measurement practices isolate the expense series as the object for within-GAAP earnings management rather than the revenue series. Revenue recognition can be conservative or aggressive, but once a company establishes a defensible basis for revenue recognition, changes in that basis are far less frequent. Persistence in the quarterly sales revenue series is far more likely to reflect underlying economic phenomena. Accordingly, we use quarterly sales persistence as an *ex post* measure of economic change. Therefore, we employed the aforementioned ARIMA models to examine whether our sample firms experienced economic change as evidenced by a change in quarterly sales persistence across the three subperiods.¹⁴ [Icerman, Lorek and Abdulkader \(1985\)](#) provide evidence supportive of the Brown-Rozeff $(1, 0, 0) \times (0, 1, 1)$ ARIMA model for sales. Additionally, [Foster \(1977\)](#) provides similar support for the Foster $(1, 0, 0) \times (0, 1, 0)$ with drift ARIMA structure.

[Table 4](#) presents descriptive evidence on quarterly sales persistence. Distributional data suggest relatively stable sales persistence estimated using the Brown-Rozeff ARIMA structure, while sales persistence estimated using the

Table 4. Quarterly Sales Persistence^a for Subperiods 1967–1978, 1979–1990, and 1991–2001.

	Minimum	25th Percentile	Median	75th Percentile	Maximum
Brown/Rozeff model					
PER _{BR} 1967–1978 ($n = 172$)	1.79	21.92	39.85	85.86	521.01
PER _{BR} 1979–1990 ($n = 172$)	3.67	26.91	43.66	68.01	319.59
PER _{BR} 1991–2001 ($n = 97$)	6.35	24.16	39.15	61.50	279.51
Foster model					
PER _F 1967–1978 ($n = 172$)	5.40	12.22	17.64	26.72	220.48
PER _F 1979–1990 ($n = 172$)	6.62	23.39	35.70	47.77	222.15
PER _F 1991–2001 ($n = 97$)	10.19	23.81	39.49	55.34	188.44

^aPersistence in quarterly sales derived from Brown-Rozeff and Foster ARIMA models in text [Eqs \(1\) and \(2\)](#), respectively.

Foster ARIMA model is actually *higher* in the second and third subperiods across the entire distribution.

In Panel A of [Table 5](#), we present the same persistence decline tests for quarterly sales as presented earlier for quarterly earnings. In marked contrast to the earnings persistence findings, we find no evidence of a decline in sales persistence. In fact, when quarterly sales persistence is measured using the Foster ARIMA model, we document a significant increase in persistence across the three subperiods (median increases from 17.64 to 35.70 to 39.49, $p = 0.0001$), with the strongest effects for firms in industries that are not information technology-intensive. Our finding that quarterly earnings persistence has declined through time while quarterly sales persistence has either remained constant or increased is consistent with [Elliott and Hanna \(1996\)](#) who document increases in the reporting of transitory items through time. These items tend to be losses ([Maydew, 1997](#)) that do not affect the sales series.

Panels B–D of [Table 5](#) present Mann-Whitney *U*-tests of all subperiod paired comparisons associated with correspondingly significant K-Sample Median tests in Panel A. For example, Panel B discloses that all three subperiod paired comparisons associated with quarterly sales persistence factors derived from the Foster ARIMA model were significant. This finding is consistent with the notion that quarterly sales persistence captured by this model increases significantly through time. The overall tenor of these results holds in the pairwise comparisons involving the partitions of data relating to information technology spending with the singular exception that the latter two subperiod comparisons are insignificant at conventional levels in both subgroups.

Table 5. Significance Tests of Decline in Quarterly Sales Persistence Through Time. (Table Entries are the Median Persistence in Quarterly Sales.^a)

Panel A: K-Sample Median Tests					
	1967–1978 Median	1979–1990 Median	1991–2001 Median	K-Sample Median Test	<i>p</i> -Value
Brown/Rozeff ARIMA model (PER _{BR})	39.85 (<i>n</i> = 172)	43.66 (<i>n</i> = 172)	39.15 (<i>n</i> = 97)	1.55	0.460
Information technology- intensive ^b	56.62 (<i>n</i> = 63)	48.18 (<i>n</i> = 63)	40.87 (<i>n</i> = 44)	5.07	0.079
Not information technology- intensive	32.23 (<i>n</i> = 109)	39.41 (<i>n</i> = 109)	36.61 (<i>n</i> = 53)	1.86	0.394
Foster ARIMA model (PER _F)	17.64 (<i>n</i> = 172)	35.70 (<i>n</i> = 172)	39.49 (<i>n</i> = 97)	79.81	0.0001
Information technology- intensive ^b	22.81 (<i>n</i> = 63)	36.04 (<i>n</i> = 63)	40.84 (<i>n</i> = 44)	14.05	0.0009
Not information technology- intensive	14.65 (<i>n</i> = 109)	33.90 (<i>n</i> = 109)	37.99 (<i>n</i> = 53)	72.25	0.0001
Panel B: Mann-Whitney <i>U</i> -tests on Pairwise Comparisons (Entire Samples)					
Brown/Rozeff ARIMA Model (PER _{BR})			Foster ARIMA Model (PER _F)		
Paired Comparison	<i>p</i> -Value	Paired Comparison		<i>p</i> -Value	
None	None	1967–1978 vs. 1979–1990		0.0001	
None	None	1967–1978 vs. 1991–2001		0.0001	
None	None	1979–1990 vs. 1991–2001		0.046	
Panel C: Mann-Whitney <i>U</i> -tests on Pairwise Comparisons (Information Technology-Intensive)					
Brown/Rozeff ARIMA Model (PER _{BR})			Foster ARIMA Model (PER _F)		
Paired Comparison	<i>p</i> -Value	Paired Comparison		<i>p</i> -Value	
None	None	1967–1978 vs. 1979–1990		0.0001	
None	None	1967–1978 vs. 1991–2001		0.0001	
None	None	1979–1990 vs. 1991–2001		0.110	

Table 5. (Continued)

Panel D: Mann-Whitney <i>U</i> -tests on Pairwise Comparisons (Not Information Technology-Intensive)			
Brown/Rozeff ARIMA Model (PER _{BR})		Foster ARIMA Model (PER _F)	
Paired Comparison	<i>p</i> -Value	Paired Comparison	<i>p</i> -Value
None	None	1967–1978 vs. 1979–1990	0.0001
None	None	1967–1978 vs. 1991–2001	0.0001
None	None	1979–1990 vs. 1991–2001	0.250

^a Persistence in quarterly sales derived from Brown-Rozeff (PER_{BR}) and Foster (PER_F) ARIMA models in text Eqs (1) and (2).

^b We define utilities and transportation (4001, 4210, 4511, 4700, 4712, 4810, 4811, 4911, 4920, 4921, 4922) and non-durable goods producers as “not information technology-intensive.” These firms had a very small increase in spending on information technology after 1979 (Brynjolfsson et al., 1994). The sample sizes are 63 (109) for information technology-intensive (not information technology-intensive) firms for the first two subperiods and 44 (53) for the last subperiod.

CONCLUSIONS AND LIMITATIONS

Although prior research has documented an inter-temporal decline in earnings relevance for equity investors, precise evidence has not been collected on *why* the decline has occurred. We find that a sample of 172 relatively older New York Stock Exchange firms experienced a substantial decline in the *persistence* of quarterly accounting earnings over the 1967 to 2001 period even though both ex ante and ex post measures of expected economic change are invariant.¹⁵ Unlike Collins, Maydew and Weiss (1997), our results pertain to quarterly earnings before special or “non-recurring” items. Our findings are robust to a partition of the data on spending on information technology through time. Additionally, we introduce two new quarterly earnings persistence factors, PER_{BR} and PER_F. These proxies were derived using statistical goodness of fit criteria to identify an appropriate ARIMA model structure rather than employing an autoregressive parameter from an assumed model structure as in extant work. Unlike previous work, our persistence proxies capture both quarter-to-quarter (i.e. adjacent) and quarter-by-quarter (i.e. seasonal) effects manifested in the SACFs of the quarterly earnings (sales) series. Finally, we document considerable variability in firm-specific quarterly earnings persistence factors which should be of considerable interest to standard setters when they consider alternative reporting standards that might have an impact on firms’ earnings persistence.

Data requirements for the ARIMA models used to measure persistence result in a sample of long-lived, economically stable firms that do not experience significant changes in either product type or barriers-to-entry measures. While our method

permits the isolation of persistence from other factors that affect earnings relevance, we do not generalize our results to “new economy” firms, smaller firms, or firms that have not survived for our full sample period. Nevertheless, it is interesting that a large decline in earnings persistence is observed for a set of economically important firms that experienced no related sales persistence decline. Our time-series research design allows firm-specific estimation of earnings persistence at the cost of inducing a survivorship bias since we impose a lengthy time-series data requirement on our sample firms. Moreover, this choice of research design (i.e. time series versus cross-sectional) allows us to provide an important triangulation on extant, cross-sectional research findings on earnings persistence.

The decline in median earnings persistence that we document is significant. We suggest that future research gauge the economic significance of this median earnings persistence decline relative to the effects of other factors on the earnings/return relation such as earnings timeliness and disclosure activity. Further, while research such as [Ely and Waymire \(1999\)](#) provides evidence of standard setting’s effects on earnings relevance in general, future research can address the success of specific policy initiatives on the firm-specific determinants of earnings relevance that the initiatives were intended to address.

NOTES

1. We adopt [Lev and Zarowin’s \(1999\)](#) view that the earnings response coefficient is a different perspective on the informativeness of earnings because of its positive association with the degree to which earnings explains security prices.

2. An earlier version of this paper measured quarterly earnings persistence for 172 sample firms across two subperiods: 1967–1978 and 1979–1990. The current version of the paper extends this analysis to also include 97 sample firms out of the aforementioned 172 firms which also have complete data for a third subperiod: 1991–2001.

3. We employ the conventional $(p, d, q) \times (P, D, Q)$ notation where (p, P) represent regular and seasonal autoregressive parameters; (d, D) represent consecutive and seasonal differencing and (q, Q) represent regular and seasonal moving-average parameters.

4. We analyzed the cross-sectionally derived sample autocorrelation functions (SACFs) and partial autocorrelation functions (PACFs) of the quarterly earnings series and found them supportive of the $(1, 0, 0) \times (0, 1, 1)$ ARIMA structure for our data in all three subperiods. Specifically, the Box-Ljung Q -statistic ([Ljung & Box, 1978](#)) indicated that the residual series were insignificantly different from a white-noise series.

5. In computing persistence, we used an annual discount rate of 10% (2.5% quarterly) for all firms. We did not vary discount rates across time periods. If we had, any documented persistence decline could have been induced by inter-temporal variation in interest rates rather than accounting measurement. Moody’s Aaa bond rates averaged 7.61% over 1967–1978, 11.03% over 1979–1990, and 7.51% over 1991–2001.

6. [Brown \(1993\)](#) states that the Foster ARIMA model is the most often used ARIMA model for quarterly earnings due to the ease with which its parameters may be estimated.

7. A side benefit is that we do not have to adjust for the documented inability of the market to link current and future quarterly earnings, and hence assess the valuation implications of quarterly earnings (e.g. Bernard & Thomas, 1990).

8. Pairwise Spearman rank correlations across the three subperiods employing the 97 firms common to all three subperiods reveal relatively modest levels of correlation in the quarterly earnings persistence factors ranging from -0.06 to 0.31 .

9. We define utilities and transportation (4001, 4210, 4511, 4700, 4712, 4810, 4811, 4911, 4920, 4921, and 4922) and non-durable goods producers (source: U.S. Department of Commerce, *Survey of Current Business*) as “not information technology-intensive.” These firms had a very small increase in spending on information technology after 1979 (Brynjolfsson et al., 1994).

10. Hayn (1995), Basu (1997), and Collins et al. (1997) argue that losses do not exhibit the same persistence properties as gains. The median number of loss quarters reported in 1967–1978 was zero out of 48 quarters, increasing to only one out of 48 quarters in 1979–1990, and three out of 44 quarters in 1991–2001.

11. Table 2 also reveals six pairwise comparisons of persistence factors across the information technology-intensive versus not information technology-intensive subsamples (i.e., 3 subperiods \times 2 ARIMA persistence factors). Consistent with our priors, the median persistence factors are greater for the information technology-intensive firms versus those that are not on 5 of 6 comparisons. Unreported Mann-Whitney U -tests reveal that three of these comparisons are statistically significant: 1991–2001 PER_{BR} comparisons ($p = 0.0005$), 1979–1990 PER_F comparisons ($p = 0.003$), and 1991–2001 PER_F comparisons ($p = 0.092$), all in the hypothesized direction.

12. See Baginski et al. (1999) for a detailed discussion of the economic determinants of earnings persistence.

13. Our analysis is limited to a set of economic variables with strong economic and empirical links to earnings persistence. The issue of whether economic conditions can explain the decline in earnings persistence remains unresolved.

14. Similar to that found for the various quarterly earnings series, the Box-Ljung Q -statistic indicated that the quarterly residual sales series were insignificantly different from a white-noise series for both ARIMA specifications.

15. Recall that only 97 of 172 sample firms were available in the most recent subperiod.

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APPENDIX: DERIVATION OF QUARTERLY PERSISTENCE FACTOR

The $(1, 0, 0) \times (0, 1, 1)$ ARIMA model may be written as:

$$(1 - \varphi B)(1 - B^4)Z_t = (1 - \Theta_4 B^4)a_t \quad (\text{A1})$$

where: Z_t = quarterly earnings at time t ; B = backward shift operator such that $BZ_t = Z_{t-1}$ and $B^4 Z_t = Z_{t-4}$; a_t = current disturbance term or earnings innovation; φ = first order autoregressive parameter, and Θ_4 = seasonal moving average parameter.

Multiplying and rearranging terms in (A1) yields:

$$Z_t = Z_{t-4} + \varphi(Z_{t-1} - Z_{t-5}) + a_t - \Theta_4 a_{t-4} \quad (\text{A2})$$

Next, we can express Z_{t-1} , Z_{t-2} , Z_{t-3} , ... in a similar fashion. For example,

$$Z_{t-1} = Z_{t-5} + \varphi(Z_{t-2} - Z_{t-6}) + a_{t-1} - \Theta_4 a_{t-5} \quad (\text{A3})$$

$$Z_{t-2} = Z_{t-6} + \varphi(Z_{t-3} - Z_{t-7}) + a_{t-2} - \Theta_4 a_{t-6} \quad (\text{A4})$$

etc.

Then, iterative substitution for Z_{t-1} , Z_{t-2} , Z_{t-3}, \dots into the RHS of Eq. (A2) yields:

$$\begin{aligned} Z_t = & a_t + \varphi a_{t-1} + \varphi^2 a_{t-2} + \varphi^3 a_{t-3} + \varphi^4 a_{t-4} + (1 - \Theta_4) a_{t-4} + \varphi^5 a_{t-5} \\ & + \varphi(1 - \Theta_4) a_{t-5} + \varphi^6 a_{t-6} + \varphi^2(1 - \Theta_4) a_{t-6} + \varphi^7 a_{t-7} \\ & + \varphi^3(1 - \Theta_4) a_{t-7} + \varphi^8 a_{t-8} + \varphi^4(1 - \Theta_4) a_{t-8} \\ & + (1 - \Theta_4) a_{t-8} + \dots \end{aligned} \quad (\text{A5})$$

Next, we express that the effect of the sum of the past disturbances on current earnings is equivalent to the effect of the current error or “shock” (a_t) on all future earnings (Z_{t+1}, Z_{t+2}, \dots).

$$Z_{t+1} = a_{t+1} + \varphi a_t + \varphi^2 a_{t-1} + \varphi^3 a_{t-2} + \dots \quad (\text{A6})$$

$$Z_{t+2} = a_{t+2} + \varphi a_{t+1} + \varphi^2 a_t + \varphi^3 a_{t-1} + \dots \quad (\text{A7})$$

$$Z_{t+3} = a_{t+3} + \varphi a_{t+2} + \varphi^2 a_{t+1} + \varphi^3 a_t + \dots \quad (\text{A8})$$

etc.

Assuming $a_t = \$1$, the effect of a_t on future earnings is: $\varphi + \varphi^2 + \dots$

Next, we can sum coefficients of the a_{t-i} terms and rearrange:

$$\begin{aligned} Z_t = & \varphi a_{t-1} + \varphi^2 a_{t-2} + \varphi^3 a_{t-3} + \dots + (1 - \Theta_4) a_{t-4} + \varphi(1 - \Theta_4) a_{t-5} \\ & + \varphi^2(1 - \Theta_4) a_{t-6} + \dots + (1 - \Theta_4) a_{t-8} + \varphi(1 - \Theta_4) a_{t-9} \\ & + \varphi^2(1 - \Theta_4) a_{t-10} + \dots \end{aligned} \quad (\text{A9})$$

etc.

Thus, Z_t may be expressed as the sum of an infinite number of infinite series. If we assume $a_t = \$1$ and discount by an appropriate quarterly rate r , the present value of the first infinite series in Eq. (A9) may be written as:

$$\left[\frac{\varphi}{(1+r)} \right] + \left[\frac{\varphi^2}{(1+r)^2} \right] + \left[\frac{\varphi^3}{(1+r)^3} \right] + \dots \quad (\text{A10})$$

or

$$\sum_{n=0}^{\infty} \left[\frac{\varphi}{1+r} \right]^n \quad (\text{A11})$$

Equation (A11) may be rewritten as:

$$\sum_{n=0}^{\infty} \left[\frac{\varphi}{1+r} \right]^n - 1 \quad (\text{A12})$$

which may be simplified to yield:

$$\frac{\varphi}{1+r-\varphi} \quad (\text{A13})$$

Equation (A13) is the first term of the Brown-Rozeff ARIMA persistence factor.

In an analogous fashion, the remaining series in Eq. (A9) may be written, after simplification and rearranging of terms, as:

$$\left[\frac{1-\Theta_4}{(1+r)^4} \right] \sum_{n=0}^{\infty} \left[\frac{\varphi}{(1+r)} \right]^n + \left[\frac{1-\Theta_4}{(1+r)^8} \right] \sum_{n=0}^{\infty} \left[\frac{\varphi}{(1+r)} \right]^n + \dots \quad (\text{A14})$$

Factoring out the common term: $\sum_{n=0}^{\infty} [\varphi/(1+r)]^n$, rearranging and simplifying yields:

$$\sum_{n=0}^{\infty} \left[\frac{\varphi}{(1+r)} \right]^n (1-\Theta_4) \sum_{n=0}^{\infty} \left[\frac{1}{(1+r)^4} \right]^n - 1 \quad (\text{A15})$$

Equation (A15) may be expanded:

$$\left(\frac{1}{1 - [\varphi/(1+r)]} \right) (1-\Theta_4) \left(\frac{1}{1 - [1/(1+r)^4]} - 1 \right) \quad (\text{A16})$$

Further simplification yields:

$$\frac{(1+r)(1-\Theta_4)}{(1+r-\varphi)[(1+r)^4-1]} \quad (\text{A17})$$

Equation (A17) depicts the second term of the Brown-Rozeff ARIMA persistence factor. Hence the infinite horizon Brown-Rozeff ARIMA persistence factor may be written as:

$$\left(\frac{\varphi}{1+r-\varphi} + \frac{(1+r)(1-\Theta_4)}{(1+r-\varphi)[(1+r)^4-1]} \right) a_t \quad (\text{A18})$$

which is our Eq. (1) in the text.

UNDERSTANDING THE SATISFACTION PROCESS FOR NEW ASSURANCE SERVICES: THE ROLE OF ATTITUDES, EXPECTATIONS, DISCONFIRMATION AND PERFORMANCE

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ABSTRACT

This study examines the consumer satisfaction formation process for new, non-traditional assurance services. Extending [Oliver's \(1997\)](#) expectancy disconfirmation model, our online survey mirrors the communications and activities in a typical ElderCare engagement. We find that consumers' attitudes toward advertisements for the new service, attitudes toward CPAs as providers, perceptions of performance, and disconfirmation are all significant determinants of satisfaction while expectations are not significant. Suggesting that consumers may not be able to form strong, stable expectations for new non-traditional services, these results imply that marketing should focus on professional qualifications and indicators of performance quality rather than on managing prepurchase expectations.

INTRODUCTION

Facing flat or decreasing revenue from audit services (AICPA, 1997; ICAA, 1997; ICAEW, 1997) and a financial market characterized by more and better information than provided by traditional audited financial reports (Adridge & Colbert, 1997; Wallman, 1995, 1996a, b), standard setters for professional accountants from North America, Europe and Australia are proactively identifying and analyzing future trends affecting the profession and translating their analysis into new assurance service offerings (AICPA, 1997; CICA, 1998; ICAA, 1997; ICAEW, 1997). In developing these new assurance services, the American Institute of Certified Public Accountants (AICPA) has specifically identified “customer focus” as one of the requisite competencies for assurance providers, noting that a customer focus requires assurers to “gain a much better understanding of users’ goals, objectives and strategies,” and calling for research to examine user/decision-makers’ needs (AICPA, 1997).

The AICPA has made strides in identifying the market for new assurance services. However, a more detailed understanding of how consumers view the service offering, provider and associated communications, and how they make satisfaction judgments about the service is vital to truly achieving a customer focus. Dissatisfied consumers may not only affect the professions’ ability to create a sustainable market for these new services, but may also result in increased liability to the profession. Therefore, the purpose of this paper is to build and test a model describing the factors shaping consumers’ satisfaction judgments for new non-traditional accounting services.

Background

The AICPA’s Special Committee on Assurance Services, also known as the Elliot Committee, was the leader in the search for new assurance services. The Elliot Committee defined assurance services as “independent professional services that improve the quality of information, or its context, for decision makers” (AICPA, 1997). After much market research, the Elliot Committee identified literally hundreds of new assurance services and developed business plans for six assurance services with significant, potential revenues.

Using the Elliot Committee’s business plans, the Canadian Institute of Chartered Accountants (CICA) and AICPA jointly developed the first new assurance services. The first service developed was WebTrust, which provides assurance to consumers about electronic commerce and is currently offered by professional accountants in the U.S., Canada, the U.K. and Australia. It was followed by

ElderCare, which provides assurance to adult children concerning the care goals for an elderly parent who lives out of state or overseas, and SysTrust, which provides assurance on the reliability of business systems.

Recognizing the centrality of marketing to the consumer for these new types of services, standard setters have concentrated on describing consumer needs for proposed new services, developing services that respond to those needs, and providing guidance for initial marketing (AICPA, 1997; CICA, 1998; ICAA, 1997). These activities are important first steps toward establishing viable new services. However, to ensure the *long-term* success of these new services, service providers must first understand consumers' expectations for the service and the forces shaping consumer satisfaction with them.

Satisfaction and Assurance Services

In the long-term, the consumer satisfaction formation process rests on the interplay among consumers' a priori expectations of the service, their subsequent evaluations of that service, and their disconfirmation, or the degree to which their perceptions of performance differ from their expectations. The satisfaction formation process, described in more detail by Oliver (1997), has been aggressively studied by marketing researchers for consumer goods (Tse & Wilton, 1988; Westbrook, 1987) and increasingly so for services (Cronin & Taylor, 1992; Halstead, Hartman & Schmidt, 1994). Though this research may still apply, new assurance services possess three distinctive characteristics that may influence the satisfaction formation process, but have not been addressed in the extant literature. First, these assurance services are completely new to consumers. Prior research has dealt exclusively with established products and services. Second, consumers are likely to perceive that services such as WebTrust and ElderCare are significant departures from the traditional accounting services, such as audit and tax, with which they are familiar (AICPA, 1997; ICAA, 1997). The influence on the satisfaction formation process of consumers' attitudes toward service providers offering non-traditional services has not been previously examined. Finally, because these services are new, representing a totally new market segment, marketing communications from the service provider may be one of the few pieces of information available to consumers before they decide to purchase. In the context of new services, for which little, if any, other information is available, the influence of marketing communications on the satisfaction formation process has not been examined.

As a result, the primary objective of this study is to examine the consumer satisfaction formation process described by Oliver (1997) in the context of new

assurance services. The study also extends the expectancy disconfirmation model to examine the role of consumers' attitudes toward professional accountants as service providers and toward advertisements about new services on the satisfaction formation process.

ElderCare was chosen as a representative new assurance service for two primary reasons. First, at the time the study was conducted, the ElderCare service was a brand new service offering in the U.S. and consumers had no prior knowledge of, or experience with, the service. Second, the ElderCare service is unique among assurance services because accountants can provide a wide range of direct, assurance or consulting services, any of which may be financial or non-financial. For example, assurance services may be provided on the financial objectives of the elderly, such as whether bills are being paid on time and all deposits are being received, or on the non-financial objectives of the elderly, such as whether medical instructions are being followed or housekeeping needs are being met (Lewis et al., 1998).

Because of the newness of the ElderCare assurance, there are too few actual consumers of the service to provide a sample adequate to examine the satisfaction formation process. Accordingly, we simulated the communications and activities in a typical ElderCare engagement using an online survey and respondents that fit the general profile for ElderCare consumers. This approach allowed us to examine all steps in the communication and satisfaction formation process for the new assurance and to gather early evidence on how consumer satisfaction for new assurances is formed. Thus, the internal validity and timeliness of the study make contributions that outweigh any weaknesses related to external validity. In this context, we are able to examine the applicability of Oliver's (1997) expectancy disconfirmation model to the satisfaction formation process for new assurance services while these services are still new.

The next section presents the conceptual model describing the satisfaction formation process for new services and related hypotheses. The following section describes the methodology and results of the study. The conclusion presents a discussion of the results and suggestions for future research.

THE CONCEPTUAL MODEL

As depicted in Fig. 1, we have developed a conceptual model that describes consumer satisfaction and expectations formation related to new assurance services. For purposes of this model, satisfaction is defined as consumers' postpurchase responses to new services, resulting from their comparison of the benefits and sacrifices stemming from the service to the expected consequences (Churchill & Surprenant, 1982; Tse & Wilton, 1988).

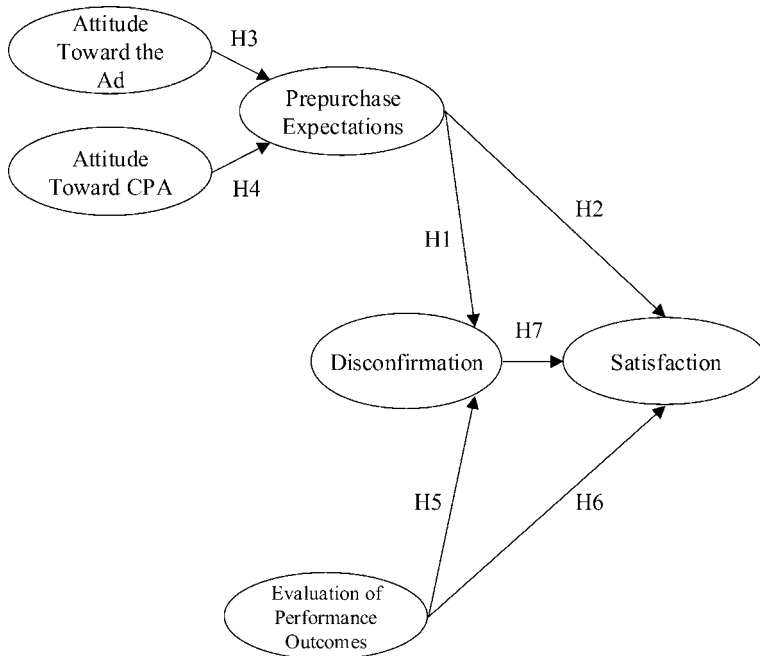


Fig. 1. Hypothesized Model.

Based on [Oliver's \(1980, 1997\)](#) expectancy disconfirmation model, our model suggests that satisfaction is a function of three independent variables – pre-purchase expectations, performance and disconfirmation. The model postulates that consumers form prepurchase expectations of new assurance services and compare these expectations to their evaluations of performance outcomes. Resulting disconfirmation of expectations, which is influenced by direct comparison of expectations and performance as well as other subjective factors, can be positive or negative depending on whether performance was perceived by the consumer as being above or below the comparison referent ([Oliver, 1997](#)). Positive disconfirmation results in increased consumer satisfaction whereas negative disconfirmation results in decreased consumer satisfaction ([Alford & Sherrell, 1996](#)). Based on subsequent extensions of Oliver's model, our model also indicates that both expectations and performance will directly influence satisfaction. The functional equation being studied is as follows:

$$\text{Satisfaction} = \alpha \text{Expectations} + \beta \text{Performance} + \chi \text{Disconfirmation}$$

With new assurance services, the source of initial expectations for the service is of paramount importance. Consequently, our model further extends Oliver's expectancy disconfirmation model by identifying two attitudinal variables that influence consumers' prepurchase expectations toward new assurance services: (1) consumers' attitudes toward the advertisements provided by professional accounting firms about the new service; and (2) consumers' attitudes toward professional accountants as providers of the new service. The key elements of this model are described in detail below.

Prepurchase Expectations

In the marketing and consumer behavior research traditions, consumer expectations play a crucial role, from determining initial demand for new products (Kopalle & Lehmann, 1995) to influencing consumers' postpurchase satisfaction with products and services (Oliver, 1997). It is this role as a determinant of consumer satisfaction with new services that requires accounting researchers to understand the nature of expectations, the process through which they influence satisfaction, and the attitudes that influence them.

Defining Expectations

Expectations can be broadly defined as "prepurchase beliefs or evaluative beliefs" (Oliver & Winer, 1987) about a product or service. While this definition establishes the subjective and predictive nature of expectations, it fails to address two other, fundamental issues: (1) What levels of desire are reflected by consumers' expectations; and (2) what levels of abstraction are reflected by consumers' expectations (Oliver, 1997)?

Regarding the level of desire, Miller (1977) classified expectations as reflecting four different levels of desire, all of which have been examined in the consumer satisfaction literature: what can be, what will be, what must be and what should (ought to) be. However, Oliver (1997) argues that predictive expectations of what will be capture the totality of one's needs, desires and values that are pre-existent and, thus, translate readily to expectations the consumer has for the product or service purchase experience.

Regarding the level of abstraction, Oliver (1997) states that expectations may be concrete predictions about *multiple attributes of performance*, an anticipation of some *general quality*, or an even more *abstract, affective* state. Because expectations are most often the comparative referent for evaluations of performance (Oliver, 1997), researchers (Boulding, Kalra, Staelin & Zeithaml, 1993; Oliver & DeSarbo, 1988; Parasuraman, Berry & Zeithaml, 1991; Tse & Wilton, 1988)

typically measure expectations as concrete predictions about the same multiple attributes used to measure performance. Thus, our model conceptualizes prepurchase expectations as *predictions* about performance outcomes on *multiple attributes*.

Expectations in the Satisfaction Process

That consumer expectations play an important role in the satisfaction process is virtually undisputed. [Oliver and DeSarbo \(1988\)](#) describe expectations as setting “the stage for later satisfaction by providing an anchor for later processing” (p. 504). Some questions remain, however, regarding the exact nature of the relation between expectations and satisfaction. Many consumer satisfaction researchers ([Cadotte, Woodruff & Jenkins, 1987](#); [Tse, Nicosia & Wilton, 1990](#); [Yi, 1990](#)) have found strong support for the underlying premise of [Oliver’s \(1997\)](#) model that expectations serve as a comparative referent for evaluating performance outcomes. This comparison results in either positive or negative disconfirmation, indicating the influence of expectations on disconfirmation and leading to our first hypothesis.

H1. Consumers’ prepurchase expectations will significantly influence disconfirmation.

The expectancy disconfirmation model also suggests that expectations directly influence satisfaction, an effect that is distinct from the mediating effect of disconfirmation ([Oliver, 1981](#)). Despite early mixed results ([Churchill & Surprenant, 1982](#)) which may be attributed to problems with manipulations, subsequent research has confirmed the separate effect of consumers’ expectations in experiments involving automobiles ([Westbrook, 1987](#)), stock market trading scenarios ([Oliver & DeSarbo, 1988](#)), and negotiation outcomes ([Oliver, Balakrishnan, Sundar & Barry, 1994](#)). Thus, the following hypothesis is presented:

H2. Consumers’ prepurchase expectations will significantly influence satisfaction.

Attitudes Influencing Expectations

Having discussed the significance of expectations to the satisfaction formation process, the next logical question is: what influences expectations? Though [Oliver’s](#) expectancy disconfirmation model does not address this question, several studies of product quality and satisfaction have examined a variety of expectations’ antecedents. Few, however, have examined antecedents of *service* expectations. And, to our knowledge, none have examined expectations’ antecedents for *new* services, i.e. those for which consumers have no previous knowledge or experience.

Oliver (1997) summarizes the product-based research involving expectations formation and classifies expectations antecedents as being derived from external or internal sources. External sources include promotional claims, word-of-mouth, third party information and product cues. Internal sources reflect consumers' past experiences with products, including the ease with which the product experience can be recalled and the vividness of that recall. Obviously, for new services, internal sources and some external sources are not available to help consumers form their initial expectations. For example, consumers of new services will not experience with the service, nor will they have access to word-of-mouth information based on the experiences of others. However, other external sources, including promotional claims and service cues, are available to consumers of new assurance services.

With regard to promotional claims, the AICPA has included information intended to help firms advertise the new assurance services in its implementation guidance. This information includes sample brochures and advertisements, some of which can be downloaded for free from the AICPA website. Previous research involving services (Webster, 1991) and products (Boulding et al., 1993; Kopalle & Lehmann, 1995; Zeithaml, Berry & Parasuraman, 1993) supports the influence of such advertising on consumers' expectations. Although these studies involved established products and services, an analogous influence of advertising on expectations of new services is intuitively appealing. Consumers of new services typically will have little else available to help them form their prepurchase expectations. Thus, the following hypothesis is suggested:

H3. Consumers' attitudes toward the advertisement will significantly influence consumers' prepurchase expectations.

In studies involving expectations formation for products, product cues have been identified as expectations antecedents (Kopalle & Lehmann, 1995). Oliver (1997) defines product cues as cues, such as brand name and store image, that have only an indirect relation to product attribute expectations. In the context of a service, the cues most available and likely to indirectly affect expectations may involve the service provider.

Alford and Sherrell (1996) note that with professional services, both the individual service provider and the category of service provider are integral components of the service. In their study, Alford and Sherrell measured consumers' reactions to dentists as a category of service provider prior to a service encounter with a specific dentist for a dental examination. Similarly, with new assurance services being offered by professional accountants, it is reasonable that consumers' expectations will depend on their attitude toward professional accountants as a provider of the service. In fact, the AICPA implicitly acknowledged this relation in the ElderCare market research conducted by Yankelovich Partners, Inc. by

specifically soliciting consumers' reactions to CPAs as providers of each service (AICPA, 1997). Thus, the following hypothesis is presented:

H4. Consumers' attitudes toward professional accountants as providers of the new assurance service will significantly influence consumers' prepurchase expectations.

Performance and the Satisfaction Process

Consumers purchase services to "do something" (Oliver, 1997), such as ensure that the care goals of an elderly parent are being met. So, what the service "does," i.e. its performance outcomes, are of the utmost importance to consumers. However, performance outcomes are not always easy to objectively quantify, especially for services. As a result, for services, consumers' *subjective evaluations* of performance outcomes are fundamental to the satisfaction process. For purposes of this study, performance is defined as the subjective evaluation of performance outcomes made by an individual after a service is consumed (Halstead et al., 1994).

In its infancy, the expectancy disconfirmation model suggested that performance only influenced satisfaction indirectly through disconfirmation, and in fact, consumers' perceptions of performance were often not measured in early examinations of the model (Oliver, 1997). Although this relation between performance and disconfirmation has been subsequently examined and supported by numerous researchers (Cadotte, Woodruff & Jenkins, 1987; Churchill & Surprenant, 1982; Tse & Wilton, 1988), others have questioned whether performance might exert a more direct influence on consumer satisfaction.

Churchill and Surprenant (1982) extended the expectancy disconfirmation model by hypothesizing and supporting a significant, direct effect of performance on satisfaction for both durable and non-durable goods. Subsequent research confirmed this effect in studies of compact disc players (Tse & Wilton, 1988), consumer telephone services (Bolton & Drew, 1991) and banking, pest control, dry cleaning and fast food (Cronin & Taylor, 1992). In addition, Oliver and DeSarbo (1988) found that the direct performance effect can operate in combination with disconfirmation effects. Thus, like expectations, performance seems to influence consumer satisfaction both directly and indirectly through disconfirmation (Oliver, 1993), prompting the following hypotheses:

H5. Consumers' evaluations of performance outcomes will significantly influence disconfirmation.

H6. Consumers' evaluations of performance outcomes will significantly influence satisfaction.

Disconfirmation and the Satisfaction Process

Disconfirmation is crucial to the satisfaction formation process, serving as an intervening variable between the exogenous variables, expectations and performance, and satisfaction (Churchill & Surprenant, 1982). Conceptually, disconfirmation arises from discrepancies between consumers' prior expectations and their perceptions of performance. The magnitude of the disconfirmation effect then influences the degree of consumers' satisfaction or dissatisfaction (Churchill & Surprenant, 1982; Oliver, 1981). However, research suggests that disconfirmation is more complex.

Disconfirmation has been conceptualized as subtractive (inferred) disconfirmation or subjective (perceived) disconfirmation (Swan & Trawick, 1981; Tse & Wilton, 1988). In its subtractive form, disconfirmation is measured algebraically by computing the difference between the subject's evaluation of product performance and their evaluation of expectations. In its subjective form, disconfirmation is measured by asking subjects to perform a separate, subjective evaluation of the difference between product performance and expectations. Therefore, subjective disconfirmation takes into account the "set of psychological processes that may mediate perceived product performance discrepancies (Tse & Wilton, 1988, p. 205)." Oliver (1980) and Tse and Wilton (1988) argue that the ability of subjective disconfirmation to capture consumers' cognitive states resulting from their comparison of performance to expectations allows it to better reflect the complex process underlying consumer satisfaction. Additionally, past research suggests that subjective disconfirmation is a superior predictor of performance (Oliver & Bearden, 1985; Tse & Wilton, 1988). Hence, we also adopt the more complex subjective conceptualization of disconfirmation and offer the following hypothesis:

H7. Disconfirmation will significantly influence consumers' satisfaction.

These seven hypotheses are summarized in the research model shown in Fig. 1.

METHOD AND RESULTS

A multi-stage, online survey was conducted to test the hypothesized model described in Fig. 1. The ElderCare assurance was chosen as a representative new assurance service for the study. The online survey was constructed to mirror the sequence of communications with potential clients in a typical ElderCare engagement as described below and to allow us to measure subjects' attitudes, expectations, perceptions of performance, disconfirmation and satisfaction at the appropriate times. Figure 2 describes the time line of the study.

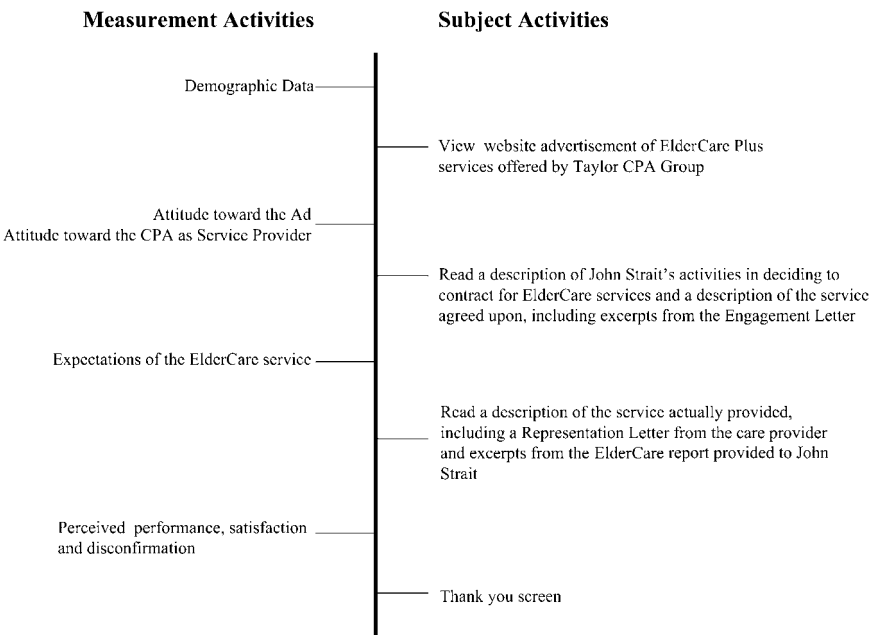


Fig. 2. Study Time Line.

After providing demographic data, subjects accessed a web site advertisement for ElderCare services sponsored by the fictitious Taylor CPA Group. Subjects had been previously informed that the entire case was hypothetical. The advertisement on this web site was created based on the promotional materials published by the [AICPA \(1999b\)](#). After subjects viewed the advertisement, their attitudes toward the advertisement and toward Taylor as ElderCare provider were measured. Next, subjects read a scenario describing a new client and his interactions with the Taylor CPA Group in contracting for the service. The scenario incorporated a detailed description of the service and excerpts from the engagement letter, both of which were prepared based on guidance provided by the [AICPA \(1997\)](#) and Practitioners Publishing Corporation ([Lewis et al., 1998](#)).

Though written prior to issuance of the Alert, the service described was very similar to the one described in the AICPA's Assurance Services Alert related to ElderCare ([1999a](#)). The service involved an agreed-upon procedures engagement including both non-financial and financial services. For the non-financial services, Taylor CPA Group agreed to regularly review daily log sheets maintained by a care provider, randomly observe the activities of the care provider and conduct

bi-weekly discussions of the quality of the care provider's work with a geriatric care manager. The care provider's duties included administering medication for the client's elderly mother, providing transportation and planning and preparing meals. For the financial services, the Taylor Group maintained the checking account for the elderly mother, paid her routine bills less than \$300 and provided a monthly accounting of these activities to the client. Accounting for deposits, bank reconciliations and approval of expenses larger than \$300 were performed by the client. To avoid introducing subjects' perceptions of the cost of the service into their evaluations, fees for services were described as a fixed monthly fee, but no amounts were specified. Additionally, a standard provision precluding the client's mother from including the CPA firm in her will was included with the engagement letter excerpt.

After subjects read the service description, their expectations of the service were measured. Then, they viewed a description of the actual service provided, including excerpts from Taylor CPA Group's report. After viewing this information, subjects were asked to evaluate the performance of Taylor CPA Group and describe their level of disconfirmation of expectations and their level of satisfaction relative to the service. The entire survey required an average of 30 minutes to complete. The following sections describe in more detail the subjects in the study and measurements used for the variables in the model in [Fig. 1](#).

Subjects

Subjects were a convenience sample of 370 adults. Criteria for participation included being between ages 24 and 65, not being an accountant, having access to the Internet and feeling comfortable reading five pages of text. Subjects were motivated through a \$5 donation to one of several charitable or non-profit organizations. They were allowed to select the organization to which their donation would be made from a listing provided by the researchers. Subjects were contacted through a variety of means. Some were contacted through e-mail lists or at events held by the benefiting charitable organizations. Other subjects were alumni or employees of the researchers' employing institutions. These individuals were contacted by the researchers via e-mail or advertisement in the university newspaper. All subjects were asked to forward information regarding the study to their family, friends and co-workers who met the criteria for participation; hence, some subjects were contacted in this manner as well.

Demographic information about the subjects is provided in [Table 1](#). Though a convenience sample, these relatively well-educated, middle-aged subjects reasonably represent the target population of interest for the ElderCare service.

Table 1. Demographic Data (Count and Percentage).

Gender		
Male	161	44%
Female	208	56%
Previously provided care to an elderly parent		
Yes	82	22%
No	287	78%
Educational level		
High school	30	8%
Associates degree	14	4%
Bachelors degree	136	37%
Masters degree	104	28%
Doctoral/medical/law degree	86	23%

Note: Average age: 43 years (standard deviation 9 years, minimum 24, maximum 65).

Variable Measures

Because of the unique nature of the service, many measures used in the study were either developed especially for the study or adapted to the ElderCare service from previous research. Given the challenge associated with obtaining enough suitable subjects to test the entire model, initial pilot testing of the instrument focused on readability, reasonableness and understandability. Several representative subjects, faculty members and ElderCare providers provided feedback during the pilot test.

Once the actual data were obtained, the measures used in hypothesis testing were refined to increase construct validity and reliability prior to inclusion in the structural equation model. First, items measuring each latent construct were analyzed using common factor analysis and varimax rotation to ascertain the dimensionality of the scale (Hair, Anderson, Tatham & Black, 1992). When this analysis revealed unidimensional scales, item analysis was utilized to select the items that most reliably measured the latent construct (Spector, 1992). These items were then utilized as indicators of the latent construct in the structural equation model. When the common factor analysis revealed multidimensional scales, factor loadings for a rotated solution were examined to develop subscales, which were then further refined using item analysis. The items for each subscale were averaged and used as indicators of the latent construct in the structural model, consistent with the recommendation of Landis, Beal and Tesluk (2000). The goal of this process was to capture as much of the content of each underlying construct as possible while still maintaining a reasonable number of indicators given the sample size.

The measures developed in this manner were then further examined through a confirmatory factor analysis, i.e. separate examination of the measurement model, as recommended by [Anderson and Gerbing \(1988\)](#). Finally, the measurement and structural models were combined and examined for hypothesis testing. The results of this process are described below.

Attitude Toward the Advertisement

Thirteen items to measure attitude toward the advertisement were adapted to the ElderCare service from measures previously developed by [Grossbart, Muehling and Kangun \(1986\)](#) and [MacKenzie and Lutz \(1989\)](#). Each item asked subjects to assess the appropriateness of bipolar adjectives describing the ElderCare advertisement. Responses were measured using a seven-point, semantic differential scale.

The first factor extracted by the exploratory factor analysis explained a total of 92.38% of the common variability in the scores, suggesting a single common factor underlying all of the items. The three items with the highest item remainder coefficients in the subsequent item analysis obtained a Cronbach's alpha of 0.88, indicating a high level of reliability given [Nunnally's \(1978\)](#) commonly cited benchmark of 0.80. Inclusion of additional items did not significantly influence reliability of the construct. As such, these three items were used as indicators of the latent variable, attitude toward the advertisement, in the structural model.

Attitude Toward the CPA as Provider of the New Assurance Service

Twenty items were developed to measure attitude toward the CPA as provider of the new assurance service. These items were adapted to the ElderCare service from measures of source or provider credibility previously developed and tested by [Gotlieb and Sarel \(1991\)](#) and [Lichtenstein and Bearden \(1989\)](#). Items were measured in a similar manner to attitude toward the advertisement with each item providing bipolar adjectives and using a seven-point, semantic differential scale.

Exploratory factor analysis revealed two factors explaining a total of 95.54% of the common variability in scores. Items loading more significantly on the first factor reflected general credibility attributes typically associated with the accounting profession such as honesty, believability, sincerity and dependability. Items loading more significantly on the second factor reflected attributes related to CPAs' competence to perform the services, such as expertise, experience,

training, knowledge and qualifications. Because the ElderCare assurance represents a significant departure from traditional services associated with CPAs, this description of the factors underlying subjects' attitudes toward the CPA as provider of the new assurance service seem plausible. Therefore, the items representing each of the two underlying factors were combined to form two subscales. Cronbach's alpha for the 15-item subscale capturing general credibility was 0.968. Cronbach's alpha for the 5-item subscale capturing competence was 0.943. Items for each of these subscales were averaged and the resulting credibility and competence measures were used as indicators of the underlying latent construct, attitude toward the CPA as provider of the new assurance service, in the structural model.

Prepurchase Expectations and Evaluation of Performance Outcomes

Prepurchase expectations and evaluation of performance outcomes were both measured using the same twenty-one items developed for the study. Each item consisted of a statement regarding a potential outcome of the ElderCare service. Subjects were asked to indicate their beliefs that the service provided by Taylor CPA Group would result in each outcome using a seven-point Likert scale anchored by "strongly agree" and "strongly disagree." Prepurchase expectations were measured after the description of the service and engagement letter, but before viewing the assurance report. Evaluations of performance outcomes were measured after subjects viewed the assurance report.

The twenty-one items measured were developed to reflect four potential dimensions of expectations and performance associated with the service described. The items measuring each dimension are shown in [Table 2](#), and each of the dimensions is described below:

- (1) *Care Provided*. These items related to the services provided by the care provider and observed by the CPA.
- (2) *Evaluation*. These items addressed providing, or assisting with, evaluations of care and the care provider, as well as assurances regarding the quality of care.
- (3) *Quality of Life*. These items dealt with the quality of life and general level of well-being provided to the client and his mother.
- (4) *Financial Services*. These items dealt with the financial services provided by Taylor CPA Group.

Exploratory factor analyses were conducted concurrently for the expectations and performance measures. Examination of eigenvalues as well as examination of rotated factor patterns suggested that a four-factor solution offered the most

Table 2. Expectations and Performance Measures.

Scale/Item	Final Reliability/ Status of Item
Care Provided	Expectations = 0.9579, Performance = 0.9495
Ensure that my mother receives appropriate physical care.	Included
Ensure that my mother has reliable transportation to her physical therapy appointments.	Included
Ensure that my mother takes her medication.	Included
Ensure that my mother has 3 meals a day.	Included
Evaluation	Expectations = 0.9491, Performance = 0.9409
Help me to evaluate the competence of care providers.	Included
Provide me with an evaluation of the competence of my mother's care providers.	Included
Guarantee a high standard of quality care.	Included
Help me evaluate the performance of my mother's care providers.	Included
Provide me with an evaluation of the performance of my mother's care providers.	Included
Provide a comprehensive evaluation of my mother's actual quality of care.	Included
Quality of Life	Expectations = 0.9229, Performance = 0.9465
Make my life a little easier.	Included
Improve the quality of my mother's life.	Included
Let me know everything is ok.	Excluded (poor item remainder coefficient)
Be valuable to me.	Included
Allow me to focus on spending quality time with my mother when I visit.	Included
Financial Services	Expectations = 0.8077, Performance = 0.8558
Protect my mother from being taken advantage of financially.	Included
Assure that my mother's money is invested wisely.	Excluded (poor item remainder coefficient)
Assure all of my mother's bills are paid when due.	Included
Result in all of my mother's money being spent unnecessarily.	Excluded (did not load from any factor)
Provide a report of my mother's monthly expenses.	Included
Provide an accurate record of the services provided to my mother. ^a	Included

^aThis item was originally part of the Care Provided subscale.

meaningful interpretation of the underlying factors. The four-factor solution also explained a significantly large proportion (99%) of the underlying common variability in scores for both expectations and performance measures. Generally, each item loaded on the same factor for both measures, suggesting a common dimensionality for the prepurchase expectations and evaluation of performance outcomes measures, as expected. Additionally, the dimensions were generally consistent with a priori expectations of the four dimensions as described above.

As shown in [Table 2](#), one item from the original financial services dimension was excluded from the final subscales because it did not have a significant loading from any of the underlying factors in either analysis. Two additional items (one each from financial services and quality of life) were excluded from the final subscale measures because of unfavorable item remainder coefficients, which show the correlation of the item with the sum of the other items in the scale ([Spector, 1992](#)). Coefficients smaller than the coefficient alpha for the scale were considered unfavorable. A final item “Provide an accurate record of the services provided to my mother” loaded on the financial services rather than the care provided factor as expected. Further consideration suggests that this item could better reflect an outcome resulting directly from the activities of the CPA as opposed to the care provider, making its inclusion in the financial services dimension reasonable.

These analyses, which are summarized in [Table 2](#), resulted in four different subscales each for prepurchase expectations and evaluation of performance outcomes. Each of these subscales possessed high degrees of reliability as measured by Cronbach’s alphas, with values ranging from 0.08077 to 0.9579 (reliabilities for each scale are shown in [Table 2](#)). As a result, items representing each subscale were averaged, and the resulting subscale measures were used as indicators of the latent constructs, prepurchase expectations and evaluation of performance outcomes, in the structural model.

Disconfirmation

Subjective disconfirmation was measured using a three-item, five-point, Likert-type scale suggested by [Oliver \(1993\)](#), [Oliver and Swan \(1989\)](#) and [Westbrook \(1987\)](#). The items required subjects to indicate whether the benefits, outcomes and service overall were relatively better or worse than expected. Exploratory factor analysis indicated that these three items reflected a single, unidimensional construct. Coefficient alpha for the resulting construct was 0.8347.

Satisfaction

Satisfaction was measured using a four-item, semantic differential scale. The items included in the scale are based on generalized satisfaction measures previously developed by [Oliver \(1993\)](#), [Oliver and Swan \(1989\)](#) and [Crosby and Stephens \(1987\)](#). In contrast to the disconfirmation items, these asked subjects to provide absolute, rather than relative, perceptions of the service. The items utilized bipolar adjective scales that required the subjects to describe their feelings about the service received. The positive adjectives on the scales were pleased, contented, satisfied and made a good choice. Coefficient alpha for the resulting scores was 0.9479. Based on the item analysis, all four were included in the structural model.

Confirmatory Factor Analysis/Measurement Model

Before examining the combined measurement and structural model for hypothesis testing, we conducted a confirmatory factor analysis to examine the properties of the measurement model ([Anderson & Gerbing, 1988](#)). Covariances between corresponding indicators of expectations and performance were estimated as part of the measurement model since the subscales used as indicators included the same items examined at different points in time, which fails to satisfy assumptions of independence ([Anderson & Gerbing, 1988](#); [Bagozzi, 1980](#); [Gerbing & Anderson, 1984](#)). The initial measurement model exhibited reasonable levels of fit; however, modification indices suggested a strong correlation between the error terms for two of the satisfaction measures. Examination of the items revealed strong similarities in their wording. Accordingly, one of these measures was deleted from the model ([Hair et al., 1992](#)).

The final measurement model is shown in [Fig. 3](#). In structural equations modeling, a number of measures of the goodness of a model's fit are available. [Hair et al. \(1992\)](#) suggests using a variety of different measures examining the absolute fit, incremental fit relative to a null model and parsimonious fit, which considers the number of paths relative to parameters in the model. Consequently, a variety of fit measures are shown in [Table 3](#) for all of the models tested here. All of the goodness of fit statistics shown in Column 1 of [Table 3](#) suggest excellent fit of the data to the measurement model except for the chi-square statistic. Chi-square is 194 with 133 degrees of freedom and $p < 0.01$. While a large p -value is desirable, indicating that the observed covariance matrix of the variables is similar to the model, small p -values are common in samples of this size ([Hair et al., 1992](#)). Other measures of fit suggest good fit. Root means square error of the approximation (RMSEA), which shows the error per degree

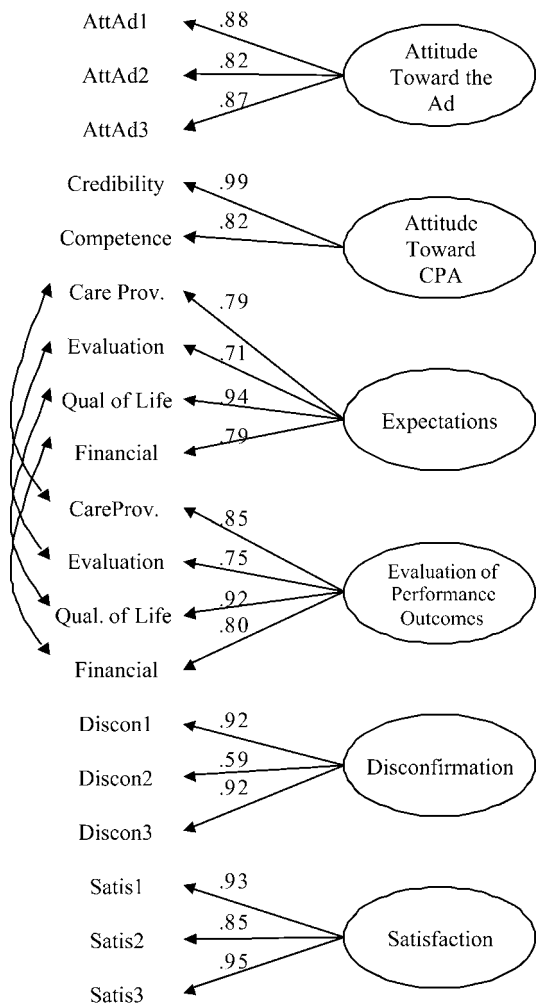


Fig. 3. Measurement Model. Note: All measurement model coefficients are significant at <0.001 .

of freedom and exhibits good fit at values less than 0.05, is 0.035. The normed fit index (NFI), which indicates good fit at values above 0.9, is 0.97. The normed chi-square, which has a recommended level between 1 and 2, is 1.46.

As shown in Fig. 3, loadings for all of the indicators for each factor were large and significant ($p < 0.001$). Table 4 shows statistics measuring the reliability of

Table 3. Goodness of Fit Statistics.

	Measurement Model	Structural Model	Modified Structural Model
Absolute fit measures			
Chi-square	194.69	424.16	140.56
Chi-square df	133	138	84
Chi-square <i>p</i> -value	0.01	0.01	0.01
RMSEA	0.035	0.075	0.043
Goodness of fit index	0.95	0.89	0.95
Comparative/incremental fit measures			
Normed fit index	0.97	0.93	0.97
Non-normed fit index	0.99	0.94	0.99
Comparative fit index	0.99	0.95	0.99
Relative fit index	0.97	0.92	0.97
Parsimonious fit indexes			
Normed chi-square – chi-square/chi-square df	1.46	3.07	1.67
Adjusted goodness of fit index	0.93	0.85	0.93
Parsimonious normed fit index	0.76	0.75	0.78
Parsimonious goodness of fit index	0.66	0.65	0.67

the indicators of each underlying construct. Composite reliability measures the degree to which the indicators of a latent construct are consistent in their measurement of the underlying factor. A minimum value of 0.7 is recommended (Hair et al., 1992). Variance extracted describes the overall amount of variance in the indicators accounted for by the latent construct. A minimum value of 0.5 is recommended (Hair et al., 1992). Composite reliability and variance extracted measures for each factor shown in Table 4 all exceed these recommended benchmarks, indicating

Table 4. Reliability and Variance Extracted for Latent Construct Measures.

Measure	Measurement Model		Full Model	
	Composite Reliability	Variance Extracted	Composite Reliability	Variance Extracted
Attitude toward the ad	0.89	0.73	0.89	0.73
Attitude toward the CPA	0.90	0.82	0.90	0.82
Expectations	0.89	0.66	0.87	0.63
Performance	0.90	0.69	0.89	0.67
Disconfirmation	0.86	0.68	0.86	0.68
Satisfaction	0.94	0.83	0.94	0.83

good reliability for the measures. Tests recommended by [Anderson and Gerbing \(1988\)](#) also reveal that correlations between constructs are significantly different from 1.0, supporting discriminant validity of the various constructs.

Based on these goodness of fit results and measurement model assessments, we concluded that there was sufficient evidence in support of the theorized measurement model. As a result, we combined the measurement and structural models to test the hypotheses presented in the paper.

Descriptive Statistics

[Table 5](#) presents descriptive statistics for key variables from the study. Examination of the means for these variables indicates some interesting results. First, subjects' attitudes toward the advertisement were more positive than their attitudes toward the CPA as new assurance provider (mean for ad = 4.85; mean for CPA = 4.61; $t = 5.44$; $p = 0.001$). When examining their views of the CPA as new assurance provider, on average, their credibility assessments were higher than their assessments of competence (mean for credibility = 4.70, mean for competence = 4.51;

Table 5. Descriptive Statistics.

Variable	Mean ^a	Std. Dev.
Attitude Toward the Advertisement	4.85	1.26
Attitude Toward the CPA as Provider	4.61	1.11
CPA Credibility	4.70	1.08
CPA Competence	4.51	1.26
Expectations	5.17	1.22
Care Provided	5.17	1.54
Evaluation	4.36	1.70
Quality of Life	5.44	1.28
Financial Services	5.69	1.13
Evaluation of Performance Outcomes	5.17	1.25
Care Provided	5.22	1.48
Evaluation	4.38	1.67
Quality of Life	5.47	1.31
Financial Services	5.60	1.24
Disconfirmation	4.68	1.29
Satisfaction	5.11	1.45

^a All variables were measured on seven-point Likert-type scales and were coded with higher numbers indicating more favorable attitudes.

$t = 4.84$; $p = 0.001$). Though these mean differences are not large, relative to the standard deviation for the measures (1.2 scale points on average), they may be large enough to suggest a degree of uncertainty in subjects' minds regarding the appropriateness of CPAs as providers of a service like ElderCare.

Regarding expectations and performance, average expectations were consistently at the same level as performance evaluations with the exception of expectations and performance for the financial service provided, where expectations were slightly higher than performance (mean = 5.69 for expectations, versus mean = 5.60 for performance; $t = 2.35$; $p = 0.0195$ for financial services). The lack of difference between expectations and performance evaluations for the remaining facets may reflect potential difficulty in establishing expectations for a new service, as will be discussed in the model modification portion of the following section of the paper. Regarding the components of expectations and performance, expectations were highest for the financial services component (5.69), followed by quality of life issues (5.44), service provider issues (5.17) and finally issues dealing with evaluation of care (4.36; t -statistics for these differences ranged between 5.72 and 17.59 for expectations with p -values all equal to or less than 0.01). This ordering may be suggestive of the more structured nature of the financial services component of the engagement and may also indicate some understanding on the part of subjects that assurances regarding the service provider's performance are only tangentially provided by the ElderCare assurance.

Structural Model Results

The fitted structural equation model hypothesized in Fig. 1 is shown in Fig. 4. Hypotheses corresponding to each path are labeled in the diagram. Each of the latent constructs exhibits similar levels of composite reliability and variance extracted to the measurement model examined earlier (statistics are shown in Table 4), as well as similar path coefficients. This suggests stability of the measurement model, allowing for useful interpretation of the structural portion of the model (Anderson & Gerbing, 1988). Goodness of fit statistics for the full model are shown in Column 2 of Table 3. These statistics show reasonable, though not ideal overall model fit (chi-square 424, df 138, $p < 0.01$, RMSEA 0.075, NFI 0.93, Normed chi-square 3.07). In particular, the RMSEA and normed chi-square exceed recommended levels of 0.05 and 2.0 respectively. Examination of the path coefficients in the structural model and their related significance levels indicates support for five of the seven hypothesized relationships.

Hypotheses 1 and 2 involving relations between expectations and disconfirmation and expectations and satisfaction are not supported by the data.

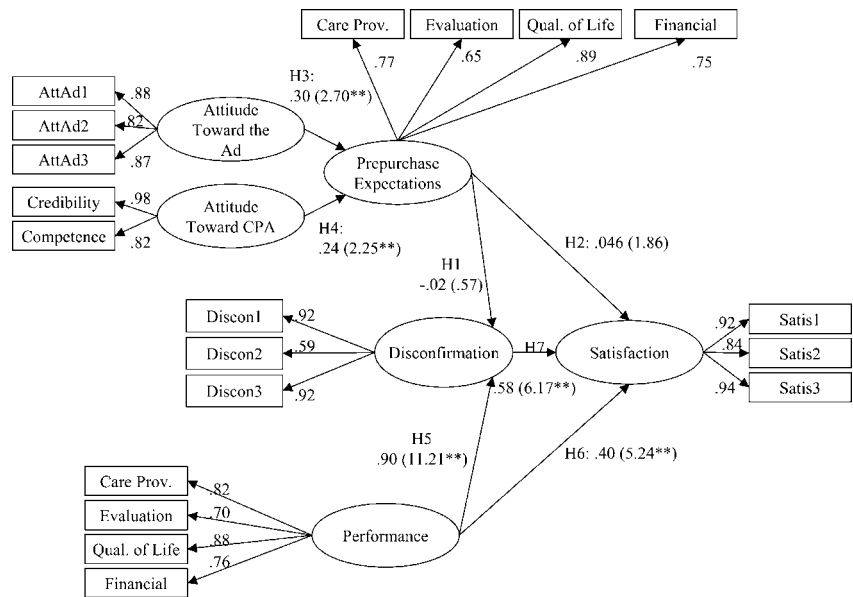


Fig. 4. Structural Equations Model. Note: Coefficient (t-value) * indicates significance at 0.05; ** indicates significance at 0.01.

Path coefficients for each of these relations are small and insignificant. Other hypothesized relations are supported. There is a significant, positive relation between subjects' attitudes toward the advertisement and expectations for the service (H3) and between their attitudes toward the CPA as provider of the new assurance and expectations (H4). Additionally, performance has a significant positive relation with both disconfirmation (H5) and satisfaction (H6). Finally, disconfirmation has a significant, positive relation with satisfaction (H7).

Model Modification

The modest goodness of fit for the model and the lack of support for the hypothesized relations between expectations and satisfaction and between expectations and disconfirmation suggest a reduced model that excludes expectations from the satisfaction formation process. Indeed, theoretical literature supports such a model modification.

In the case of new services, the literature provides evidence that consumers may be unable to form strong prepurchase expectations that will subsequently

affect satisfaction judgments. Studies of existing products and services (Halstead et al., 1994; Webster, 1991) have identified prior experience as one of the most influential determinants of consumers' prepurchase expectations. Consumers of new assurance services cannot base expectations on prior experience or specific knowledge, but instead must draw on factors such as their attitude toward the advertisement or general attitude toward the CPA as ElderCare provider. Halstead et al. (1994) argue that expectations based on these types of sources may be "weaker, less complete and less stable" than those based on prior experience. This idea is supported by Shaffer and Sherrell (1997) in their study of physicians and by Szymanski and Henard (2001) in a meta analysis of satisfaction judgments.

The intangibility of a service offering may also affect consumer's abilities to form strong, stable expectations. Services are often described as high in experience qualities so that evaluation of the service offering can only be discerned after purchase or during consumption (Zeithaml & Bitner, 2000). In support of this influence of intangibility, as well as the importance of prior experience, Johnson, Nader and Fornell (1996) find that expectations have little influence on satisfaction for bank loans, a service they describe as complex and intangible, one with which customers have little experience, and one for which customers cannot typically separate production from consumption.

Finally, Zwick, Pieters and Baumgartner (1995) find that when consumers choose to make a purchase, their level of hindsight expectations, those measured at the same time as performance, has a greater influence on satisfaction judgments than foresight expectations, those measured prior to performance. Further, these hindsight expectations are significantly influenced by evaluations of performance. Thus, even if consumers are able to develop prepurchase expectations, they may not actually be used.

These arguments suggest that the very newness and intangibility of assurance services prevent consumers from effectively developing prepurchase expectations, and the effect of any prepurchase expectations for new services may be transient, preventing them from functioning as originally hypothesized. Based on these arguments, the modified model shown in Fig. 5 excludes the expectations construct.

Research also suggests that it is appropriate to retain the disconfirmation construct in the modified model, despite the lack of influence of prepurchase expectations. As discussed earlier, two different forms of disconfirmation exist, subtractive and subjective. While subtractive disconfirmation (the calculated difference between expectations judgments and performance judgments) has been shown to influence satisfaction, subjective disconfirmation (a separately measured construct) has been shown to have a significant effect beyond that of subtractive disconfirmation (Oliver & Bearden, 1985). Tse and Wilton (1988) explain that:

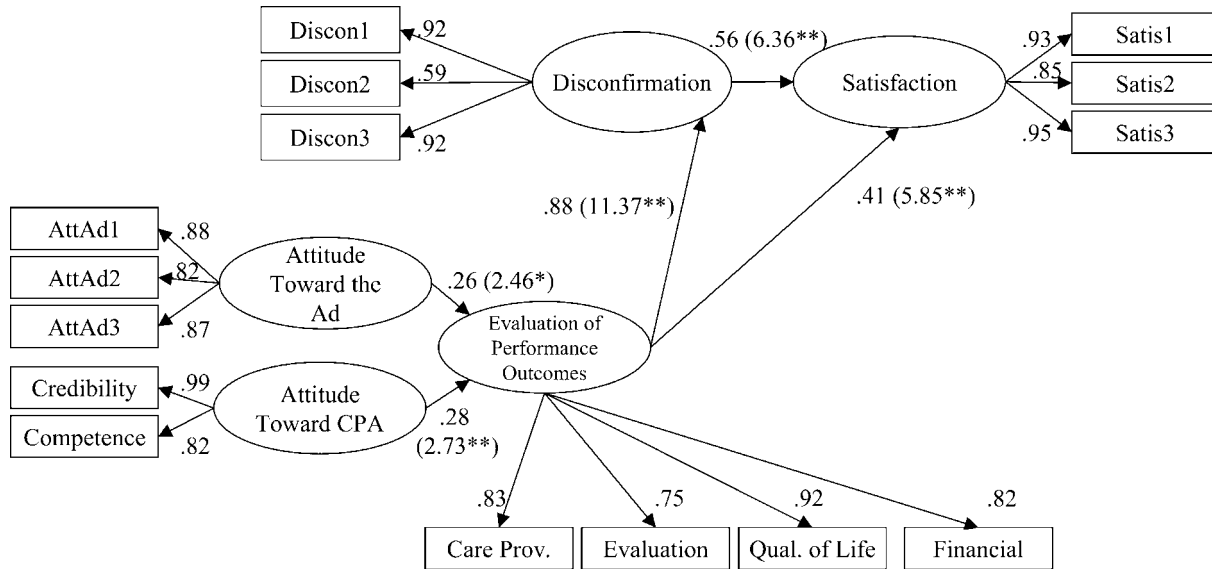


Fig. 5. Modified Structural Equations Model. Note: Coefficient (*t*-value) * indicates significance at 0.05; ** indicates significance at 0.01.

Subjective disconfirmation represents a subjective evaluation of the difference between product performance and the comparison standard; that is, subjective disconfirmation encompasses the set of psychological processes that may mediate perceived product performance discrepancies. Such processes are likely to be important in situations in which product performance cannot be judged discretely . . . subjective disconfirmation is likely to offer a richer explanation of the complex processes underline CS/D formation (p. 205).

That subjective disconfirmation captures a richer underlying construct may be true for a number of reasons. One reason may be the use of hindsight, rather than foresight, expectations as a comparative referent in developing disconfirmation judgments, as found by [Zwick et al. \(1995\)](#). Another possible explanation might be that disconfirmation judgments take into account aspects of the service that subjects either did not initially consider or discounted before experiencing the service ([Spreng & Olshavsky, 1993](#)).

In addition to being supported by theoretical and empirical evidence, the inclusion of disconfirmation without expectations is supported by a significant history of research in marketing. In their meta-analysis of satisfaction judgments, [Szymanski and Henard \(2001\)](#) analyze results for only 23 correlations between expectations and disconfirmation, but 137 correlations between disconfirmation and satisfaction, indicating that a significant number of studies included disconfirmation but not expectations. While the existence of studies that exclude expectations does not conclusively establish that disconfirmation can be validly measured in the absence of stable expectations, these studies do support the notion that other referents for measuring disconfirmation may exist. As a result, the disconfirmation construct remains in the modified model shown in [Fig. 5](#).

The original model hypothesized and supported relations between the attitudinal variables and expectations. Although the revised model excludes expectations, research suggests both attitude toward the advertisement and attitude toward the CPA as provider of the new service may still influence the satisfaction formation process as antecedents of perceptions of performance. Noting the inability for consumers to separate the production and consumption of services, [Zeithaml and Bitner \(2000\)](#) suggest that the service provider, in this case the CPA, is perceived as a service attribute; thus, attitudes toward the CPA can be expected to impact performance judgments of their services. The importance of the provider in assessments of both expectations and performance evaluation is further supported by [Parasuraman et al.'s SERVQUAL model \(1988\)](#). One element of the Parasuraman et al. SERVQUAL measure for both consumers' expectations and their perceptions of performance is assurance, which directly examines the degree to which the provider instills a feeling of confidence, safety, courteousness and knowledge. Assurance corresponds well to our measure of perceptions of the CPA as service provider.

In relation to attitude toward the advertisement, Zeithaml (1988) suggests viewing perceived quality as an attitude influenced by both intrinsic cues, such as physical composition of a product; and extrinsic cues, such as perceptions of brand and advertising. Thus, perceived performance or quality may be strongly influenced by advertising, an extrinsic cue. The likelihood of using extrinsic cues is further increased when the service itself is not highly observable, as with ElderCare. Also, support for advertising as an antecedent of performance evaluations is found in the service quality literature where communication is one aspect of both service performance and service expectations (Parasuraman et al., 1988). Based on these arguments, the modified model in Fig. 5 includes both attitudinal variables as antecedents of perceptions of performance.

To summarize, the modified model presented in Fig. 5 differs from the original model in that expectations are excluded and the attitudinal variables are shown as antecedents of performance. The remainder of the model includes all variables and paths specified in the original model. Goodness of fit statistics for the modified model are shown in Column 3 of Table 3. These statistics compare favorably to the statistics for the original Fig. 4 model, indicating improved fit. Though no direct statistical comparison of the models is possible because they are non-nested models (Hair et al., 1992), each of the selected goodness of fit measures in Table 3 shows an improvement for the modified model over the original model (chi-square 141, df 84, RMSEA 0.043, NFI 0.97, normed chi-square 1.67). In particular, the RMSEA and normed chi-square are now within recommended ranges. All of the structural paths in Fig. 5 are significant and in expected directions. As a result, we can conclude that modified model shown in Fig. 5 presents a plausible and potentially superior alternative to describing subjects' satisfaction formation processes for new assurance services.

CONCLUSION

As professional accountants begin to aggressively offer an array of new, non-traditional services, the need to focus on consumers' responses to these new services becomes paramount. This evaluation of the satisfaction formation process offers accountants valuable information regarding how consumers make satisfaction judgments, and thus, how accountants can market their service offerings to ensure satisfactory exchanges with their clients. This section provides a summary of the results of this study, examines implications for practice and identifies opportunities for future research.

Summary of Results

Results suggest that, as hypothesized, consumers' attitudes toward professional accountants as service providers, attitudes toward their advertising, perceptions of performance, and disconfirmation all significantly influence the satisfaction formation process for the ElderCare service. Contrary to the expectancy disconfirmation model, expectations did not play a significant role in satisfaction formation for ElderCare, possibly because consumers do not have sufficient information, outside of the communications from accountants, to form strong, stable expectations as do consumers of more traditional, well-established services. In a modified model, attitude toward the CPA as service provider and attitude toward the advertisement are shown to significantly influence consumers' perceptions of the performance of the ElderCare service.

Discussion

In interpreting these results, it is important to recognize both the strengths and weaknesses of the study methodology. The strength of the study is its systematic evaluation, using an online simulation, of the factors influencing satisfaction judgments for a new, non-traditional service. Additionally, while not randomly chosen, the study sample is representative in both age and income of the target clientele for services like ElderCare. While one might argue that limiting the study to individuals with online access may create a degree of bias, it is likely that the target population will indeed have computer access. However, the online survey methodology also creates limitations, both in the type communication employed and the timing of responses. It is likely that the actual type of initial communication to the client would differ from the online advertisement used here and the entire process of evaluating the service would span a much larger time frame. Despite these weaknesses, the study provides interesting results that warrant discussion. Additionally, though the results were obtained for the ElderCare assurance, it seems reasonable to extend these conclusions to similar new, non-traditional services, especially those that involve both financial and non-financial components and are presented on a more personal level to an individual or small group.

Given the current environment where the public is actively questioning the reliability of audits as an assurance vehicle, the results of this study are important for accountants seeking to provide other assurances. Results of this study suggest the unique nature of the satisfaction formation process for new services. First, unlike most existing services, the satisfaction formation process for new assurance services does not seem to be reliant on consumer's a priori

expectations. Second, results suggest that consumer satisfaction with new assurance services is dominated by post-service perceptions of disconfirmation and performance. Specifically, disconfirmation has the strongest direct effect on satisfaction (path coefficient of 0.56) but performance also has a significant effect, especially when considering both the direct effect (path coefficient of 0.41) and the indirect effect (direct effect of performance on disconfirmation of 0.88 multiplied by disconfirmation effect of 0.56 equals 0.49). Third, evaluation of performance outcomes is influenced approximately equally by attitude toward the advertisement (path coefficient of 0.26) and attitude toward the CPA as provider of the ElderCare service (path coefficient of 0.28). Together, these two items explain 28% of the variability in performance evaluations, as evidenced by the *R*-squared for the equation describing the relation between these factors and performance. Attitude toward the CPA as provider of the ElderCare service can be conceptualized as having two distinct dimensions, competence and credibility, with credibility being the more important determinant in this situation.

Taken together, these results indicate that accountants providing new services must focus on providing a quality service and convincing providers of this high quality level. Given the high degree of intangibility of the service provided, this objective can be particularly challenging. Better methods for communicating with clients about the engagement may help practitioners meet this challenge. Anecdotal evidence from subjects' post-survey comments suggests that the communications related to the engagement, in particular the assurance report, were viewed as legalistic and limiting. As one subject put it, "Because of the language in the contract and in the advertisement, I really didn't trust them that much – the language didn't seem to encourage trust." Another subject indicated "I understand the need for disclaimer for liability but if I was John (the client) I would want a great assurance that my mother was being properly cared for in my absence. Taylor CPA does not seem willing to assume that responsibility. However their review of the logs and occasional general observations diminished that concern at least to a small degree." Yet another indicated that "I found the contract letter the most 'off-putting' of all. Too legalistic and too much insistence on not being held responsible . . . for much of anything!" Another indicated that "Seems like there are too many 'legalese' statements about things not being their responsibility. That may be needed, but it injects a lot of doubt in my mind about their trustworthiness and reliability. I really wouldn't want a report about my mom's care to sound like an auditor's opinion from an annual report." Consequently, communications that are more consistent with the type of service being provided and that give a more realistic picture of the outcomes of the service may be needed to increase perceived quality and decrease disconfirmation.

Even with improved communication, the assurance services still possess a high degree of intangibility. Consumers of the service will likely feel unable to

judge the actual quality of the service, especially in the case of a family member who lives in a different community. Consequently, attention to other indicators of service quality will also be important. As suggested by this study, perceptions of the advertisement and the provider both appear to serve as quality indicators. Hence, careful attention to advertisements and other communications is inherently important, not just for purposes of attracting consumers to the service, but also for managing their perceptions of the final service. The same is true in regard to perceptions of the provider. Comments from survey participants, for example, indicate that CPAs should be particularly explicit in identifying their experience and qualifications. These comments also support the idea that potential clients' perceptions of both the individual provider and of CPAs in general are paramount. As one subject indicated, "As someone who may be responsible for this type of care for my grandmother in a few years, I would not trust a CPA group to have the expertise needed to take adequate care of her." Another was explicit in indicating the importance of describing qualifications, noting that, "They should explain what accountants are doing in the physical care business. No brochure provides enough information to pick so important a service. More information in the scenario about the actual physical care providers would be reassuring, and is what I would ask for in real life."

Suggestions for Future Research

Our study provides theoretical and empirical support for describing the satisfaction formation process for new assurance services. However, to fully understand the nature of this process, additional research triangulating our findings with actual assurance consumers is needed. In addition, explicit examination of the role of foresight versus hindsight expectations is needed. As assurance services are adopted by consumers, resulting in a higher degree of service familiarity and experience, and as they advance through their life cycle, it will be necessary to understand how the satisfaction formation process may vary, specifically the role of expectations. This knowledge will be particularly valuable as other new assurances are developed and marketed.

A more complete review of the ways in which consumers evaluate performance and form subjective disconfirmation judgments will also be important. In looking at performance, auditing standards, and especially the expectations gap standards, have previously focused on evaluations of the process involved in delivering the service. This approach is clearly expectations-focused; it emphasizes establishing an a priori expectation of the appropriate process for delivering the service and then comparing the actual process to this standard. This study, however, suggests

that consumers are likely to evaluate performance more based on the outcome, using only a subjective standard for evaluating whether the service met their expectation. Consequently, a look at both evaluations of processes and outcomes by consumers may be fruitful.

Finally, the importance of different cues, such as provider credibility, communications, and others in developing performance judgments should be examined. In short, with new assurance services, managing the “expectations” gap is a much more complex and subtle process that involves careful attention to both expectations and consumer perceptions of performance, which may be influenced by a large number of service quality cues.

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RE-ESTIMATIONS OF THE ZMIJEWSKI AND OHLSON BANKRUPTCY PREDICTION MODELS

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ABSTRACT

Current accounting research uses the [Zmijewski \(1984\)](#) and [Ohlson \(1980\)](#) bankruptcy prediction models as proxies for financial distress/bankruptcy. Such use assumes that the models' predictive powers transcend to time periods, industries, and financial conditions outside of those used to originally develop the models. The objective of this paper is to address whether the construct validity of the financial distress/bankruptcy proxies (based on the original models) used in those recent studies is possibly open to question. The evidence provided in this study suggests that researchers who use the Zmijewski and Ohlson models using recent data should re-estimate the models' coefficients to improve the predictive accuracy of the models.

1. INTRODUCTION AND MOTIVATION

Though the [Zmijewski \(1984\)](#) and [Ohlson \(1980\)](#) models were developed using samples from the 1970s, there is limited evidence addressing the sensitivity of these models to time periods, financial distress situations, and industries outside those of the original samples. Even so, bankruptcy prediction models such as these are still employed in current accounting research to proxy for financial conditions

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of firms from a variety of industries and time periods (e.g. Altman, 1993; Berger, Ofek & Swary, 1996; Carcello, Hermanson & Huss, 1995; Carcello & Neal, 2000; Chen & Church, 1996; Chen & Wei, 1993; Dichev, 1998; Robertson & Mills, 1991; Subramanyan & Wild, 1996). The current use of bankruptcy prediction models by researchers and practitioners assumes that the models' predictive powers transcend to time periods, industries and financial conditions other than those used to originally develop the models. Consequently, the construct validity of the financial distress/bankruptcy proxies (based on the original models) used in those recent studies is possibly open to question. The objective of this paper is to address this construct validity issue by evaluating the research questions listed below.

Recent studies have demonstrated that the predictive accuracy of the Zmijewski (1984), Ohlson (1980), and Altman (1968) bankruptcy prediction models significantly declines when applied to current time periods (e.g. Grice & Dugan, 2001; Grice & Ingram, 2001). Further, the Grice and Ingram study found that improved predictive accuracy can be achieved with Altman's (1968) model by re-estimating the model using samples from periods close to the test period. These prior findings and the continued use of bankruptcy prediction models lead to three research questions considered in this paper: (1) Do the predictive accuracies of the Zmijewski and Ohlson models increase when re-estimated using samples that are closer to the test periods? (2) Are re-estimated Zmijewski and Ohlson models as accurate for predicting bankruptcy of non-industrial firms as they are for predicting industrial firms? (3) Are re-estimated Zmijewski and Ohlson models as accurate for predicting financial distress conditions other than bankruptcy as they are for predicting bankruptcy?

The remainder of this paper is organized as follows. Section 2 discusses Zmijewski's (*X*-score) and Ohlson's (*Y*-score) models and relevant prior research. Section 3 describes the samples and tests employed to evaluate Zmijewski's and Ohlson's models. Section 4 presents the findings, and Section 5 discusses the implications of those findings for users of the Zmijewski and Ohlson models.

2. CONTRIBUTION TO PRIOR RESEARCH

This section summarizes Zmijewski (1984), Ohlson (1980), and other studies that have developed and evaluated bankruptcy prediction models. It explains the contributions of the present study in identifying and resolving the inherent construct validity issues in those earlier studies.

Zmijewski (1984) used financial ratios that measured firm performance, leverage, and liquidity to develop his model. The ratios were not selected on a theoretical basis, but rather on the basis of their performance in prior studies.

Zmijewski's probit model based on 40 bankrupt and 800 non-bankrupt industrial firms from the 1972 to 1978 time period was:

$$X = -4.3 - 4.5X_1 + 5.7X_2 - 0.004X_3, \quad (1)$$

where X_1 = net income/total assets, X_2 = total debt/total assets, X_3 = current assets/current liabilities, and X = overall index. The score is used to determine the probability of membership in the bankrupt group based on a cumulative normal probability function. Zmijewski (1984) developed numerous models using 40 bankrupt and 40–800 non-bankrupt firms; however, the model based on the 40:800 proportion of bankrupt to non-bankrupt firms is the model most commonly used by accounting researchers (e.g. Carcello & Neal, 2000; Carcello et al., 1995; Chen & Wei, 1993).

Ohlson (1980) indicated that the nine predictors used to develop his model were selected because they appeared to be the ones most frequently mentioned in the literature. He employed logistic analysis to derive his bankruptcy prediction model using nine measures of firms' size, leverage, liquidity, and performance. Based on a sample that included 105 bankrupt and 2,058 non-bankrupt industrial firms from the 1970 to 1976 time period, his model was:

$$Y = -1.3 - 0.4X_1 + 6.0X_2 - 1.4X_3 + 0.1X_4 - 2.4X_5 - 1.8X_6 \\ + 0.3X_7 - 1.7X_8 - 0.5X_9, \quad (2)$$

where X_1 = log (total assets/GNP price-level index), X_2 = total liabilities/total assets, X_3 = working capital/total assets, X_4 = current liabilities/current assets, X_5 = one if total liabilities exceed total assets, zero otherwise, X_6 = net income/total assets, X_7 = funds provided by operations/total liabilities, X_8 = one if net income was negative for the last two years, zero otherwise, X_9 = measure of change in net income,¹ and Y = overall index. The overall index is used to determine the probability of membership in the bankrupt group based on a logistic function.

Though the Zmijewski and Ohlson models are the only models that are re-estimated in this study, the findings of this study may apply to other models that were derived using a similar methodological approach. Studies that have developed and tested bankruptcy prediction models include Altman (1968), Deakin (1972), Mensah (1983), and Zavgren (1985). These studies selected estimation and hold-out samples from different time periods and reported relatively high accuracy rates for the models using small samples and short windows of time. For example, Altman reported that his model exhibited an 84% accuracy rate using a hold-out sample from a time period different from that employed to originally develop the model. It should be noted that the extant literature includes other

studies that also developed and tested models; however, they used estimation² and hold-out samples drawn from the same time period (e.g. [Blum, 1974](#); [Gentry, Newbold & Whitford, 1985](#); [Zmijewski, 1984](#)).

The hold-out sample tests represent more rigorous tests of the models' accuracy. Though lower than estimation sample rates, the hold-out sample accuracy rates reported in prior studies are potentially upwardly biased (meaning the hold-out sample accuracy rates are higher than the rates users should expect when they apply the models) for three reasons: (1) the time periods for the estimation and hold-out sample are not substantially different; (2) the hold-out sample consisted of firms from the same restricted set of industries as those in the estimation sample; and (3) the hold-out samples were small (the largest sample was 111 firms).

Applying the original coefficients of the Zmijewski and Ohlson models to recent samples tests the stability of the relation between bankruptcy and the respective models' financial ratios. [Begley, Ming and Watts \(1997\)](#) applied Ohlson's original model to 1,365 industrial firms and reported a 98% classification accuracy. [Grice and Dugan \(2001\)](#) applied Ohlson's original model to firms drawn from the 1988 to 1991 (1992 to 1999) time period and reported a classification accuracy of 39.8% (34.8%). They also applied Zmijewski's original model to 1988–1991 (1992–1999) firms and reported a classification accuracy of 81.3% (77.6%). This study assesses the construct validity of the models' use as proxies for financial distress/bankruptcy by re-estimating the coefficients using recent firm data. Tests in the current study compare both the predictive accuracy rates and estimated coefficients of the original Zmijewski and Ohlson models to those of the re-estimated models. [Begley et al. \(1997\)](#) re-estimated Ohlson's model using 100 bankrupt and 2,000 non-bankrupt companies from 1980 to 1989. They reported that the re-estimated [Ohlson \(1980\)](#) model exhibited an overall estimation sample classification accuracy of 99%; however, the coefficients of the model changed when re-estimated using data drawn from the 1980s.

Re-estimating the coefficients of models using recent samples evaluates the models in periods that are likely to exhibit economic differences from the periods in which the models were originally developed. [Platt and Platt \(1990\)](#) indicated that differences in the economic environment may change the: (1) relationships between the dependent (e.g. bankruptcy) and independent variables (e.g. financial ratios); (2) average range of the independent variables; and (3) relationships among the independent variables. Platt and Platt suggested that these changes are attributable to shifts in the business cycle, corporate strategy, the competitive nature of the market, and technology.

The hold-out sample tests in prior studies also were potentially biased upward (with respect to a sample of firms from a cross-section of industries) since the hold-out samples consisted of firms from the same industries as those in the estimation

sample. These hold-out sample tests do not provide evidence about the models' predictive power across industries. Tests in the current study evaluate Zmijewski's (1984) and Ohlson's (1980) re-estimated models in industries other than those used to derive the original model. These findings are relevant to accounting researchers who apply bankruptcy prediction models to firms from various industries. Recent examples include (Carcello & Neal, 2000; Carcello et al., 1995; Chen & Church, 1996; Chen & Wei, 1993; Dichev, 1998; Subramanyan & Wild, 1996). Each of these studies assumed the bankruptcy prediction models were valid across industries and time periods other than those used to develop the model. Importantly, Robertson and Mills (1991) indicated that it is not appropriate for models derived for one industry group to be used to evaluate the financial conditions of other industry groups; consequently, the predictive powers of the *X* and *Y*-score models should decline using industries different from those used to originally develop the models.

2.1. Bankruptcy or Financial Distress?

Even though the Zmijewski (1984) and Ohlson (1980) models were developed to predict the event of bankruptcy, this event is only one of several indicators of financial distress. It is not clear whether these models are specifically useful for identifying firms that are likely to go bankrupt or whether they are more generally a model for identifying firms experiencing financial distress. While firms that experience financial distress are more likely to declare bankruptcy than other firms, most financially distressed firms are not likely to declare bankruptcy. Gilbert, Menon and Schwartz (1990) suggest that financial dimensions that set apart bankrupt and healthy firms are different from those that separate bankrupt and distressed firms. They developed prediction models using both bankrupt/healthy and bankrupt/distressed estimation samples. The model developed using the bankrupt/healthy estimation sample was unable to distinguish failed firms from distressed firms. Bankruptcy usually is a joint result of financial stress and other events that precipitate legal action.

Additional analyses included in this study relate to the re-estimated models' abilities to assess financial distress in a variety of situations as identified by codings on the Compustat Database. Compustat maintains codes for bankruptcy, liquidation, reorganization, S&P ratings for bonds vulnerable to default, and S&P ratings for stocks, all of which may identify firms that are financially distressed. If Ohlson's and Zmijewski's models are better suited for predicting bankruptcy than for predicting other manifestations of financial distress, they may not provide appropriate proxies for some of the applications for which they have been used.

Alternatively, if the models predict financial distress rather than just bankruptcy, care should be used in employing the models to identify bankrupt firms because most distressed firms will not declare bankruptcy.

3. RESEARCH DESIGN

This section describes the methodology employed to re-estimate and test the coefficients of the X and Y -score models. In addition, this section describes the selection criteria used to identify the distressed and non-distressed sample companies.

3.1. Sample

The analyses in this study used an estimation sample and a hold-out sample, with each sample including distressed and non-distressed firms.³ Distressed companies were defined as those reported by Compustat as meeting one or more of the following conditions: (1) Chapter 11 bankruptcy; (2) Chapter 7 liquidation; (3) bonds vulnerable to default; or (4) low stock ratings. The non-distressed firms were selected randomly from the population of firms that were evaluated by S&P but did not receive poor S&P stock or bond ratings.⁴ That is, companies that maintained codes for data item 280 (282) that were less than 19 (18) were included in the non-distressed population.⁵

The final estimation samples for the X and Y -score models included 1,048 companies (181 distressed and 867 non-distressed) and 1,059 companies (153 distressed and 906 non-distressed). These samples were used to re-estimate Zmijewski's (1984) and Ohlson's (1980) original coefficients shown in Eqs (1) and (2). The final hold-out samples for the X and Y -score models included 1,024 firms (183 distressed and 841 non-distressed) and 1,043 firms (154 distressed and 889 non-distressed). These hold-out samples were used to evaluate the predictive accuracies of the original and re-estimated X and Y -score models. The financial ratios described in Eqs (1) and (2) were calculated for each firm in both samples with data from Compustat's Industrial Annual Research file (CIAR) and Compustat's Industrial Annual file (CIA).

Two subsets of the hold-out samples were used in analyses for this study. A subset of the distressed and non-distressed firms from the industries used by Zmijewski and Ohlson to develop their models was used to evaluate the sensitivity of the models to industry classifications. A subset of distressed firms that Compustat identified as bankruptcies was used to evaluate the sensitivity of the models to bankruptcy as opposed to other financial distress situations.

Table 1A. Profile Analysis for Zmijewski Samples.

Sample ^a	Statistic	X_1	X_2	X_3
Estimation				
Non-distressed ($N = 887$)	Mean	0.0451	0.5465	2.2547
	Std. Dev.	0.084	0.193	2.173
	Min	-0.936	0.027	0.383
	Max	0.428	1.941	35.947
Distressed ($N = 181$)	Mean	-3.0791	0.9495	1.3969
	Std. Dev.	0.916	0.846	2.441
	Min	-10.648	0.056	0.006
	Max	0.354	8.555	19.347
	p -Value ^b	0.000	0.000	0.030
Hold-out				
Non-distressed ($N = 841$)	Mean	0.0376	0.5637	2.1789
	Std. Dev.	0.122	0.231	2.380
	Min	-2.290	0.016	0.144
	Max	0.825	3.375	49.612
Distressed ($N = 183$)	Mean	-0.1745	0.8896	3.1177
	Std. Dev.	0.375	0.646	14.329
	Min	-2.447	0.002	0.080
	Max	0.877	5.816	184.104
	p -Value ^b	0.000	0.000	0.056

Note: Variables: X_1 = net income/total assets; X_2 = total liabilities/total assets; X_3 = current assets/current liabilities.

^aThe distressed group includes companies that experienced bankruptcy or liquidation as well as those that received low S&P ratings for their bonds or stock. The non-distressed group includes companies that were rated by S&P and did not receive low bond or stock ratings.

^b p -Value one-tailed t -test of differences in variable means between the distressed and non-distressed groups.

Tables 1A and 1B report descriptive statistics, by distressed and non-distressed groups, for the estimation samples used to re-estimate the X and Y -score models' coefficients. A comparison of the distressed and non-distressed variable means for the Zmijewski estimation sample indicated that the ratios deteriorated in the distressed group. For example, net income to total assets was lower for the distressed (-3.0791) than for the non-distressed group (0.0451). Also, the total debt to total assets and current assets to current liabilities ratios were higher for the distressed than for the non-distressed group. The p -values for the test of mean differences between distressed and non-distressed companies were significant for the net income to total assets, total debt to total assets, and current assets to current liabilities variables. Zmijewski (1984) did not report whether the variable means

Table 1B. Profile Analysis for Ohlson Samples.

Sample ^a	Statistic	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Estimation										
Non-distressed ($N = 906$)	Mean	1.6858	0.5541	0.2159	0.6534	0.0099	0.0431	0.2208	0.0496	0.0145
	Std. Dev.	1.845	0.177	0.201	0.561	0.098	0.073	0.239	0.217	0.491
	Min	-3.059	0.032	-1.001	0.056	0.000	-0.611	-0.533	0.000	-1.000
	Max	6.814	1.949	0.841	13.324	1.000	0.326	2.705	1.000	1.000
Distressed ($N = 153$)	Mean	-0.9913	0.8981	0.0671	1.3931	0.2026	-0.2492	-0.1167	0.5359	-0.0659
	Std. Dev.	2.021	0.803	0.461	2.457	0.403	0.474	0.515	0.501	0.664
	Min	-5.138	0.055	-3.041	0.051	0.000	-3.056	-4.623	0.000	-1.000
	Max	5.833	8.555	0.841	18.509	1.000	0.354	1.818	1.000	1.000
	p -Value ^b	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.153
Hold-out										
Non-distressed ($N = 889$)	Mean	1.5224	0.5779	0.2059	0.7031	0.0359	0.0352	0.2264	0.0731	-0.0369
	Std. Dev.	1.942	0.248	0.229	0.574	0.186	0.138	0.343	0.261	0.487
	Min	-4.015	0.045	-2.493	0.047	0.000	-2.299	-1.961	0.000	-1.000
	Max	6.335	3.375	0.914	8.023	1.000	0.825	4.917	1.000	1.000
Distressed ($N = 154$)	Mean	-0.8146	0.8649	0.0446	1.2669	0.2468	-0.1789	-0.0871	0.4741	-0.1646
	Std. Dev.	2.036	0.514	0.505	1.766	0.432	0.361	0.573	0.501	0.691
	Min	-4.874	0.084	-3.441	0.097	0.000	-2.447	-4.201	0.000	-1.000
	Max	4.069	4.026	0.861	12.455	1.000	0.877	2.466	1.000	1.000
	p -Value ^b	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Variables: X_1 = log (total assets/GNP price-level index); X_2 = total liabilities/total assets; X_3 = working capital/total assets; X_4 = current liabilities/current assets; X_5 = one if total liabilities exceed total assets, zero otherwise; X_6 = net income/total assets; X_7 = funds provided by operations/total liabilities; X_8 = one if net income was negative for the last two years, zero otherwise; X_9 = measure of change in net income.

^aThe distressed group includes companies that experienced bankruptcy or liquidation as well as those that received low S&P ratings for their bonds or stock. The non-distressed group includes companies that were rated by S&P and did not receive low bond or stock ratings.

^b p -Value one-tailed t -test of differences in variable means between the distressed and non-distressed groups.

for his estimation sample were significantly different between the distressed and non-distressed groups.

A comparison of the distressed and non-distressed variable means for the Ohlson estimation sample also indicated that each variable deteriorated in the distressed group. For example, total liabilities to total assets was higher for the distressed (0.8981) than for the non-distressed group (0.5541). Also, the performance measure, return on assets, was lower for the distressed (-0.2492) than the non-distressed group (0.0431). The p -values for the test of mean differences between distressed and non-distressed companies were significant for each of the variables except for the measure of change in net income. The descriptive statistics for Ohlson's variables using the estimation sample were similar to those reported by [Ohlson \(1980\)](#). Ohlson indicated that all the variable means were significantly different between the distressed and non-distressed groups at the 0.05 level. The descriptive statistics for the hold-out samples are also reported in [Tables 1A and 1B](#). For each sample, these statistics were similar to those of the estimation sample except for the measure of change in net income (Ohlson sample). The mean of this ratio was (was not) significantly different between the distressed and non-distressed firms in the hold-out (estimation) sample.

The Zmijewski and Ohlson models used financial ratios that discriminated among industrial firms. This study evaluated the predictive accuracy and re-estimated the coefficients of the models using both industrial and non-industrial companies. Consequently, the financial data necessary to calculate the models' ratios were not on CIAR and CIA for some non-industrial companies.⁶ Companies were deleted from the sample if CIAR and CIA did not report the necessary financial data. The estimation (hold-out) sample used to test the Zmijewski model included 282 (285) non-industrial and 886 (739) industrial companies. The estimation (hold-out) sample used to test the Ohlson model included 264 (304) non-industrial and 795 (739) industrial companies. Both samples included approximately the same number of industrial and non-industrial firms in the distressed and non-distressed groups. The equal distribution of the industrial and non-industrial firms within each sample was necessary to clearly demonstrate the sensitivity of the X and Y -score models to industry classifications.

Analyses in this study also evaluated the predictive accuracy and re-estimated the coefficients of X and Y -score models using only bankruptcies from the samples. Specifically, the distributions for the distressed firms were partitioned into two categories: (1) those identified as distressed because of bankruptcy; and (2) those identified as distressed for reasons other than bankruptcy. The estimation (hold-out) sample included 70–98 (88–121) bankrupt companies and 83 (62–66) companies that were identified as financially distressed because of reasons other than bankruptcy. The mix of financially distressed companies attributable to

bankruptcy and those attributable to factors other than bankruptcy was used to test the sensitivity of the models to various financial conditions to evaluate the construct validity issue.

3.1.1. Model Re-estimations

The *X* and *Y*-score models' coefficients were re-estimated using the estimation sample. The coefficients were re-estimated using the methodology originally employed to derive the models. Zmijewski and Ohlson used probit and logit analysis to derive the models shown in Eqs (1) and (2). These statistical methodologies were used to re-estimate the *X* and *Y*-score models' coefficients. For each model, the coefficients were re-estimated using: (1) the full estimation sample; (2) a subset of the sample containing only bankrupt firms in the distressed group; and (3) a subset of the sample containing only industrial firms in both distressed and non-distressed groups. Subsequent discussion refers to these models as: (1) the full *X* and *Y*-score models; (2) the bankruptcy-only *X* and *Y*-score models; and (3) the industrial-only *X* and *Y*-score models.

This study compared the magnitude and significance of the coefficients for the industrial-only and bankruptcy-only *X* and *Y*-score models to those for the full *X* and *Y*-score models, respectively, to evaluate whether re-estimations of the models were sensitive to industry classifications or financial conditions. As discussed above, the samples used to re-estimate these models differed in terms of industry or financial conditions. As such, differences in the coefficients of the models would indicate a sensitivity to industry or financial distress situations. This study also compared the coefficients of the full *X* and *Y*-score models to those shown in Eqs (1) and (2), respectively, to provide further evidence about the stability of the models. If the models are stable, then the coefficients reported in Eqs (1) and (2) should be similar to those of the re-estimated models.

The predictive accuracies also were evaluated for the full, bankruptcy-only, and industrial-only (*X* and *Y*-score) models using the hold-out sample. This study used binomial tests to compare the accuracies of the re-estimated models to those using the original Zmijewski (1984) and Ohlson (1980) models reported in the Grice and Dugan (2001) study. These tests provided evidence about whether the predictive power of the *X* and *Y*-score models was affected when they were re-estimated using a recent sample.

4. RESULTS AND DISCUSSION

This section reports the findings of the tests used to evaluate the construct validity of the proxies generated by the *X* and *Y*-score models. The predictive accuracies of the re-estimated models using the hold-out samples and the stability of their

coefficients when re-estimated using the estimation samples are discussed. Evidence related to the models' sensitivity to non-industrial firms and financial conditions is reported.

4.1. Unstable Coefficients

Evidence related to the stability of the X and Y -score models was evaluated by re-estimating the models' coefficients using the estimation samples. If the models are stable, then the coefficients of the original models should be similar to those derived from the estimation samples. As previously discussed, the full estimation sample, a subset of the sample containing only bankrupt firms in the distressed group, and a subset of the sample containing only industrial firms in both distressed and non-distressed groups were used to re-estimate three models: (1) the full X and Y -score models; (2) the bankruptcy-only X and Y -score models; and (3) the industrial-only X and Y -score models. These three samples were used to evaluate whether Zmijewski's (1984) and Ohlson's (1980) models were sensitive to industry classifications or financial condition.

The results reported in Table 2 indicated similar coefficients for the full, bankruptcy-only, and industrial-only X -score models. This finding suggests that

Table 2. Coefficients for Zmijewski's (1984) and Re-estimated Models.

Statistic	Zmijewski's (1984) Model ^a	Full Model ^b	Bankruptcy-Only Model ^c	Industrial-Only Model ^d
Net income/total assets (p -value)	-3.599 (<0.05)*	-4.341 (0.000)*	-4.076 (0.000)*	-4.325 (0.000)*
Total debt/total assets (p -value)	5.406 (<0.05)*	2.106 (0.000)*	1.921 (0.000)*	2.194 (0.000)*
Current assets/current liabilities (p -value)	-0.100 (>0.05)	0.092 (0.024)*	0.991 (0.003)*	0.077 (0.116)

Note: X_1 = net income/total assets; X_2 = total debt/total assets; X_3 = current assets/current liabilities.
 p -Value represents the significance of the coefficient.

^aThese are the coefficients and significance levels reported in Zmijewski's (1984) study. N = 840 (40 bankrupt and 800 non-bankrupt firms).

^bCoefficients estimated using the full estimation sample containing all industry classifications and financially distressed companies. N = 1,048 (181 distressed and 867 non-distressed companies).

^cCoefficients estimated using a subset of the estimation sample that only includes bankrupt companies in the distressed group. N = 990 (123 distressed and 867 non-distressed firms).

^dCoefficients estimated using a subset of the estimation sample that only includes industrial companies. N = 791 (155 distressed and 636 non-distressed firms).

*Indicates significance at 0.05 level.

Zmijewski's model was not sensitive to various distress situations and industry classifications. The coefficients that were significant in both the original and full X-score models were lower in the full model than they were in the original model. These variables include net income to total assets and total debt to total assets. Also, the current assets to current liabilities variable was significant in the full X-score model but not in the original model. Thus, the results indicate that the coefficients of the original X-score model are not stable across time periods.

The results reported in [Table 3](#) indicated similar coefficients for the variables that were significant in both the full and bankruptcy-only Y-score models. These variables included log of total assets to price-level index,⁷ total liabilities to total assets, and funds provided by operations to total liabilities. Again, these results suggest that the model was not sensitive to various distress situations even though Ohlson used only bankrupt firms to develop the original model. The coefficients for total liabilities to total assets, funds provided by operations to total liabilities, and dummy variable for negative net income for the industrial-only Y-score model were lower than those for the full Y-score model. Additionally, the coefficient for the net income to total assets variable was significant in the industrial-only Y-score model, but not in the full Y-score model. This finding indicates that Ohlson's model is sensitive to industry classifications. Since the full, bankruptcy-only, and industrial-only Y-score models reported in [Table 4](#) were similar relative to the original Y-score model, the following comparisons for Ohlson's model refer only to the full model.

The coefficients that were significant in both the original and full Y-score models were higher in the original than they were in the full Y-score model. These variables include log of total assets to price-level index, total liabilities to total assets, and funds provided by operations to total liabilities. Additionally, the dummy variable for negative net income was (was not) significant in the full (original) Y-score model. Ohlson also reported that the coefficients for the dummy variable for total liabilities greater than total assets and the measure of change in net income were significant in the original Y-score model; however, these coefficients were not significant in the full Y-score model. The findings provide further evidence that the original Y-score model's coefficients are not stable across time. The differing coefficients and related significance of the [Ohlson \(1980\)](#) and full models indicate that the relationships from period to period between Ohlson's ratios and financial distress change.

Predictive Accuracy for Re-estimated Models: Additional evidence of the stability of the X-score and Y-score models was obtained by applying the re-estimated models to the hold-out samples. [Table 4](#) reports the predictive accuracies of the re-estimated coefficients for the distressed and non-distressed groups for the full, bankruptcy-only, and industrial-only X and Y-score models using the hold-out

Table 3. Coefficients for [Ohlson's \(1980\)](#) and Re-estimated Models.

Statistic	Ohlson's (1980) Model ^a	Full Model ^b	Bankruptcy-Only Model ^c	Industrial-Only Model ^d
Log (total assets/price-level index) (<i>p</i> -value)	-0.407 (<0.05)*	-0.777 (0.000)*	-0.881 (0.000)*	-0.706 (0.000)*
Total liabilities/total assets (<i>p</i> -value)	6.030 (<0.05)*	3.224 (0.000)*	3.931 (0.000)*	2.204 (0.003)*
Working capital/total assets (<i>p</i> -value)	-1.430 (>0.05)	-0.323 (0.323)	0.054 (0.962)	-1.250 (0.075)
Current liabilities/current assets (<i>p</i> -value)	0.076 (>0.05)	0.589 (0.199)	0.166 (0.657)	0.455 (0.300)
1 if total liabilities exceed total assets, 0 otherwise (<i>p</i> -value)	-1.720 (<0.05)*	0.041 (0.761)	0.645 (0.493)	0.553 (0.552)
Net income/total assets (<i>p</i> -value)	-2.370 (>0.05)	-2.810 (0.158)	-0.548 (0.729)	-3.790 (0.106)*
Funds provided by operations/liabilities (<i>p</i> -value)	-1.83 (<0.05)*	-2.854 (0.003)*	-2.886 (0.007)*	-4.591 (0.000)*
1 if net income negative past 2 years, 0 otherwise (<i>p</i> -value)	0.285 (>0.05)	0.372 (0.003)*	0.656 (0.151)	0.157 (0.003)*
Measure of change in net income (<i>p</i> -value)	-0.521 (<0.05)*	0.206 (0.354)	-0.300 (0.278)	0.309 (0.250)

Note: X_1 = log (total assets/GNP price-level index); X_2 = total liabilities/total assets; X_3 = working capital/total assets; X_4 = current liabilities/current assets; X_5 = one if total liabilities exceed total assets, zero otherwise; X_6 = net income/total assets; X_7 = funds provided by operations/total liabilities; X_8 = one if net income was negative for the last two years, zero otherwise; X_9 = measure of change in net income. *p*-Value represents the significance of the coefficient.

^a These are the coefficients and significance levels reported in [Ohlson's \(1980\)](#) study. $N = 2,163$ (105 bankrupt and 2,058 non-bankrupt firms).

^b Coefficients estimated using the full estimation sample containing all industry classifications and financially distressed companies. $N = 1,004$ (153 distressed and 851 non-distressed companies).

^c Coefficients estimated using a subset of the estimation sample that only includes bankrupt companies in the distressed group. $N = 953$ (102 distressed and 851 non-distressed firms).

^d Coefficients estimated using a subset of the estimation sample that only includes industrial companies. $N = 750$ (130 distressed and 620 non-distressed firms).

* Indicates significance at 0.05 level.

Table 4. Comparisons of the Classification Accuracy of the Hold-Out Samples Using Zmijewski's and Ohlson's Coefficients and Those from the Re-estimated Models.

Model	Statistic	Overall	Distressed Group	Non-distressed Group
Zmijewski				
Zmijewski (1984) ^a	Accuracy ^b	81.3%	58.7%	86.1%
Full ^c	Accuracy ^b	85.7%	36.4%	96.3%
	Test statistic ^d	2.577*	4.341*	6.171*
Bankruptcy-only ^e	Accuracy ^b	86.1%	33.2%	97.3%
	Test statistic ^d	2.801*	4.979*	6.793*
Industrial-only ^f	Accuracy ^b	86.1%	41.3%	95.6%
	Test statistic ^d	2.801*	3.387*	5.477*
Ohlson				
Ohlson (1980) ^a	Accuracy ^b	39.8%	95.4%	30.1%
Full ^c	Accuracy ^b	88.7%	59.1%	93.7%
	Test statistic ^d	22.827*	15.319*	29.332*
Bankruptcy-only ^e	Accuracy ^b	88.5%	51.9%	94.8%
	Test statistic ^d	22.648*	18.327*	14.356*
Industrial-only ^f	Accuracy ^b	88.1%	62.9%	92.9%
	Test statistic ^d	22.603*	13.677*	28.971*

^a Zmijewski's (1984) and Ohlson's (1980) models are represented in Eqs (1) and (2).

^b Accuracy rates represent the correct classifications for each model using the hold-out samples.

^c Model estimated using the full estimation sample containing all industry classifications and financially distressed firms. See coefficients in Tables 2 and 3.

^d z-Statistic comparing the re-estimated model's accuracy rates to those of Zmijewski's or Ohlson's original model as reported in Grice and Dugan (2001).

^e Model estimated using a subset of the estimation sample that only includes the bankrupt firms from the distressed group. See coefficients in Tables 2 and 3.

^f Model estimated using a subset of the estimation sample that only includes industrial firms. See coefficients in Tables 2 and 3.

*The null hypothesis of equal accuracy rates is rejected at 0.05 level.

sample. The overall accuracies for the *X* and *Y*-score models range from 85.7 to 86.1% and 88.1 to 88.7%. The results of binomial tests indicate that the overall predictive accuracies for Zmijewski's (81.3%) and Ohlson's (39.8%) original models when applied to the hold-out samples were significantly less than those for the full, bankruptcy-only, and industrial-only *X* and *Y*-score models.⁸ Thus, these results suggest that those individuals who employ the models using recent data should re-estimate the models' coefficients to obtain more construct valid results.

Predictive accuracy of the bankruptcy-only re-estimated models: [Table 4](#) reports the predictive accuracies for the bankruptcy-only re-estimated models using the hold-out sample. The overall accuracies of the bankruptcy-only *X*-score and *Y*-score re-estimated models were 86.1 and 88.5%. These accuracy rates are similar to those using the full models, which indicates that the models are not sensitive to financial distress conditions. These results suggest that though the models were developed to predict bankruptcy, they seem more generally useful for identifying financial distress. This finding should be carefully considered by researchers using model predictions as proxies for financial health, as opposed to proxies for just bankruptcy.

Predictive accuracy of the industrial-only re-estimated models: [Table 4](#) also reports the predictive accuracies for the industrial-only re-estimated models using the hold-out sample. The overall accuracies of the industrial-only *X*-score and *Y*-score re-estimated models were 86.1 and 88.1%. Consistent with the findings for the bankruptcy-only models, these accuracy rates are similar to those using the full models which indicates that the models are not sensitive to industry classification. However, as previously mentioned, researchers should consider that no theoretical justification exists for applying models to firms that are outside the industry classifications used to develop the models.

5. SUMMARY

This study evaluated the sensitivity of [Zmijewski's \(1984\)](#) and [Ohlson's \(1980\)](#) re-estimated bankruptcy prediction models to samples of distressed and non-distressed companies from time periods, industries, and financial conditions other than those used to develop their models. The findings indicated that the accuracy of the models increased when the coefficients are re-estimated. [Zmijewski \(1984\)](#) and [Ohlson \(1980\)](#) reported 98.2 and 96.4% overall accuracies for their original models using samples from the mid-seventies and before. However, the coefficients of the *X* and *Y*-score models changed dramatically when re-estimated using more recent estimation samples. Thus, it appears the relation between financial ratios and financial distress changes over time. Further, the relative importance of the various ratios in predicting distress conditions was not constant.

The results of this study suggest that the current broad application of the original Zmijewski and Ohlson models raises a construct validity issue. Specifically, evidence in this study suggests that those who employ the *X* and *Y*-score models using recent data should re-estimate the models' coefficients. When the models' coefficients were re-estimated using recent data, their predictive accuracies were significantly higher than those of [Zmijewski's \(1984\)](#) and [Ohlson's \(1980\)](#) original

models when applied to data for the hold-out sample. This study also demonstrated that the re-estimated models were not sensitive to industry classifications and financial distress conditions. Thus, researchers who use the models to predict the event of bankruptcy, not just financial distress, should do so cautiously.

NOTES

1. The change in net income was measured as $(NI_t - NI_{t-1})/(|NI_t| + |NI_{t-1}|)$, where NI_t is net income for the most recent period.

2. An estimation sample is the sample used to develop the model. The model is applied to that estimation sample to determine its explanatory power. Estimation sample rates should be high since the firms are classified based on a model estimated using these same firms. This study's focus relates to the predictive power of a model based on a hold-out sample (sample other than that used to develop the model). Prior studies typically rely on the models' predictive powers to address research questions related to time periods other than those used to originally develop the models.

3. This study used S&P ratings for stocks and bonds from Compustat's Industrial Annual Research file (CIAR) and Compustat's Industrial Annual file (CIA) to identify the firms used in this study. CIAR and CIA did not report these ratings prior to 1985. CIAR contains firms that were deleted from CIA for various reasons, including bankruptcy and liquidation. The estimation (hold-out) sample used in this study was from the 1985 to 1987 (1988 to 1991) period.

4. A random number generator was used to select the companies for the non-distressed group. The method used to select the companies was one that: (1) closely equated the number of non-distressed firms in the 1985–1987 and 1988–1991 samples; and (2) minimized the probability of selecting the same firm for multiple years since each sample year included many of the same non-distressed companies.

5. Firms not rated by S&P were excluded from the non-distressed population because it was not reasonable to assume firms were non-distressed just because they were not rated by S&P.

6. CIAR and CIA do not report current assets or current liabilities for financial institutions, life insurance, or property and casualty companies. The industrial classification includes SIC codes less than 4,000 and 5,000–5,999 for the Zmijewski and Ohlson samples.

7. The price-level index ranged from 99.7 (102.3) to 102.3 (116) for the estimation (hold-out) period.

8. The full X and Y -score models were also estimated after outliers were excluded from the samples. Outliers were defined as the upper and lower 1% of the companies based on Zmijewski's and Ohlson's ratios. The results reported in Table 4 did not change when the accuracies of the re-estimated models based on the reduced samples were used.

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PROLIFIC AUTHORS OF ACCOUNTING LITERATURE

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ABSTRACT

Measurement of the research productivity of accounting faculty continues to evolve. Many studies on accounting research focused on measuring the perceived quality of accounting and related journals, or measured the research productivity of a limited number of journals or on the research productivity of a limited number faculty. Other studies measured the accounting research productivity of academic institutions and doctoral programs and the effects of research on perceptions about institutions and programs. Finally, some studies measured limited topics such as the productivity of female faculty and the effects on research on perceptions of institutions.

In recent years, comprehensive databases on both accounting faculty and publications in accounting and related journals have provided an opportunity to study research productivity on a broader scale. These databases allowed the development of benchmarks for research productivity by years of experience and by journal quality. In developing these benchmarks, the publication records of individual faculty were unreported.

We analyzed 40 journals for the 35-year period 1967–2001 and identified the most prolific authors and their productivity records. The top 10 researchers based on number of publications in the 40 journals were identified by year of doctoral graduation for the 30-year period 1968–1997. Analyzing all U.S.

faculty holding the rank of Assistant Professor and above for the academic year 2001–2002 by the number of publications, we listed the top 75 academic researchers in the 40 journals, including category of publication. Finally, an analysis was made of publication records in ten premier accounting journals.

INTRODUCTION

Accounting faculty, academic administrators, doctoral candidates, and others seek information about the research productivity of accounting faculty to help evaluate their own research, the research of others, and the research quality of college accounting programs. The desire for such information has increased in recent years. [Campbell, Gaertner and Vecchio \(1983\)](#) found that most accounting programs have placed increased emphasis on research productivity. [Schultz, Meade and Khurana's \(1989\)](#) survey of accounting faculty and business school deans predicted that we would witness even greater emphasis on research production as the critical measure in the academic reward process.

Academic administrators seek objective data for use in performance evaluations and in making hiring, tenure, and promotion decisions – particularly *benchmark* data to help set standards of research productivity. Accounting faculty would like to use benchmarks to measure their own progress. The [American Assembly of Collegiate Schools of Business \(1996\)](#) now requires business schools and accounting programs to develop standards of achievement and to measure outcomes against those standards.

Previous studies on the research productivity of accounting faculty generally have used four types of data: (1) measures of the perceived quality of accounting and related journals; (2) quantitative measures of the research productivity of individual faculty; (3) quantitative measures of the research productivity of institutions and accounting programs; and (4) quantitative measures of the research productivity by graduates of specific doctoral programs. However, researchers performing such prior studies typically found difficulty in developing comprehensive databases of faculty and deriving composite qualitative and quantitative publication measures.

By combining [Hasselback's \(2002–2003\)](#) comprehensive faculty database faculty with Heck's Economic Literature Database (2002) and Pacific Research Company's (1995) comprehensive faculty publications databases, we overcame some limitations of prior studies and developed a composite measure of publication quantity and journal quality to develop benchmarks. We provide three measures of research productivity: (1) the number of articles published by each faculty, giving full credit to each author for co-authored articles (*full credit*

articles); (2) the number of articles adjusted for co-authorship (*co-author adjusted articles*); and (3) a composite measure of articles adjusted for both co-authorship (i.e. quantity) and quality of journal (*Q&Q composite score*).

Our first efforts helped develop benchmarks of research productivity of accounting faculty in the highest rated accounting journals (best 4 of over 100 journals, best 12, best 22, and best 40 journals). We reported these benchmarks according to the number of years since the authors received a doctoral degree (Hasselback, Reinstein & Schwan, 2000). While our prior report focused on developing general benchmarks of accounting faculty, this paper reports on the research output of the most prolific individuals in accounting education.

LITERATURE REVIEW

Need for Benchmarks of Faculty Research Productivity

The literature shows much desire for information on faculty research productivity (see, for example, Cargile & Bublitz, 1986; Hexer, 1969; Kida & Mannino, 1980; Ostrowsky, 1986). Previous researchers have used three techniques to assess the research productivity of individual faculty and academic programs: counting, citation analysis, and survey.

Counting

Counting techniques, presumably an objective and cost-efficient method, enumerate the number of articles a faculty member or academic program publishes in certain journals, which often ignore the articles' quality. While decision makers may agree that subjective attributes such as quality and rigor are important, they often prefer to use a verifiable measure such as counting.

Previous studies have generated interesting and useful information using the counting technique. Zivney, Bertin and Gavin (1995), for example, discovered that only 5% of doctoral-degree faculty had published at least one article in the 48 accounting and finance journals included in their database. Chung, Pak and Cox (1992) found that nearly one-third of the most prolific scholars had graduated from only seven doctoral programs and derived a distribution function relating the number of articles to the number of authors. Dwyer (1994) used this method to show that females earning their doctorates in 1981 had written significantly fewer articles than male graduates of the same year. Streuly and Maranto (1994) reached similar conclusions for two-year and five-year intervals.

Unfortunately, counting is neither as objective nor as simple as it may appear. The selection of journals to include in a study requires several subjective decisions,

including identification of potentially relevant and representative journals, justification for the inclusion of those journals, and justification for the exclusion of others. Prior studies often included only articles appearing in the most prestigious journals, impairing the general usefulness of their findings. The recent development of large databases has reduced some of the biases of using small samples.

Other biases persist with the counting technique. For example, should one give full or partial credit for co-authored articles, since there is no objective evidence that one method is better than the other? Most studies use only one method to measure publications. To date, only [Jacobs, Hartgraves and Beard \(1986\)](#), [Hasselback and Reinstein \(1995a, b\)](#), and [Hasselback, Reinstein and Schwan \(2000\)](#) have provided information containing measures of both *full credit* and *co-author adjusted* articles.

Citation Analysis

Citation analysis measures the frequency in which articles, authors, or journals are referenced in other articles, adopting the underlying assumption that higher quality articles are more often cited than those of lower quality. This technique simply counts how often other articles mention or cite the “studied” article. [Sriram and Gopalakrishnan \(1994\)](#) used citation analysis to rank the top 34 doctoral programs and their most prolific graduates. [Seetharaman and Islam \(1995\)](#) used this technique to rank the quality of 32 accounting journals, considering factors such as a journal’s age and circulation, and citations of articles appearing in both premier accounting journals and non-accounting journals. They also compared their results from 1985 to 1987 and 1988 to 1989 to ascertain “movements” in these rankings over time.

Like counting, a valued attribute of citation analysis is its presumed objectivity. Either an article is cited or it is not. However, citation analysis suffers from the same weaknesses as counting and other problems, as well. [MacRoberts and MacRoberts \(1989\)](#) note that citation analysis often fails to consider all but “first-named” authors in co-authored pieces, usually fails to differentiate between different types of journals, and gives credit to cited articles whether they are praised or criticized. Citation frequency can also be influenced by the reputation of the author, the sensitivity of the subject matter, and the journal’s circulation and coverage.

Surveys of Journal Quality

Other studies have used surveys to assess the quality of accounting and related journals. Typically, faculty or administrators are asked to rank journals relative to an “anchor” journal. For example, [Howard and Nikolai \(1983\)](#) used *The Journal of Accountancy* as their anchor, assigning it a rating of 100. Average responses usually are used to rank-order journals. [Smith \(1994\)](#) used this technique to rank 93 major accounting and other business journals.

Surveys have been used primarily for measuring the quality of journals. On the other hand, most counting and citation analysis studies have measured the quantity, but not the quality, of faculty research. However, [Hasselback and Reinstein \(1995a\)](#) combined [Hull and Wright's \(1990\)](#) and [Jolly, Schroeder and Spear's \(1995\)](#) reported journal rankings with [Hasselback's \(1992\)](#) database and databases of publications to help measure both the quantity (both *full credit* and *co-author adjusted*) and quality of publications in 40 journals by faculty affiliated with over 700 institutions. They (1995b) also used this method to measure the quantity and quality of articles of the 2,708 doctoral graduates from 73 major U.S. accounting programs.

Like other assessment techniques, surveys have potential flaws. [Morris, Cudd and Crain \(1990\)](#) found that faculty who publish frequently in top journals tend to exhibit significant bias in rating those journals. [Jolly, Schroeder and Spear \(1995\)](#) found significant differences in quality ratings among the nearly 1,000 respondents at AACSB-accredited institutions.

While productivity can be evaluated on an ordinal, interval, or ratio basis, most recent studies (e.g. [Howard & Nikolai, 1983](#); [Hull & Wright, 1990](#); [Schroeder, Payne & Harris, 1988](#)) have used the more inferential ratio scale. Other issues include the selection of the anchor, the identification of appropriate persons to evaluate journals, potential response biases due to the specialty interests of the respondents, and the use of cluster analysis (e.g. [Morris, Cudd & Crain, 1990](#)) to group journals rather than rank-ordering them.

CURRENT STUDY

The purposes of our recent research into the productivity of accounting faculty are: (1) to generate comprehensive data on the quantity, co-authorship, and quality of accounting faculty research that could be used as benchmarks; and (2) to explore ways to use such data.

Methodology

Our database contains all 4,890 faculty who graduated from accounting doctoral programs during the 30-year period from 1968 to 1997, as listed in [Hasselback](#) for the academic year 2001–2002 (2002–2003). We ended the sample in 1997, assuming that more recent graduates would have insufficient time (as of 2001) to develop a representative publication record. Faculty in the sample were classified by name, year of graduation from a doctoral program, doctoral accounting program, and present institutional affiliation.

Next we identified over 100 journals from the five most recent published studies on journal rankings (Hall & Ross, 1991; Hull & Wright, 1990; Jolly, Schroeder & Spear, 1995; Schroeder, Payne & Harris, 1988; Smith, 1994) that ranked academic accounting, professional accounting, and business journals. To gain a comprehensive, yet manageable database of publications, we selected the 40 highest ranking journals, which included 30 academic, five professional, and five business journals. Hull and Wright's (1990) study provided a preliminary basis to assign weights to the journals. We then used the Morris, Cudd, and Crain methodology to separate the 40 ranked journals into nine clusters, with all journals in the same cluster receiving the same rank weighting.

A database of journal articles was compiled from Pacific Research Company (1995) and Heck's Economic Literature Database (2002). All 40 journals are included in the former database and all but three journals are included in the latter one, allowing us to verify the accuracy of our data. We also resolved problems such as name misspellings, the use of initials rather than first names, and multiple persons with the same name by checking actual articles in our universities' libraries. Faculty members changing names are given credit under their present name. Exhibit 1 lists the journals included in the study and their assigned quality weights.

Next we identified the number of articles each individual faculty wrote and aggregated these data by the year of their doctoral degrees. To supply potential benchmark data, Exhibit 2a shows *full credit* for faculty articles by year that they earned their doctoral degrees. For example, suppose an accounting program wishes each of its faculty to attain a publication record of full credit articles within the top 1/3 of all faculty. Exhibit 2a indicates that a 1983 doctoral graduate should have published at least four articles (because 60 of 162 individuals who graduated in 1983 have published four or more articles). On the other hand, a 1995 graduate, having a shorter "time in grade," needs roughly two articles (because 65 of 160 have two or more articles).

The data reported in Exhibit 2a then were adjusted downward, individual by individual, to determine *co-author adjusted* articles. Each person co-authoring an article with one other person earned one-half credit for that article; each person co-authored an article with two others received one-third credit; and so on. Exhibit 2b thus allows those who wish to discount co-authored articles in the same manner as illustrated above to use these data as benchmarks.

To determine the *Q&Q composite* scores, Exhibit 2c shows each *co-author adjusted* article written by each individual multiplied by the quality weight of the journal (i.e. from Exhibit 1) in which it appeared. These *Q&Q composite* scores combine both the quantity of articles with the quality of journals to serve as benchmarks in a manner similar to the *full credit* articles and *co-author adjusted* articles data supplied in Exhibits 2a and 2b.

Exhibit 1. Journals Included in the Study and Their Quality Weights.

Journal of Accounting Research	2.25
The Accounting Review	2.25
Journal of Accounting and Economics	2.00
Journal of Finance	2.00 ^a
Accounting, Organizations and Society	1.60
Contemporary Accounting Research	1.60
Journal of Accounting, Auditing and Finance	1.60
Journal of the American Taxation Association	1.60
Journal of Business	1.60 ^a
Journal of Finance and Quantitative Analysis	1.60 ^a
Journal of Financial Economics	1.60 ^a
Management Science	1.60 ^a
Auditing: A Journal of Practice and Theory	1.35
Journal of Accounting and Public Policy	1.35
Journal of Business, Finance and Accounting	1.35
Journal of Management Accounting Research	1.35
Journal of Taxation	1.35 ^b
National Tax Journal	1.35
Abacus	1.15
Accounting and Business Research	1.15
Behavioral Research in Accounting	1.15
Journal of Accounting Literature	1.15
Accounting, Auditing and Accountability	1.00
Accounting Horizons	1.00
Financial Analysts Journal	1.00 ^b
Issues in Accounting Education	1.00
Journal of Accountancy	1.00 ^b
Advances in Accounting	0.95
International Journal of Accounting Education and Research	0.95
Journal of Accounting Education	0.95
Advances in International Accounting	0.90
Advances in Taxation	0.90
Critical Perspectives on Accounting	0.90
The Journal of Information Systems	0.90
Research in Accounting Regulation	0.90
Research in Governmental and Nonprofit Accounting	0.90
Accounting Educators' Journal	0.85
Accounting and Finance	0.85
The CPA Journal	0.85 ^b
Management Accounting	0.85 ^b

^aBusiness journal.^bProfessional journal.

Exhibit 2a. Distribution of Faculty According to Number of Articles Published and Year of Doctoral Degree.

Year of Doctoral Graduation	Number of Graduates	Total Articles	Number of Faculty by Number of Articles Published									
			0	1	2	3	4	5	6	7	8	9+
1968	101	458	44	18	7	8	0	3	1	0	4	16
1969	103	447	35	17	10	5	8	9	0	2	1	16
1970	143	530	56	23	9	6	9	8	6	4	4	18
1971	140	439	54	18	11	15	9	8	6	1	2	16
1972	144	544	60	17	16	9	5	7	5	5	4	16
1973	151	546	65	19	13	8	9	4	4	1	5	23
1974	167	638	70	18	11	11	12	2	6	8	5	24
1975	152	637	52	24	13	8	10	4	1	5	4	31
1976	134	535	44	18	11	10	5	7	10	6	6	17
1977	133	703	41	15	12	9	6	6	6	6	4	28
1978	179	971	52	27	16	11	9	8	9	8	8	31
1979	131	504	44	23	10	12	2	9	6	6	2	17
1980	136	631	39	19	8	14	8	9	4	5	3	27
1981	174	756	60	21	9	11	20	3	13	4	7	26
1982	177	785	57	17	17	15	17	4	5	5	9	31
1983	162	692	49	23	16	14	10	5	3	8	2	32
1984	161	575	50	31	12	17	6	4	4	8	7	22
1985	171	584	53	25	22	15	7	7	11	8	4	19
1986	188	660	63	35	18	9	7	10	3	7	9	27
1987	201	672	59	29	21	20	14	14	11	6	5	22
1988	205	601	70	30	25	22	10	7	9	5	10	17
1989	212	607	67	39	21	21	18	13	9	5	4	15
1990	171	537	57	27	24	13	5	4	9	8	7	17
1991	193	464	68	39	12	14	17	17	7	7	3	9
1992	199	451	66	46	29	9	14	8	7	6	8	6
1993	199	317	91	41	21	14	11	8	4	2	5	2
1994	198	396	76	35	30	18	13	11	7	3	1	4
1995	160	271	63	32	26	11	7	11	4	3	2	1
1996	159	235	79	29	20	11	11	2	2	1	2	2
1997	146	150	74	35	19	9	5	1	1	0	2	0
Totals	4,890	16,336	1,758	790	489	369	284	213	173	143	139	532
Percents	100%		36	16	10	8	6	4	4	3	3	11

Time in Grade

“Time in grade,” i.e. the number of years since the faculty member earned a doctoral degree, constitutes a key factor to meaningfully assess research productivity, since a recent graduate has less time to establish a research record than an older one.

Exhibit 2b. Distribution of Faculty According to Number of Articles Adjusted for Co-authorship and Year of Doctoral Degree.

Year of Doctoral Graduation	Number of Graduates	Total Articles	Number of Faculty by Number of Articles Published									
			0	1	2	3	4	5	6	7	8	9+
1968	101	458	44	19	10	8	0	0	4	3	3	10
1969	103	447	35	20	15	8	8	2	2	4	0	9
1970	143	530	56	28	10	10	13	6	4	4	1	11
1971	140	439	54	21	23	12	10	1	4	3	5	7
1972	144	544	60	21	15	20	10	0	3	0	3	12
1973	151	546	65	26	13	11	11	3	8	1	3	10
1974	167	638	70	20	21	15	12	8	2	2	4	13
1975	152	637	52	31	17	9	6	9	6	9	2	11
1976	134	535	44	25	14	12	9	12	5	2	2	9
1977	133	703	41	19	19	7	10	10	4	4	1	18
1978	179	971	52	39	17	15	16	7	6	7	5	15
1979	131	504	44	28	16	12	8	7	3	4	0	9
1980	136	631	39	23	23	9	13	5	6	3	5	10
1981	174	756	60	29	22	20	11	7	7	4	5	9
1982	177	785	57	24	27	20	14	7	11	2	3	12
1983	162	692	49	35	20	14	8	8	7	7	5	9
1984	161	575	50	40	20	15	10	9	5	3	3	6
1985	171	584	53	37	28	17	10	9	7	3	1	6
1986	188	660	63	50	14	12	19	9	10	4	2	5
1987	201	672	59	46	29	25	20	4	4	6	1	7
1988	205	601	70	52	28	16	12	12	8	1	4	2
1989	212	607	67	55	32	27	14	4	7	2	0	4
1990	171	537	57	47	20	12	13	9	5	3	3	2
1991	193	464	68	48	28	23	14	7	1	1	2	1
1992	199	451	66	69	24	18	12	5	2	1	1	1
1993	199	317	91	59	23	14	7	4	0	1	0	0
1994	198	396	76	56	32	24	4	3	1	1	0	1
1995	160	271	63	53	22	14	6	2	0	0	0	0
1996	159	235	79	48	13	9	6	2	1	0	0	1
1997	146	150	74	47	16	5	4	0	0	0	0	0
Totals	4,890	16,336	1,758	1,115	611	433	310	171	133	85	64	210
Percents	100%		36	23	12	9	6	3	3	2	1	4

Exhibit 3 standardizes the findings of **Exhibits 2a, 2b, and 2c** by dividing each data point by the related number of years between graduation and 2001. For example, 1968 data were divided by 33 years, 1969 by 32 years, and 1997 by 4 years. As **Exhibit 3** indicates, the individual research productivity per year, on average, has remained fairly stable but surprisingly low. The average number of full credit

Exhibit 2c. Distribution of Faculty According to Number of Articles Adjusted for Quality and Quantity (Q&Q), and Year of Doctoral Degree.

Year of Doctoral Graduation	Number of Graduates	Total Articles	Number of Faculty by Number of Articles Published									
			0	1	2	3	4	5	6	7	8	9+
1968	101	458	44	14	7	11	3	2	2	0	3	15
1969	103	447	35	14	8	9	9	5	5	2	3	13
1970	143	530	56	23	9	9	10	4	3	6	3	20
1971	140	439	54	18	11	16	10	3	6	2	3	17
1972	144	544	60	15	13	12	13	8	2	5	1	15
1973	151	546	65	17	16	8	8	5	8	5	2	17
1974	167	638	70	17	12	17	15	5	7	5	2	17
1975	152	637	52	28	14	11	3	6	2	8	6	22
1976	134	535	44	18	12	15	11	7	2	3	7	15
1977	133	703	41	13	16	12	4	8	3	6	6	24
1978	179	971	52	34	16	13	11	8	10	3	4	28
1979	131	504	44	26	12	12	8	5	4	3	2	15
1980	136	631	39	19	22	9	7	5	8	3	5	19
1981	174	756	60	28	18	13	14	5	7	5	8	16
1982	177	785	57	19	25	14	16	6	5	5	8	22
1983	162	692	49	29	20	13	10	3	5	1	7	25
1984	161	575	50	33	21	11	7	9	6	7	4	13
1985	171	584	53	33	23	18	4	9	8	5	3	15
1986	188	660	63	43	17	8	10	14	9	7	5	12
1987	201	672	59	33	34	16	23	11	2	5	5	13
1988	205	601	70	42	26	21	6	6	4	11	5	14
1989	212	607	67	42	36	23	16	6	4	4	3	11
1990	171	537	57	33	24	12	11	7	4	5	2	16
1991	193	464	68	41	22	19	15	12	6	5	2	3
1992	199	451	66	55	30	17	8	9	2	4	0	8
1993	199	317	91	52	20	15	9	4	0	3	2	3
1994	198	396	76	42	32	15	14	7	6	2	1	3
1995	160	271	63	40	21	15	5	4	6	3	2	1
1996	159	235	79	34	21	2	9	5	4	1	2	2
1997	146	150	74	38	19	8	4	2	0	0	1	0
Totals	4,890	16,336	1,758	893	577	394	293	190	140	124	107	414
Percents	100%		36	18	12	8	6	4	3	3	2	8

articles published in the 40 journals per year is 0.21, the average co-author adjusted articles is 0.11 per year, and the average Q&Q composite score is 0.16 per year. The numbers for the early years are not as low as expected when compared to the more recent years. The earlier graduates are not under the tenure pressure to publish as the more recent graduates.

Exhibit 3. Faculty Research Productivity by Year of Doctoral Degree (Full Credit Articles, Co-author Adjusted Articles and Q&Q Composite).

Year of Doctoral Degree	Number of Graduates	Total Articles			Articles/Faculty			Articles/Faculty/Year		
		Full Credit Articles	Co-author Adjust Articles	Q&Q Composite Score	Full Credit Articles	Co-author Adjust Articles	Q&Q Composite Score	Full Credit Articles	Co-author Adjust Articles	Q&Q Composite Score
1968	101	458	316.29	466.15	4.53	3.13	4.62	0.14	0.09	0.14
1969	103	447	266.95	411.91	4.34	2.59	4.00	0.14	0.08	0.12
1970	143	530	348.20	485.81	3.71	2.43	3.40	0.12	0.08	0.11
1971	140	439	282.12	380.36	3.14	2.02	2.72	0.10	0.07	0.09
1972	144	544	351.89	508.92	3.78	2.44	3.53	0.13	0.08	0.12
1973	151	546	328.03	489.12	3.62	2.17	3.24	0.13	0.08	0.12
1974	167	638	376.09	525.14	3.82	2.25	3.14	0.14	0.08	0.12
1975	152	637	366.55	500.29	4.19	2.41	3.29	0.16	0.09	0.13
1976	134	535	317.10	411.21	3.99	2.37	3.07	0.16	0.09	0.12
1977	133	703	394.11	580.36	5.29	2.96	4.36	0.22	0.12	0.18
1978	179	971	539.62	727.03	5.42	3.01	4.06	0.24	0.13	0.18
1979	131	504	283.07	389.64	3.85	2.16	2.97	0.17	0.10	0.14
1980	136	631	334.27	479.09	4.64	2.46	3.52	0.22	0.12	0.17
1981	174	756	398.94	528.20	4.34	2.29	3.04	0.22	0.11	0.15
1982	177	785	424.07	571.89	4.44	2.40	3.23	0.23	0.13	0.17
1983	162	692	359.53	504.79	4.27	2.22	3.12	0.24	0.12	0.17
1984	161	575	300.33	424.54	3.57	1.87	2.64	0.21	0.11	0.16
1985	171	584	316.79	423.06	3.42	1.85	2.47	0.21	0.12	0.15
1986	188	660	343.38	453.89	3.51	1.83	2.41	0.23	0.12	0.16
1987	201	672	367.08	472.63	3.34	1.83	2.35	0.24	0.13	0.17
1988	205	601	322.19	450.11	2.93	1.57	2.20	0.23	0.12	0.17
1989	212	607	327.14	434.47	2.86	1.54	2.05	0.24	0.13	0.17
1990	171	537	273.73	404.61	3.14	1.60	2.37	0.29	0.15	0.22
1991	193	464	250.65	320.15	2.40	1.30	1.66	0.24	0.13	0.17
1992	199	451	223.74	309.38	2.27	1.12	1.55	0.25	0.12	0.17
1993	199	317	159.00	205.66	1.59	0.80	1.03	0.20	0.10	0.13
1994	198	396	203.74	281.49	2.00	1.03	1.42	0.29	0.15	0.20
1995	160	271	135.20	204.66	1.69	0.84	1.28	0.28	0.14	0.21
1996	159	235	132.32	186.34	1.48	0.83	1.17	0.30	0.17	0.23
1997	146	150	77.14	98.81	1.03	0.53	0.68	0.26	0.13	0.17
Totals	4,890	16,336	9,119.26	12,629.71	3.34	1.86	2.58	0.21	0.11	0.16

Aggregate Measures of Research Productivity

We calculated the average number of authors per article and the average journal quality for each year. The average number of authors per articles was determined by dividing the total number of *full credit* articles published by graduates of each year by the total number of *co-author adjusted* articles. The average journal quality of the articles published by graduates of each year was calculated by dividing the total *Q&Q composite* score for each graduation year by the number of *co-author adjusted* articles for that year. After 1976 the number of co-authors have increased slightly but have remained reasonably constant during the last 20 years. The average quality of journal articles has fluctuated only slightly over the 30-year period.

[Exhibits 1 through 4](#) report descriptive statistics of the entire doctoral faculty database. Some decision makers may wish to use these data to determine general benchmarks based on overall averages. Others, however, may wish to set benchmarks at *best of breed* or *world class* levels. [Lucertini, Nicolo and Telmon \(1995\)](#), for example, suggest that accounting programs should seek relevant benchmarks to “continuously search, measure, and compare” their processes to the best practices that their competitors have developed. To provide initial data for those who wish the latter, [Exhibit 5](#) lists the ten most prolific publishers in terms of *full credit* articles for each graduation year. In our analysis, we have broken the 40 journals into four categories. Category I includes the top three Accounting journals, Category II includes the remainder of the top 12 journals, Category III includes the next 10 ranked journals, and Category IV includes the remaining 18 journals from the study. The number of full credit articles for each of the four categories is shown for each person. This exhibit may indicate those individuals who may have moved up the listing by publishing in lower ranked journals. Also included in [Exhibit 5](#) are the current affiliations (as of 2002) of these authors and the universities at which they earned their doctoral degrees. These averages could be used as *best of breed* benchmarks.

Overall Faculty Productivity

We next aggregated all 2001–2002 accounting faculty holding the rank of Assistant Professor or higher. [Exhibit 6](#) shows that from 1967 to 2001, almost 50% of all faculty had no articles published in the 40 journals, and over 70% of them wrote two or fewer articles. These data can be used to estimate where an individual productivity record fits among all faculty.

Exhibit 4. Average Number of Authors per Article and Average Quality of Articles by Year of Doctoral Graduation.

Year of Doctoral Degree	Average Number of Authors per Article	Average Quality
1968	1.73	1.48
1969	2.04	1.50
1970	1.80	1.40
1971	1.88	1.34
1972	1.85	1.43
1973	2.00	1.47
1974	2.03	1.40
1975	2.07	1.36
1976	2.02	1.29
1977	2.11	1.44
1978	2.10	1.34
1979	2.11	1.36
1980	2.21	1.41
1981	2.23	1.31
1982	2.17	1.34
1983	2.28	1.40
1984	2.27	1.39
1985	2.23	1.34
1986	2.27	1.33
1987	2.22	1.29
1988	2.24	1.38
1989	2.22	1.32
1990	2.30	1.46
1991	2.21	1.29
1992	2.40	1.38
1993	2.38	1.28
1994	2.30	1.36
1995	2.32	1.46
1996	2.17	1.41
1997	2.25	1.27
Averages	2.14	1.37

Best of Breed

[Exhibit 7](#) provides additional data to help develop *best of breed* benchmarks, by listing those faculty with 25 or more *full credit* articles in the 40 journals of our database, regardless of year of doctoral degree. Some of the listed persons are not affiliated with U.S. schools.

Exhibit 5. Research Productivity of Most Productive Doctoral Graduates for the Years 1968–1997 in 40 Journals.

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
1968									
Kinney, William R. Jr.	44	28	5	6	5	31.58	59.33	Texas-Austin	Mich St
Kaplan, Robert S.	42	17	9	3	13	28.70	49.93	Harvard	Cornell
Lev, Baruch	42	27	10	1	4	25.67	51.18	New York U	Chicago
Carmichael, Douglas R.	37	3	2	1	31	27.00	28.93	CUNY-Baruch	Illinois
Revsine, Lawrence	28	17	0	2	9	21.33	37.24	Northwestern	Nrthwstrn
Weygandt, Jerry J.	25	10	2	1	12	13.50	21.42	Wisconsin	Illinois
Nurnberg, Hugo	24	8	1	1	14	20.33	29.08	CUNY-Baruch	Columbia
Huefner, Ronald J.	18	6	2	1	9	12.50	17.28	SUNY-Buffalo	Cornell
Smith, Charles H.	18	7	2	2	7	8.58	13.48	Penn State	Penn St
Brown, Philip R.	12	3	4	4	1	5.08	8.06	W Australia	Chicago
1969									
Strawser, Robert H.	43	10	1	5	27	17.32	22.28	Texas A&M	Maryland
McKeown, James C.	30	23	4	3	0	15.83	33.30	Penn State	Mich St
Mock, Theodore J.	29	9	2	12	6	14.33	24.08	So Calif	Berkeley
Gonedes, Nicholas J.	27	16	9	0	2	23.83	46.60	Pennsylvania	Tx-Austin
Swieringa, Robert J.	24	12	4	0	8	14.33	23.30	Cornell	Illinois
Shank, John K.	21	7	2	3	9	12.67	19.10	Dartmouth	Ohio St
Cushing, Barry E.	17	7	1	4	5	13.33	20.40	Utah	Mich St
Parker, James E.	16	3	5	3	5	10.58	15.43	Missouri	Mich St
Dascher, Paul E.	14	5	0	1	8	6.00	8.20	Stetson	Penn St
Brenner, Vincent C.	13	7	0	0	6	6.08	10.35	Stetson	Penn St
1970									
Ronen, Joshua	39	17	15	3	4	20.92	38.07	New York U	Stanford
Seago, W. Eugene	35	0	2	30	3	29.00	38.16	Virg Tech	Georgia
Loeb, Stephen E.	24	5	0	9	10	18.33	24.68	Maryland	Wisconsin
Most, Kenneth S.	19	5	0	4	10	17.50	23.55	Fla Internat	Florida
Stickney, Clyde P.	18	7	1	2	8	10.33	16.21	Dartmouth	Fla St
Nichols, Donald R.	17	7	0	4	6	10.83	15.45	Tx Christian	Oklahoma
Felix, William L., Jr.	16	9	2	2	3	8.17	15.48	Arizona	Ohio St
Gibson, Charles H.	15	0	0	1	14	10.33	9.61	Toledo	Kent St
Robertson, Jack C.	15	5	1	2	7	9.50	13.30	Texas-Austin	N Carol
Williams, Jan R.	14	1	0	0	13	8.83	8.47	Tennessee	Arkansas
1971									
Watts, Ross L.	25	16	9	0	0	13.15	25.35	Rochester	Chicago
Bailey, Andrew D., Jr.	19	7	2	5	5	7.92	13.19	Illinois	Ohio St
Miller, Paul B. W.	19	0	0	0	19	15.83	14.78	Colorado Spr	Tx-Austin
Largay, James A., III	18	3	4	2	9	10.00	14.78	Lehigh	Cornell
Guy, Dan M.	17	1	0	0	16	7.75	7.69	AICPA-Audit	Alabama
Reichardt, Karl E.	16	0	0	0	16	8.83	7.51	Valparaiso	Missouri
Cerullo, Michael J.	12	0	0	0	12	10.33	8.78	SW Missouri	LSU
Greer, Willis R., Jr.	12	2	2	4	4	9.00	12.67	No Iowa	Michigan
Klammer, Thomas P.	12	1	1	3	7	7.67	9.56	North Texas	Wisconsin
Liao, Shu S.	11	1	1	2	7	9.00	10.55	Naval Postgr	Illinois

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
1972									
Ohlson, James A.	44	20	24	0	0	30.50	58.11	New York U	Berkeley
Riahi-Belkaoui, Ahmed	36	3	6	14	13	31.33	41.47	Ill-Chicago	Syracuse
Abdel-khalik, A. Rashad	28	19	7	0	2	21.83	43.65	Illinois	Illinois
Previts, Gary John	27	1	2	5	19	15.50	16.10	Case Western	Florida
Ball, Raymond J.	21	13	7	1	0	12.00	24.08	Chicago	Chicago
Choi, Frederick D. S.	19	1	1	1	16	17.00	17.73	New York U	U Wash
Dilley, Steven C.	18	3	1	0	14	10.00	10.99	Michigan St	Wisconsin
Hagerman, Robert L.	17	6	6	1	4	9.67	16.26	SUNY-Buffalo	Rochester
Deakin, Edward B.	16	10	0	1	5	11.67	21.32	Texas	Illinois
Johnson, L. Todd	16	2	0	0	14	9.58	10.38	FASB	Michigan
1973									
Gordon, Lawrence A.	31	2	8	18	3	17.75	24.40	Maryland	Rensselaer
Ashton, Robert H.	29	17	5	3	4	19.83	37.70	Duke	Minnesota
Sunder, Shyam	27	17	6	1	3	20.33	38.42	Yale	Car Mellon
Imhoff, Eugene A., Jr.	24	9	3	3	9	16.67	24.41	Michigan	Mich St
Boatsman, James R.	22	11	2	3	6	9.25	15.53	Arizona St	Tx-Austin
Collins, Daniel W.	21	15	4	0	2	9.75	18.57	Iowa	Iowa
Schnee, Edward J.	16	0	4	3	9	8.33	9.76	Alabama	Mich St
Coffman, Edward N.	15	2	0	3	10	6.00	7.00	Virg Comm	Geo Wash
Epstein, Marc J.	15	0	2	1	12	9.67	9.09	Rice	Oregon
Nikolai, Loren A.	14	6	0	0	8	8.00	11.17	Missouri	Minnesota
Uecker, Wilfred C.	14	11	3	0	0	8.33	17.61	Rice	Tx-Austin
1974									
Libby, Robert	32	22	7	2	1	17.83	35.82	Cornell	Illinois
Ferris, Kenneth R.	29	3	12	7	7	17.50	25.14	Am Grad Sch	Ohio St
Hughes, John S.	26	14	11	1	0	13.98	26.86	UCLA	Purdue
Zimmerman, Jerold L.	24	20	2	0	2	15.23	30.52	Rochester	Berkeley
Baiman, Stanley	19	14	4	1	0	10.17	20.57	Pennsylvania	Stanford
Holder, William W.	19	1	1	2	15	11.33	12.83	So Calif	Oklahoma
Magee, Robert P.	17	13	4	0	0	12.42	26.11	Northwestern	Cornell
Schultz, Joseph J., Jr.	17	4	1	7	5	8.08	11.21	Arizona St	Tx-Austin
Bremser, Wayne G.	16	3	0	0	13	11.33	12.74	Villanova	Penn
Liao, Woody M.	16	3	1	5	7	10.42	14.25	Cal-Riversid	Florida
1975									
Dirsmith, Mark W.	36	0	22	7	7	17.00	23.63	Penn State	Nrthwstrn
Fellingham, John C.	25	7	8	5	5	9.78	16.75	Ohio State	UCLA
Harrell, Adrian M.	22	2	7	8	5	11.58	15.83	So Carolina	Tx-Austin
Foster, George	21	10	4	6	1	16.83	30.75	Stanford	Stanford
Vickrey, Don W.	21	5	0	13	3	14.33	20.67	Ariz St-West	Tx-Austin
Flesher, Dale L.	17	1	3	1	12	9.67	10.27	Mississippi	Cincinnati
Givoly, Dan	16	7	5	2	2	8.33	14.68	Penn State	NYU
Lorek, Kenneth S.	16	11	0	1	4	6.83	13.23	No Arizona	Illinois
Krogstad, Jack L.	15	2	1	4	8	5.86	7.74	Creighton	Nebraska
Baker, C. Richard	14	2	1	2	9	12.00	14.70	Mass-Dartmou	UCLA

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
1976									
Bloom, Robert	30	0	1	3	26	14.42	14.13	John Carroll	NYU
Englebrecht, Ted D.	30	1	4	2	23	14.67	15.31	Louisiana Te	S Carol
Dillard, Jesse F.	18	1	6	2	9	9.92	12.93	Cen Florida	S Carol
Porcano, Thomas M.	18	1	4	0	13	12.83	15.40	Miami U-Ohio	Indiana
Pastena, Victor S.	18	11	6	0	1	7.92	15.39	SUNY-Buffalo	NYU
Gibbins, Michael	17	7	7	2	1	9.25	16.57	Univ Alberta	Cornell
Graham, Lynford E.	16	0	2	4	10	11.17	11.22	BDO Seidman	Penn
Maples, Lawrence D.	16	0	0	8	8	11.50	13.77	Tenn Tech	Miss St
Ro, Byung T.	15	5	4	5	1	9.50	16.37	Purdue	Mich St
Patton, James M.	14	6	1	0	7	7.58	12.19	Pittsburgh	Wash U
1977									
Ingram, Robert W.	43	13	4	8	18	22.25	33.78	Alabama	Tx Tech
Dhaliwal, Dan S.	31	11	7	11	2	17.00	27.70	Arizona	Arizona
Ketz, J. Edward	25	3	4	3	15	13.83	18.28	Penn State	Va Tech
Wolfson, Mark A.	25	12	8	3	2	11.25	20.24	Stanford	Tx-Austin
Welker, Robert B.	23	4	2	8	9	9.33	13.03	So Illinois	Ariz St
Cheung, Joseph K.	21	1	3	8	9	14.25	17.34	HongKon Tech	Michigan
Romney, Marshall B.	21	0	1	0	20	11.17	10.50	Brigham Yg	Tx-Austin
Jiambalvo, James J.	19	7	6	5	1	9.42	16.66	U Washington	Ohio St
Pratt, Jamie H.	19	9	5	1	4	10.67	17.73	Indiana	Indiana
Grimlund, Richard A.	18	6	3	7	2	10.75	17.96		U Wash
1978									
Reckers, Philip M. J.	64	4	8	24	28	28.33	34.21	Arizona St	Illinois
Wallace, Wanda A.	49	3	3	5	38	39.92	43.29	Wm & Mary	Florida
Larcker, David F.	39	23	10	6	0	18.25	35.00	Pennsylvania	Kansas
Munter, Paul	38	1	1	2	34	19.33	17.67	U Miami	Colorado
Shields, Michael D.	35	6	18	8	3	16.67	26.50	Michigan St	Pittsburgh
Pany, Kurt J.	30	7	0	8	15	12.92	17.80	Arizona St	Illinois
Penman, Stephen H.	25	14	11	0	0	18.33	35.10	Columbia	Chicago
Ratcliffe, Thomas A.	25	0	1	1	23	13.83	12.36	Troy State	Alabama
Schwartz, Bill N.	23	0	3	2	18	13.00	14.05	Ind-So Bend	UCLA
Hopwood, William S.	22	15	4	2	1	9.83	19.94	Fla Atlantic	Florida
1979									
Wright, Arnold M.	35	5	4	17	9	21.42	29.69	Boston Coll	S Calif
Raman, Kris K.	30	4	6	12	8	16.67	24.23	North Texas	Indiana
Covaleski, Mark A.	22	0	16	5	1	9.83	14.88	Wisconsin	Penn St
Messier, William F., Jr.	22	4	6	11	1	11.75	18.15	Georgia St	Indiana
Solomon, Ira	22	7	5	8	2	9.83	16.21	Illinois	Tx-Austin
Giroux, Gary A.	19	2	2	8	7	8.67	11.28	Texas A&M	Tx Tech
Baldwin, Bruce A.	15	4	0	0	11	9.58	13.10	Ariz St-West	Ariz St
Brownell, Peter	15	8	5	1	1	11.50	21.42		Berkeley
Mensah, Yaw M.	14	5	2	6	1	10.17	17.07	Rutgers-N Br	Illinois
Smith, David B.	14	7	0	2	5	6.07	10.21	Iowa State	Illinois

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
1980									
Banker, Rajiv D.	39	11	18	4	6	16.28	27.93	Texas-Dallas	Harvard
Bamber, E. Michael	20	3	4	6	7	9.75	13.58	Georgia	Ohio St
DeAngelo, Linda E.	20	8	11	0	1	12.00	22.47	S Calif	U Wash
Holthausen, Robert W.	18	12	6	0	0	8.42	16.37	Pennsylvania	Rochester
Leftwich, Richard W.	18	11	7	0	0	9.33	18.27	Chicago	Rochester
Roth, Harold P.	18	0	0	0	18	11.00	9.95	Tennessee	Va Tech
Arrington, C. Edward	17	2	6	4	5	8.67	11.32	N Car-Greens	Fla St
Evans, John H., III	17	9	2	4	2	7.67	13.60	Pittsburgh	Car Mellon
Reinstein, Alan	17	0	1	1	15	7.92	7.45	Wayne State	Kentucky
Baber, William R.	15	9	0	4	2	8.67	15.22	George Wash	N Carol
Morris, Michael H.	15	3	6	5	1	7.67	12.21	Notre Dame	Cincinnati
Smieliauskas, Wally	15	5	7	3	0	10.00	17.89	Univ Toronto	Wisconsin
Tondkar, Rasoul H.	15	0	0	0	15	6.00	5.66	Virg Comm	North Tx
1981									
Chow, Chee W.	58	8	9	14	27	27.00	36.06	San Diego St	Oregon
Knight, Lee G.	43	0	0	3	40	20.33	19.31	Wake Forest	Alabama
Murray, Dennis F.	20	4	5	5	6	11.50	16.74	Colo-Denver	Mass
Robinson, John R.	20	2	6	7	5	8.25	12.08	Texas-Austin	Michigan
Waller, William S.	20	9	7	3	1	10.67	19.72	Arizona	U Wash
Hooks, Karen L.	19	0	1	4	14	11.14	11.81	Fla Atlantic	Geo St
Knechel, W. Robert	19	4	2	7	6	13.42	18.97	Florida	N Carol
Stone, Mary S.	19	5	0	6	8	10.23	13.99	Alabama	Illinois
White, Richard A.	16	2	3	3	8	7.50	10.18	So Carolina	Ariz St
Antle, Rick	15	9	4	2	0	8.00	16.37	Yale	Stanford
1982									
Kaplan, Steven E.	44	2	3	23	16	22.42	27.86	Arizona St	Illinois
Stout, David E.	36	0	0	1	35	15.23	14.30	Villanova	Pittsburgh
Wilson, Earl R.	20	5	2	5	8	9.17	13.19	Missouri	Missouri
Bernard, Victor L.	19	10	6	2	1	11.50	21.36	Michigan	Illinois
Borthick, A. Faye	18	1	0	0	17	10.17	9.88	Georgia St	Tennessee
Lys, Thomas Z.	18	10	7	1	0	8.65	15.99	Northwestern	Rochester
Abdolmohammadi, Mohammad	17	1	3	5	8	11.33	14.03	Bentley	Indiana
Lambert, Richard A.	17	14	1	2	0	9.17	18.72	Pennsylvania	Stanford
Limberg, Stephen T.	16	1	4	5	6	8.67	11.15	Texas-Austin	Ariz St
Schneider, Arnold	16	3	2	4	7	10.83	15.07	Georgia Tech	Ohio St
1983									
Hassell, John M.	25	5	2	2	16	9.58	12.55	Indiana-Indy	Indiana
Smith, L. Murphy	22	0	1	0	21	10.00	9.15	Texas A&M	La Tech
Bamber, Linda S.	19	6	4	3	6	8.33	14.39	Georgia	Ohio St
Simon, Daniel T.	19	5	1	4	9	8.67	11.65	Notre Dame	Nrthwstrn
Collins, Julie H.	18	7	6	3	2	8.17	13.82	No Carolina	Florida
Richardson, Gordon D.	18	4	11	0	3	6.75	11.05	Univ Toronto	Cornell
Schaefer, Thomas F.	18	5	4	1	8	8.00	11.95	Notre Dame	Illinois
Palepu, Krishna G.	17	8	6	0	3	8.03	14.16	Harvard	MIT

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
Young, S. Mark	16	3	5	8	0	6.92	11.20	So Calif	Pittsburgh
Doupnik, Timothy S.	15	0	0	0	15	9.17	8.49	So Carolina	Illinois
Healy, Paul M.	15	8	5	1	1	7.58	13.75	Harvard	Rochester
1984									
Landsman, Wayne R.	22	14	3	1	4	9.33	17.27	No Carolina	Stanford
Waymire, Gregory B.	20	14	5	1	0	10.33	21.58	Emory	Chicago
Holmes, Sarah A.	19	0	1	4	14	7.65	8.14	Texas A&M	North Tx
Read, William J.	19	0	0	1	18	8.62	8.52	Bentley	Va Tech
Thomas, Jacob K.	17	9	7	1	0	9.67	18.48	Columbia	Michigan
Jain, Prem C.	16	6	9	0	1	11.17	20.82	Georgetown	Florida
Swenson, Charles W.	16	4	5	5	2	9.50	15.07	So Calif	S Calif
Barton, Thomas L.	14	0	0	1	13	6.33	5.86	North Fla	Florida
McNichols, Maureen F.	14	11	2	1	0	7.75	15.72	Stanford	UCLA
Williams, David D.	13	2	2	6	3	6.67	9.58	Ohio State	Penn St
1985									
Strawser, Jerry R.	27	1	1	11	14	13.75	15.95	Texas A&M	Tx A&M
Siegel, Philip H.	23	0	2	1	20	8.67	8.51	F Dick-Madis	Memphis
Datar, Srikant M.	20	10	9	0	1	8.08	15.24	Harvard	Stanford
Rezaee, Zabihollah	19	1	1	1	16	12.83	12.78	Memphis	Miss
Shaw, Wayne H.	18	7	10	1	0	10.33	19.82	So Methodist	Tx-Austin
Anderson, Urton L.	13	1	1	5	6	4.62	5.78	Texas-Austin	Minnesota
Bedard, Jean C.	13	2	2	7	2	5.92	8.64	Northeastern	Wisconsin
Blinc, Dennis M.	11	0	0	3	8	5.50	5.39	Bryant	Arkansas
Reiter, Sara A.	11	2	1	2	6	9.00	10.58	SUNY-Bingham	Missouri
Zarowin, Paul A.	11	5	6	0	0	7.17	13.45	New York U	Chicago
1986									
Kothari, S. P.	28	16	12	0	0	12.73	24.12	MIT	Iowa
King, Ronald R.	26	9	11	5	1	12.67	22.12	Wash Univ	Arizona
Hite, Peggy A.	19	1	4	2	12	11.50	13.18	Indiana	Colorado
Shevlin, Terry	16	9	6	0	1	7.75	14.75	U Washington	Stanford
Balakrishnan, Ramji	15	4	6	2	3	8.94	14.26	Iowa	Columbia
Hill, John W.	15	1	0	6	8	5.83	6.98	Indiana	Iowa
Pasewark, William R.	15	0	1	2	12	6.25	6.77	Texas Tech	Tx A&M
Schatzberg, Jeffrey W.	14	3	3	4	4	5.58	8.80	Arizona	Iowa
Viator, Ralph E.	14	0	3	1	10	9.00	10.30	Texas Tech	Tx A&M
Church, Bryan K.	13	2	3	3	5	6.67	9.05	Georgia Tech	Florida
Gaver, Jennifer J.	13	6	4	3	0	6.67	11.75	Georgia	Arizona
1987									
Cohen, Jeffrey R.	21	1	1	5	14	10.50	11.48	Boston Coll	Mass
Bricker, Robert J.	16	1	6	4	5	8.08	11.37	Case Western	Case Wes
Lundholm, Russell J.	15	8	6	0	1	9.58	18.28	Michigan	Iowa
Sutton, Steve G.	15	0	0	5	10	6.33	6.35	Connecticut	Missouri
Tyson, Thomas N.	15	0	0	2	13	10.33	9.83	St John Fshr	Geo St
Francis, Jennifer	14	12	0	1	1	8.67	16.74	Duke	Cornell
Street, Donna L.	14	0	0	2	12	6.00	5.86	Dayton	Tennessee
Beneish, Messod D.	13	4	4	3	2	9.33	14.74	Indiana	Chicago

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
DeFond, Mark L.	13	7	2	3	1	6.25	10.89	So Calif	U Wash
Hand, John R. M.	12	7	5	0	0	8.00	16.19	No Carolina	Chicago
Stone, Dan N.	12	1	3	1	7	8.50	9.85	Kentucky	Tx-Austin
1988									
Geiger, Marshall A.	22	0	1	3	18	13.46	13.57	Richmond	Penn St
Bonner, Sarah E.	15	9	3	2	1	7.92	14.27	So Calif	Michigan
Ryan, Stephen G.	15	7	3	0	5	7.53	12.61	New York U	Stanford
Sivaramakrishnan, K.	14	8	4	1	1	6.25	12.13	Texas A&M	Nrthwstrn
Wheeler, Stephen W.	14	3	0	5	6	4.92	6.86	Pacific	Ariz St
Roberts, Michael L.	13	0	4	1	8	8.00	9.94	Alabama	Geo St
Kachelmeier, Steven J.	12	4	2	5	1	5.25	8.46	Texas-Austin	Florida
Schadewald, Michael S.	12	2	3	1	6	5.45	7.60	Wis-Milwauke	Minnesota
Davidson, Ronald A.	11	1	2	3	5	5.33	6.96	Ariz St West	Arizona
Kaplan, Steven N.	11	0	11	0	0	8.00	13.80	Chicago	Harvard
Oakes, Leslie S.	11	1	4	1	5	4.83	6.47	New Mexico	Wisconsin
Young, James C.	11	0	3	1	7	5.50	6.28	No Illinois	Mich St
1989									
Fogarty, Timothy J.	29	0	3	6	20	15.33	16.82	Case Western	Penn St
Barth, Mary E.	25	17	2	0	6	11.67	21.16	Stanford	Stanford
Skinner, Douglas J.	19	12	6	0	1	12.57	23.33	Michigan	Rochester
Ponemon, Lawrence A.	16	1	4	3	8	11.33	14.33		Union
Khurana, Inder K.	13	3	0	4	6	5.64	8.31	Missouri	Ariz St
Stevens, Kevin T.	13	0	1	0	12	6.92	6.70	DePaul	Kentucky
Bushman, Robert M.	11	9	2	0	0	4.92	10.35	No Carolina	Minnesota
Indjekian, Raffi J.	11	8	3	0	0	5.58	11.20	Michigan	Penn
Warfield, Terry D.	11	4	0	0	7	5.33	7.39	Wisconsin	Iowa
Arnold, Vicky	10	0	0	3	7	3.33	3.40	Connecticut	Arkansas
Bartov, Eli	10	7	3	0	0	6.00	12.38	New York U	Berkeley
Trezevant, Robert H.	10	3	5	2	0	5.67	9.81	So Calif	Arizona
1990									
Raghunandan, K.	20	0	2	4	14	8.75	10.02	Tx A&M Intl	Iowa
Carcello, Joseph V.	19	2	1	6	10	6.42	8.37	Tennessee	Geo St
Sansing, Richard C.	16	6	7	3	0	12.50	22.30	Dartmouth	Tx-Austin
Shackelford, Douglas A.	15	12	1	2	0	7.50	14.74	No Carolina	Michigan
Lee, Charles M. C.	14	4	8	0	2	7.58	14.05	Cornell	Cornell
Jeter, Debra C.	13	4	2	5	2	6.00	9.19	Vanderbilt	Vanderbilt
Rajan, Madhav V.	13	9	3	1	0	6.58	13.96	Stanford	Car Mellon
Hammond, Theresa D.	12	0	4	0	8	7.83	9.08	Boston Coll	Wisconsin
Kim, Oliver	12	10	2	0	0	5.92	12.03	Maryland	Penn
Koonce, Lisa L.	12	4	2	4	2	6.00	9.90	Texas-Austin	Illinois
Nelson, Mark W.	12	7	3	2	0	5.83	11.07	Cornell	Ohio St
1991									
Amir, Eli	13	7	5	1	0	7.17	14.03	Tel Aviv Un	Berkeley
Adhikari, Ajay	12	0	0	0	12	5.00	4.70	American U	Va Comm
Young, Joni J.	12	0	6	0	6	8.83	11.08	New Mexico	Illinois
Ghosh, Dipankar	10	0	2	6	2	7.50	9.20	Oklahoma	Penn St

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
Balsam, Steven	9	1	4	1	3	5.67	7.47	Temple	Baruch
Cullinan, Charles P.	9	0	0	5	4	6.67	7.19	Bryant	Kentucky
Ramsay, Robert J.	9	1	2	4	2	4.17	6.39	Kentucky	Indiana
Ruhl, Jack M.	9	0	0	0	9	5.00	4.52	W Michigan	Case Wes
Zimmermann, Raymond A.	9	0	0	1	8	3.00	2.84	Txs-El Paso	Tx Tech
Green, Brian P.	8	0	0	1	7	3.25	3.27	Mich-Dearbrn	Kent St
Seetharaman, Ananth	8	0	5	1	2	4.67	6.41	St Louis	Geo St
Wahlen, James M.	8	4	2	0	2	3.11	6.01	Indiana	Michigan
1992									
Sloan, Richard G.	20	15	5	0	0	9.83	19.81	Michigan	Rochester
Cloyd, C. Bryan	13	4	4	4	1	7.50	13.18	Illinois	Indiana
Ittner, Christopher D.	13	6	4	3	0	5.75	10.94	Pennsylvania	Harvard
Lowe, D. Jordan	11	0	0	6	5	3.98	4.54	Nev-L Vegas	Ariz St
Fordham, David R.	9	0	0	0	9	6.28	5.70	Jms Madison	Fla St
Glover, Jonathan C.	9	5	3	0	1	3.12	6.10	Carnegie Mel	Ohio St
Beatty, Anne L.	8	5	3	0	0	4.33	8.14	Penn State	MIT
Bernardi, Richard A.	8	0	1	1	6	4.83	4.80	Roger Wm	Union
Berger, Philip G.	8	2	6	0	0	4.50	8.32		Chicago
Gigler, Frank B.	8	7	1	0	0	4.17	9.16	Minnesota	Minnesota
Hutton, Amy P.	8	4	4	0	0	3.25	6.17	Harvard	Rochester
Hirst, D. Eric	8	6	2	0	0	4.50	9.15	Texas-Austin	Minnesota
Luft, Joan L.	8	3	1	4	0	5.17	8.58	Michigan St	Cornell
Robinson, Thomas R.	8	0	1	0	7	2.92	2.89	U Miami	Case Wes
1993									
Hermanson, Dana R.	19	0	1	4	14	7.00	7.34	Kennesaw St	Wisconsin
Dechow, Patricia M.	11	7	4	0	0	4.58	8.85	Michigan	Rochester
Fargher, Neil L.	8	0	2	5	1	3.00	4.12	New So Wales	Arizona
Maydew, Edward L.	8	7	0	1	0	4.17	8.57	No Carolina	Iowa
Spilker, Brian C.	8	2	2	1	3	3.67	6.10	Brigham Yg	Tx-Austin
Salterio, Steven E.	8	2	5	1	0	4.83	8.15	Un Waterloo	Michigan
Yancey, William F.	8	0	0	3	5	3.50	3.59		Tx-Austin
Barron, Orie E.	7	4	3	0	0	3.08	6.18	Penn State	Oregon
Swenson, Dan W.	7	0	0	2	5	4.33	4.51	Ariz St West	Miss
Anderson, Shannon W.	6	1	3	1	1	3.83	6.23	Rice	Harvard
Mastracchio, Nicholas J.	6	0	0	0	6	3.33	2.83	SUNY-Albany	Union
Subramanyam, K. R.	6	4	2	0	0	3.58	7.12	So Calif	Wisconsin
Stinson, Christopher H.	6	3	1	1	1	1.92	3.23		Stanford
1994									
Hunton, James E.	37	1	4	5	27	19.83	21.86	Bentley	Tx-Arlin
Wilkins, Michael S.	12	1	2	5	4	5.25	6.89	Texas A&M	Arizona
Beasley, Mark S.	11	2	2	2	5	4.92	7.58	N Carol St	Mich St
Behn, Bruce K.	10	1	3	1	5	4.33	5.55	Tennessee	Ariz St
Vafeas, Nikos	8	0	3	5	0	7.00	10.00	Cyprus	Kansas
Hwang, Lee-Seok	7	1	3	1	2	2.83	4.31	CUNY-Baruch	NYU
Iyer, Govind S.	7	0	3	2	2	3.00	4.14	Arizona St	Geo St

Exhibit 5. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score	Present Affiliation	Doctoral Program
Walker, Paul L. Seven tied	7 6	1	0	1	5	2.67	3.37	Virginia	Colorado
1995									
Jacob, John	9	6	1	0	2	3.92	7.41	Colorado	Nrthwstrn
Aboody, David	8	7	1	0	0	4.67	9.83	UCLA	Berkeley
D'Souza, Julia D.	8	4	2	0	2	3.75	7.07	Cornell	Nrthwstrn
DeZoort, F. Todd	7	0	3	3	1	4.17	5.67	Alabama	Alabama
Gramling, Audrey A.	7	1	1	2	3	3.25	4.24	Georgia St	Arizona
Thomas, Wayne B.	7	1	0	2	4	3.67	4.82	Oklahoma	Okla St
Houston, Richard W.	6	2	1	2	1	3.00	4.46	Alabama	Indiana
Kemsley, Deen	6	4	1	1	0	3.00	6.23	Columbia	N Carol
Karim, Khondkar E.	6	0	0	1	5	2.08	1.95	Rochest Tech	Miss St
Kasznik, Ron	6	6	0	0	0	3.00	6.54	Stanford	Berkeley
1996									
Erickson, Merle M.	10	6	3	1	0	5.00	9.72	Chicago	Arizona
Ayers, Benjamin C.	8	2	4	1	1	3.67	6.43	Georgia	Tx-Austin
Phillips, Fred	8	1	1	0	6	5.83	7.68	Saskatchewan	Tx-Austin
Ballou, Brian	7	0	0	3	4	3.33	3.50	Auburn	Mich St
Calegari, Michael J.	6	2	3	1	0	4.17	7.03	Santa Clara	Arizona
Sinason, David H.	6	0	0	0	6	2.03	1.90	No Illinois	Fla St
Krumwiede, Kip R.	5	0	0	2	3	3.33	3.50	Brigham Yg	Tennessee
Mills, Lillian F.	5	1	3	1	0	3.50	6.00	Arizona	Michigan
Eleven tied	4								
1997									
Nichols, Nancy B.	8	0	1	1	6	3.08	3.40	Jms Madison	North Tx
Pacini, Carl J.	8	0	0	1	7	2.87	2.89	Fl GulfCoast	Fla St
Johnstone, Karla M.	6	1	0	1	4	3.17	4.12	Wisconsin	Conn
Bushee, Brian J.	5	4	1	0	0	3.50	7.22	Pennsylvania	Michigan
Ashbaugh, Hollis	4	1	0	1	2	2.33	3.31	Wisconsin	Iowa
Mahoney, Lois S.	4	0	0	0	4	2.00	1.78	Cen Florida	Cen Fla
Mauldin, D. Shawn	4	0	0	0	4	1.42	1.28	Nicholls St	Miss
Seida, Jim A.	4	2	2	0	0	2.33	4.07	Notre Dame	Tx A&M
Tinkelman, Daniel	4	0	1	0	3	3.33	3.83	Pace	NYU
Nine tied	3								

Some decision makers believe that accounting faculty should write only for such premier journals as *The Accounting Review*, *The Journal of Accounting Research*, and *The Journal of Accounting and Economics* (the three journals with the highest quality weights). [Exhibit 8](#) discloses how frequently tenured or tenure-track faculty members have written articles appearing in these three premier journals. [Exhibit 9](#) expands upon this list to identify those individuals who have published at least 12 articles from 1982 to 2001 in the top 10 accounting journals,

Exhibit 6. Distribution of Faculty Holding the Rank of Assistant Professor, or Higher, and Teaching at U.S. Schools,^a According to the Number of Articles Published in 40 Journals: 1967–2001.

Number of Articles	Number of Faculty	Percentage of All Faculty	Cumulative Percentage
0	2,907	49.68	49.68
1	752	12.85	62.54
2	453	7.74	70.28
3	323	5.52	75.80
4	264	4.51	80.31
5	187	3.20	83.51
6	161	2.75	86.26
7	133	2.27	88.53
8	124	2.12	90.65
9	72	1.23	91.88
10	73	1.25	93.13
11–15	212	3.62	96.75
16–20	89	1.52	98.27
21–30	67	1.15	99.42
Over 30	34	0.58	100.00
Total	5,851	100.0%	

^a As listed in [Hasselback \(2002–2003\)](#).

according to Johnson, Reckers and Solomon’s recent ranking of “comprehensive institutions.”

Institutional Analysis

[Hasselback and Reinstein \(1995a, b\)](#) previously reported the number of *full credit* articles, *co-author adjusted* articles, and *Q&Q composite* scores institutional basis for over 700 institutions and for 79 accounting doctoral programs. We re-analyzed these data to ascertain if the three different measures of productivity were statistically correlated. Coefficients of determination (r^2) for various pairing of measures are reported in [Exhibit 10](#), both on a total institution basis and on a per-faculty basis. These correlations were then repeated for only the doctoral granting institutions and for the 34 top publishers (based on total articles written). As shown in [Exhibit 10](#), extremely high correlations arose among the three measures on an institutional basis—perhaps indicating that the one measure can be a surrogate for the other two. *Fully credited* articles, of course, would be the easiest of the measures to use.

Exhibit 7. Most Prolific Authors in 40 Journals: 1967–2001 with 25 or more Articles (Unadjusted).

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score
Reckers, Philip M. J.	64	4	8	24	28	28.33	34.21
Chow, Chee W.	58	8	9	14	27	27.00	36.06
Beaver, William H.	52	33	1	0	18	31.50	52.63
Chambers, Raymond J.	49	7	3	32	7	46.14	59.74
Wallace, Wanda A.	49	3	3	5	38	39.92	43.29
Demski, Joel S.	46	35	8	2	1	30.17	63.04
Kaplan, Steven E.	44	2	3	23	16	22.42	27.86
Kinney, William R., Jr.	44	28	5	6	5	31.58	59.33
Ohlson, James A.	44	20	24	0	0	30.50	58.11
Verrecchia, Robert E.	44	33	9	1	1	28.83	58.13
Bierman, Harold, Jr.	43	10	17	6	10	33.00	52.42
Ingram, Robert W.	43	13	4	8	18	22.25	33.78
Knight, Lee G.	43	0	0	3	40	20.33	19.31
Lee, Thomas A.	43	1	1	32	9	37.67	44.32
Strawser, Robert H.	43	10	1	5	27	17.32	22.28
Kaplan, Robert S.	42	17	9	3	13	28.70	49.93
Lev, Baruch	42	27	10	1	4	25.67	51.18
Banker, Rajiv D.	39	11	18	4	6	16.28	27.93
Larcker, David F.	39	23	10	6	0	18.25	35.00
Ronen, Joshua	39	17	15	3	4	20.92	38.07
Munter, Paul	38	1	1	2	34	19.33	17.67
Carmichael, Douglas R.	37	3	2	1	31	27.00	28.93
Hunton, James E.	37	1	4	5	27	19.83	21.86
Dirsmith, Mark W.	36	0	22	7	7	17.00	23.63
Riahi-Belkaoui, Ahmed	36	3	6	14	13	31.33	41.47
Stout, David E.	36	0	0	1	35	15.23	14.30
Brown, Lawrence D.	35	14	12	4	5	19.50	33.16
Shields, Michael D.	35	6	18	8	3	16.67	26.50
Seago, W. Eugene	35	0	2	30	3	29.00	38.16
Wright, Arnold M.	35	5	4	17	9	21.42	29.69
Crumley, D. Larry	33	6	3	7	17	19.33	27.33
Libby, Robert	32	22	7	2	1	17.83	35.82
Dhaliwal, Dan S.	31	11	7	11	2	17.00	27.70
Firth, Michael A.	31	5	8	14	4	25.58	39.39
Gordon, Lawrence A.	31	2	8	18	3	17.75	24.40
Hakansson, Nils H.	31	5	22	0	4	26.17	46.33
Bloom, Robert	30	0	1	3	26	14.42	14.13
Englebrecht, Ted D.	30	1	4	2	23	14.67	15.31
Ijiri, Yuji	30	15	4	1	10	22.44	36.10
McKeown, James C.	30	23	4	3	0	15.83	33.30
Pany, Kurt J.	30	7	0	8	15	12.92	17.80

Exhibit 7. (Continued)

Name	Full Credit Articles	I	II	III	IV	Co-author Adjusted Articles	Q&Q Composite Score
Peasnell, Kenneth V.	30	2	0	28	0	19.50	25.24
Raman, Kris K.	30	4	6	12	8	16.67	24.23
Ashton, Robert H.	29	17	5	3	4	19.83	37.70
Copeland, Ronald M.	29	18	3	3	5	14.33	27.21
Ferris, Kenneth R.	29	3	12	7	7	17.50	25.14
Fogarty, Timothy J.	29	0	3	6	20	15.33	16.82
Mock, Theodore J.	29	9	2	12	6	14.33	24.08
Weil, Roman L.	29	9	6	0	14	15.17	24.18
Abdel-khalik, A. Rashad	28	19	7	0	2	21.83	43.65
Cooper, William W.	28	6	14	1	7	9.13	15.82
Dopuch, Nicholas	28	19	5	3	1	15.08	28.19
Francis, Jere R.	28	9	6	11	2	17.00	26.23
Kothari, S. P.	28	16	12	0	0	12.73	24.12
Revsine, Lawrence	28	17	0	2	9	21.33	37.24
Falk, Haim	27	7	4	9	7	16.00	24.05
Gonedes, Nicholas J.	27	16	9	0	2	23.83	46.60
Previts, Gary John	27	1	2	5	19	15.50	16.10
Strawser, Jerry R.	27	1	1	11	14	13.75	15.95
Sunder, Shyam	27	17	6	1	3	20.33	38.42
Gul, Ferdinand A.	26	3	4	9	10	18.00	22.33
Hughes, John S.	26	14	11	1	0	13.98	26.86
King, Ronald R.	26	9	11	5	1	12.67	22.12
Livnat, Joshua	26	5	9	8	4	12.33	19.76
Barth, Mary E.	25	17	2	0	6	11.67	21.16
Fellingham, John C.	25	7	8	5	5	9.78	16.75
Hassell, John M.	25	5	2	2	16	9.58	12.55
Jaggi, Bikki L.	25	3	2	6	14	15.83	19.73
Ketz, J. Edward	25	3	4	3	15	13.83	18.28
Penman, Stephen H.	25	14	11	0	0	18.33	35.10
Parker, Lee D.	25	1	3	16	5	17.08	20.07
Ratcliffe, Thomas A.	25	0	1	1	23	13.83	12.36
Tippett, Mark J.	25	0	0	21	4	16.00	18.35
Watts, Ross L.	25	16	9	0	0	13.15	25.35
Wolfson, Mark A.	25	12	8	3	2	11.25	20.24
Weygandt, Jerry J.	25	10	2	1	12	13.50	21.42

Exhibit 8. Distribution of Faculty Holding the Rank of Assistant Professor, or Higher, and Teaching at U.S. Schools,^a According to the Number of Articles Published in *The Accounting Review*, *The Journal of Accounting Research*, and *The Journal of Accounting and Economics*.

Number of Articles	Number of Faculty	Percentage of All Faculty	Cumulative Percentage
0	4,804	82.11	82.11
1	440	7.52	89.63
2	192	3.28	92.91
3	120	2.05	94.96
4	73	1.25	96.21
5	47	0.80	97.01
6	37	0.63	97.64
7	38	0.65	98.29
8	16	0.27	98.56
9	22	0.38	98.94
10	10	0.17	99.11
11–15	31	0.53	99.64
16–20	13	0.22	99.86
21–30	5	0.09	99.95
Over 30	3	0.05	100.00
Total	5,851	100.0%	

^a As listed in [Hasselback \(2002–2003\)](#).

Exhibit 9. Most Prolific Authors in Ten Premier Accounting Journals, 1982–2001.^a

Faculty	Full Credit Articles	Co-author Adjusted Articles
Verrecchia, Robert E.	29	18.50
Reckers, Philip M. J.	27	10.92
Kaplan, Steven E.	25	12.50
Kinney, William R., Jr.	25	16.00
Larcker, David F.	24	10.83
Ohlson, James A.	24	16.17
King, Ronald R.	23	11.50
Libby, Robert	23	10.83
Wright, Arnold M.	23	13.25
Barth, Mary E.	22	10.00
Chow, Chee W.	22	9.83
Dirsmith, Mark W.	22	10.33
Shields, Michael D.	22	9.83
Brown, Lawrence D.	21	11.00
Demski, Joel S.	20	10.50

Exhibit 9. (Continued)

Faculty	Full Credit Articles	Co-author Adjusted Articles
Waymire, Gregory B.	19	10.00
Banker, Rajiv D.	18	7.25
Dopuch, Nicholas	18	10.08
Hughes, John S.	18	8.45
Kothari, S. P.	18	8.40
Landsman, Wayne R.	18	7.67
Waller, William S.	18	9.67
Beaver, William H.	17	8.75
Dhaliwal, Dan S.	17	7.83
Datar, Srikant M.	17	7.08
Francis, Jere R.	17	8.83
Pany, Kurt J.	17	7.25
Sloan, Richard G.	17	8.75
Covaleski, Mark A.	16	7.33
Messier, William F., Jr.	16	8.00
Penman, Stephen H.	16	11.17
Solomon, Ira	16	6.92
Shevlin, Terry	16	7.75
Feltham, Gerald A.	15	8.00
Gibbins, Michael	15	8.50
Hopwood, William S.	15	5.83
Jiambalvo, James J.	15	6.92
Lev, Baruch	15	8.50
McKeown, James C.	15	6.50
Richardson, Gordon D.	15	5.75
Abdel-khalik, A. Rashad	14	11.00
Biggs, Stanley F.	14	6.50
Baiman, Stanley	14	6.83
Harrell, Adrian M.	14	6.08
Imhoff, Eugene A., Jr.	14	7.17
Lundholm, Russell J.	14	9.25
Lee, Chi-Wen Jevons	14	8.50
Mock, Theodore J.	14	6.00
Pastena, Victor S.	14	5.42
Smieliauskas, Wally	14	9.50
Thomas, Jacob K.	14	8.33
Bamber, E. Michael	13	6.50
Bernard, Victor L.	13	7.50
Collins, Julie H.	13	5.50
Dye, Ronald A.	13	10.83
Hemmer, Thomas	13	7.50
Ingram, Robert W.	13	7.50
Knechel, W. Robert	13	7.92
Lys, Thomas Z.	13	6.32

Exhibit 9. (Continued)

Faculty	Full Credit Articles	Co-author Adjusted Articles
Lambert, Richard A.	13	7.50
Murray, Dennis F.	13	8.33
Pratt, Jamie H.	13	6.67
Ronen, Joshua	13	5.75
Swieringa, Robert J.	13	7.25
Sansing, Richard C.	13	10.00
Skinner, Douglas J.	13	9.07
Shackelford, Douglas A.	13	6.67
Wolfson, Mark A.	13	5.08
Wallace, Wanda A.	13	9.75
Antle, Rick	12	6.67
Amir, Eli	12	6.67
Balachandran, Bala V.	12	6.00
Bonner, Sarah E.	12	6.17
Brownell, Peter	12	8.50
Collins, Daniel W.	12	4.75
Carcello, Joseph V.	12	4.17
Francis, Jennifer	12	6.67
Grimlund, Richard A.	12	7.58
Hunton, James E.	12	5.58
Penno, Mark C.	12	9.08
Ryan, Stephen G.	12	6.19
Shaw, Wayne H.	12	6.67
Strawser, Jerry R.	12	6.17
Sunder, Shyam	12	7.33
Wild, John J.	12	6.67

^aBased upon [Johnson, Reckers and Solomon \(2001\)](#) study, the ten premier accounting journals include *The Accounting Review*; *Journal of Accounting Research*; *Journal of Accounting & Economics*; *Accounting, Organizations & Society*; *Auditing: A Journal of Practice & Theory*; *Journal of the American Tax Association*; *Contemporary Accounting Research*; *Journal of Accounting, Auditing & Finance*; *Behavioral Research in Accounting*; and *Accounting Horizons*.

DISCUSSION

The exhibits provide much data to help develop benchmarks of faculty or institutional research productivity. [Exhibit 2a](#) shows, for example, that a faculty member with four listed articles who earned a doctoral degree in 1987 falls in the top 36% of faculty graduating that year (since 72 of the 201 graduates had four or more articles published).

Our study indicates that only 64% of faculty graduating with a doctorate in accounting from 1968 to 1997 have published even one article in the 40 major

Exhibit 10. Correlations Among Articles, Articles Adjusted for Co-authorship and Articles Adjusted for Co-authorship and Journal Quality.^a

Sample	Variable <i>X</i>	Variable <i>Y</i>	<i>r</i> ²
All schools in H&R studies on a total institution basis	Total articles written	Total articles written, adjusted for co-authorship	0.98
	Total articles written, adjusted for co-authorship	Total articles written, adjusted for co-authorship and journal quality	0.96
All schools in H&R studies on a per faculty basis	Articles written per faculty	Articles per faculty, adjusted for co-authorship	0.96
	Articles per faculty adjusted for co-authorship	Articles per faculty, adjusted for co-authorship and journal quality	0.94
79 schools in H&R studies granting Ph.D./D.B.A. on a total institution basis	Total articles written	Total articles written, adjusted for co-authorship	0.96
	Total articles written, adjusted for co-authorship	Total articles written, adjusted for co-authorship and journal quality	0.87
79 schools in H&R studies granting Ph.D./D.B.A. on a per faculty basis	Articles written per faculty	Articles per faculty, adjusted for co-authorship	0.99
	Articles per faculty adjusted for co-authorship	Articles per faculty, adjusted for co-authorship and journal quality	0.94
34 top publishers (total articles) in current study	Articles written	Articles, adjusted for co-authorship	0.22
	Articles adjusted for co-authorship	Articles, adjusted for co-authorship and journal quality	0.41

^aBased on data from [Hasselback and Reinstein \(H&R\) \(1995a, b\)](#).

journals included in our study. While these findings confirm the results of other studies (e.g. [Chung, Pak & Cox, 1992](#)), we were somewhat surprised to find that, among those faculty who had published, a relatively high percentage had published only one or two articles.

Some have suggested that the competitiveness of the current environment has led to an increase in the tendency to co-author articles; however, [Exhibit 4](#) indicates that the average number of authors per article has increased in recent years from the 2.14 average over the 30-year period. On the other hand, [Exhibit 4](#) indicates some changes in the average quality of the articles written over this 30-year period. In the early 1970s, the average quality was about 1.4. It dropped to 1.29 in 1987, but recently has increased toward 1.4. While these changes seem insignificant, we

expect that one factor causing the change is the uneven growth in a number of journals that have not had time to earn high quality ratings.

We found extremely high correlations (r^2 over 0.90) among the three measures of research productivity when measured on a total institution basis, which suggest that adjusting the number of articles written for co-authorship or journal quality may not add useful information. Merely counting the number of articles often provides a good surrogate for the other, more complex measures; however, much lower correlations exist among the three measures for the top producers. These differences suggest that counting articles may be a useful and cost efficient way to compare institutions, while some disagreement on the usefulness of *full credit* articles for assessing the productivity of individual faculty may exist.

LIMITATIONS

Like all prior studies measuring faculty research productivity or ranking programs, the study has limitations. We omitted notes and commentaries appearing in the 40 journals as well as monographs – and may have excluded some “quality” journals. Since there has not been a recent study ranking journals, some newer journals may not have received the benefit of moving up in the rankings. The developed *Q&Q composite* measures of research productivity also are sensitive to the perceptions of those who rate the quality of the journals. While not addressing the issue of the quality of individual articles, we used the perceived journal quality as a surrogate for the quality of specific articles; however, journals of lower perceived quality often publish seminal articles, and not all articles in premier journals are of high quality. In addition, as Christensen, Finger and Latham (2002) pointed out, many accounting scholars publish much of their work in non-accounting journals. Hence, studies like ours can understate their productivity. Moreover, since various types of schools have distinct research missions and resources, comparing non-doctoral and doctoral-granting programs could be difficult.

CONCLUSIONS

Faculty, academic administrators, and others can use our data as benchmarks to help assess actual or desired faculty research productivity, using three measures of productivity: *full credit* articles, *co-author adjusted* articles, and *Q&Q composite* scores. In addition, we report research productivity for all faculty and for the most prolific publishers for a 35-year time span.

Our findings on inter-relationships among the three measures of productivity are mixed. On a total institution basis, total articles seem to be a suitable surrogate for more sophisticated measures incorporating co-authorship and journal quality; however, for individual faculty whose publications are close in number, additional information on their relative productivity might be obtained by adjusting for co-authorship and journal quality.

While we developed major benchmarks for the research productivity of accounting faculty, further research could develop additional benchmarks. While the data-gathering and analysis processes are time-consuming due to the large databases needed, available computerized databases permit more comprehensive studies of this important issue.

The *Best of Breed* information in Exhibits 5 and 6 is interesting historically, since they also provide data for those wishing to set world-class levels of accounting.

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THE IMPACT OF NON-AUDIT SERVICE FEE DISCLOSURE REQUIREMENTS ON AUDIT FEE AND NON-AUDIT SERVICE FEE IN THE UNITED KINGDOM: AN EMPIRICAL ANALYSIS

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ABSTRACT

Since the early 1990s the accounting profession has been in the midst of a debate about the deleterious effects of public accounting firms providing non-audit services to their audit clients. In response to increasing demand for regulation curbing the growth of non-audit services provided by auditing firms and to provide greater transparency of the auditor-client relationship, the SEC adopted rule amendments regarding auditor independence. One such rule requires public companies to disclose among other things, fees paid to auditors for rendering non-audit services. In the United Kingdom, the Companies Act 1989 (Disclosure of Remuneration for Non-Audit Work) 1991 Regulations required disclosure of non-audit service fees paid to the incumbent auditor for years ending on or after September 30th, 1992. The purpose of this study is to explore the effect of such disclosure requirement on audit fee and non-audit service fee.

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Based on a sample of 156 companies in the United Kingdom we find that there were significant differences in the level of non-audit service fee and ratio of non-audit service fee to audit fee for companies that voluntarily disclosed 1991 non-audit service fee and companies that did not disclose 1991 non-audit service fee. Also, a comparison of the trends in audit fee and non-audit service fee between these two groups from 1991 to 1994 indicated that the disclosure requirement had some limited effect in curbing the growth in non-audit service fee. Furthermore, audit fees were positively related to non-audit service fees and a first-difference regression (Iyer & Iyer, 1996; Maher et al., 1992) revealed that changes in audit fee were also positively related to changes in non-audit service fee.

1. INTRODUCTION

The provision of non-audit services by public accounting firms to their audit clients has come under increased scrutiny especially after the collapse of Enron Corporation. For example, institutional investors and labor unions are calling for companies to adopt “conflict of interest policies” that would prevent their accounting firm from providing any non-audit services (Solomon, 2002). In November 2000, the Securities and Exchange Commission (SEC) adopted rule amendments regarding auditor independence (SEC, 2000).¹ One of the rules require most public companies to disclose in their annual proxy statements certain information related to, among other things, the non-audit services provided by their auditor during the most recent fiscal year. This rule applies to all proxy and information statements filed with the SEC after February 5th, 2001. The impetus for this rule comes from the unabated growth in the provision of non-audit services by public accounting firms since the 1990s.² Non-audit service fees have increased manifold while audit fees have stagnated or in several cases even decreased. For example, the Panel on Audit Effectiveness (August, 2000, p. 112) reports that between 1990 and 1999, the revenue mix of the Big 5 firms has shifted toward consulting services. In 1990, accounting and audit services accounted for 71% of the revenue from SEC audit clients, consulting services accounted for 12%, and tax services accounted for 17% of the revenue. In 1999, the ratios were 48%, 32%, and 20% respectively. Regulators, investors, academicians, and even a few members of the accounting profession have expressed reservations regarding the effect of such non-audit service fee growth on the independence (or perceived independence) of the auditor with respect to the client.³

SEC comments that “the dramatic expansion of non-audit services may fundamentally alter the relationships between auditors and their audit clients in two

principal ways. First, as auditing becomes a smaller portion of a firm's business with its audit clients, auditors become increasingly vulnerable to economic pressures from audit clients. Second, certain non-audit services, by their very nature, raise independence issues."⁴ In fact, SEC's recent rule amendments contain a number of restrictions relating to the provision non-audit services. For example, the rules identify certain non-audit services such as legal and actuarial services that, if provided by an accounting firm to an audit client, impair an auditor's independence.

The SEC's final rule also requires companies to disclose in their proxy statements information regarding the fees paid to their auditors (SEC, November, 2000). Specifically, it requires companies to aggregate and disclose the fee paid for the annual audit and for the review of the company's financial statements included in the company's Forms 10-Q or 10-QSB for the most recent fiscal year under a caption entitled "Audit Fees." In addition, companies will also have to disclose non-audit services fee paid to their auditors classified under two separate categories, i.e. "Financial Information Systems Design and Implementation Fees," and "All Other Fees."

The SEC notes that, "In requiring disclosure of aggregate fees, we are adopting a disclosure requirement that is similar to the disclosure that the United Kingdom has required since 1989. As discussed in the Proposing Release, since 1989, the British government has required companies to disclose their annual audit fee and fees paid to their auditor for non-audit services."⁵ The SEC provides rationale for the disclosure requirement as: "The disclosure related to non-audit services fees received by auditors would give investors insight into the relationship between a company and its auditor. In so doing, the disclosure will reduce uncertainty about the scope of such relationships by providing facts about the magnitude of non-audit service fees. This information may help shareholders decide, among other things, how to vote their proxies in selecting or ratifying management's selection of an auditor." Clearly, the SEC like the United Kingdom feels that the magnitude of non-audit fee vis-à-vis audit fee provides important information regarding the independence of the auditor.

While the intent of the disclosure requirement is clear, i.e. to maintain or enhance the perception of independence of the auditor, it also has other, perhaps unintended, consequences. The disclosure requirement not only makes the auditors' stream of revenues from different sources public, it also legitimizes the extent of provision of non-audit services as a *prima facie* evidence of independence or lack thereof. Naturally, one can expect the auditors to behave strategically, by either curbing the extent of non-audit services or by re-classifying some revenues as audit revenues. Thus, one can expect the disclosure to impact the level of non-audit services provided by the auditor. Interestingly, reactions to the new disclosure were

mixed. While some industry executives and analysts predicted that many public companies would opt to end existing consulting relationships with their auditors, some of the big accounting firms did not believe that the disclosure rules will have any impact on company's choice of consultants (Schroeder & Weil, 2000).

Given that the audit and non-audit fee disclosure requirement has existed in the United Kingdom for some time, the U.K. system provides an ideal scenario to empirically test whether such disclosure requirement has any effect on the magnitude of non-audit services provided. Also, since a few companies voluntarily disclosed non-audit service fees for 1991 (the year before the disclosure requirement came into effect) we employ it as a benchmark and compare it to the level of audit fees and non-audit service fees for the next three years following the disclosure requirement. We also explore the relationship between changes in audit fee and the changes in non-audit service fee by examining a panel of companies over a four-year period.

This study differs from the prior studies in the following ways: First, unlike prior studies (e.g. Firth, 1997), Barkess and Simnett (1994), and Ezzamel et al. (1996) that focus primarily on detailing the magnitude of non-audit service fees, we examine the possible impact of the disclosure requirement on audit fees and non-audit service fees. We study the trend in *real* audit fees (i.e. audit fees adjusted for inflation), *real* non-audit service fees, and *real* assets. In addition, we also look at the relationship between changes in audit fees and changes in non-audit service fees. Second, we examine the differences in audit fees and non-audit services fees between companies that voluntarily disclosed non-audit service fees for 1991 and companies that did not disclose this information. Finally, while most prior studies have dealt with the relationship of audit and non-audit service in a single period setting focussing almost exclusively on companies audited by the Big 8, this study follows a panel of companies over a four-year period using data from companies audited by the Big 6 as well as non-Big 6 auditors.

The remainder of the paper is organized as follows: In Section 2 we present the disclosure requirements in the United Kingdom and the background for the current study. Section 3 contains data, research design and the empirical results. Section 4 concludes the paper with a brief summary including the limitations of the study.

2. DISCLOSURE REQUIREMENTS IN THE UNITED KINGDOM

Companies Act in the United Kingdom has required the disclosure of audit fees in the annual report for a long time. However, the requirement to disclose non-audit

service fees paid to the incumbent auditor has been a recent reform. The impetus for this amendment to the Companies Act 1989 was provided by growing allegations that large accounting firms were submitting “loss leading” bids for audit contracts in the hope of securing lucrative consulting work. In response to such allegations, the Companies Act 1989 (Disclosure of Remuneration For Non-Audit Work) 1991 Regulations mandated that non-audit fees paid to the incumbent auditor should be disclosed in the annual report.⁶ The disclosure requirement is predicated on the belief that it would lead to the increased transparency of the economic bonding of the auditor and the client management. That is, shareholders, lenders, investors, and others would be able to judge for themselves whether the auditor is overly dependent on a particular client for a substantial amount of income thereby impairing auditor independence. Shareholders who become concerned about the relationship could force the company to restrict purchase of consultancy services from the incumbent auditor or insist that another auditing firm be selected.

The increased transparency of the economic bonding of the auditor and the client management can also become another weapon in the armory of a shareholder in case of a shareholder lawsuit against the auditor for sub-standard audit. Deep pocket auditors become more vulnerable to shareholders’ lawsuits especially in situations where they have provided large amounts of non audit services (where shareholders can cite prima facie lack of independence). Alternatively, an auditor may also indicate his/her independence by curtailing the revenue generated from non-audit services. In the following sections, we document the effect of the disclosure requirement in the United Kingdom by tracking a sample of companies over a period of four years.

3. RESEARCH METHOD AND RESULTS

3.1. Data and Sample Selection Procedure

The *Companies Act 1989 (Disclosure of Remuneration for Non-audit Work) 1991 Regulations* in the United Kingdom requires UK companies (other than small and medium-sized ones) to disclose in a note to their annual accounts, the remuneration paid to their auditors for non-audit work separately from the audit fees. In this study we examine such data for the years 1991–1994 to determine the relationship between audit fees and non-audit service fees.

The variables of interest included external audit fees, the remuneration to the incumbent auditor for non-audit services, and some of the determinants of external audit fees identified in the prior audit fee literature. These are total assets, net sales, inventory, accounts receivable, foreign sales, and identity of the auditor

(Francis, 1984; Iyer & Iyer, 1996; Simunic, 1980). The sample was collected based on the following criteria. First, in order to be included in the sample, all the above variables had to be available for the years 1991–1994. Second, companies that had joint auditors were dropped from the study. Third, banks and financial institutions were dropped from the analyses because prior research has shown that the audit fee function is different for such industries (Simunic, 1980). The final sample consisted of 156 companies.⁷ Descriptive statistics of the sample are provided in Table 1. Audit and non-audit service fee data were collected from annual reports of companies and the other variables of interest were collected from the Worldscope CD-ROM database. Table 1 shows that the mean audit fee increased from £269,690 in 1992 to £275,570 in 1994 while the mean non-audit service fee decreased from £156,160 in 1992 to £149,390 in 1994. The ratio of non-audit services fees to audit fees has decreased from 0.85 in 1992 to 0.77 in 1994.

3.2. *Effect of Disclosure on Audit Fee and Non-audit Service Fee*

We use 1991 as a benchmark for comparing the trend in the non-audit service fees for years 1992, 1993, and 1994. First, we document the trends in the mean audit fee, non-audit service fee, and total assets after adjusting for the effects of inflation.⁸ In Table 2 we present the trend in the *real* audit fee and the *real* non-audit service fee.

It can be seen that between 1991 and 1992, both audit fees and non-audit service fees decreased by approximately 3.5%. Between 1992 and 1993, while audit fees increased by about 5% there was no significant change in non-audit service fees. However, between 1993 and 1994, audit fees and non-audit service fees decreased by 6.5% and 7.2% respectively. This implies that changes in audit and non-audit service fee are positively related. This is also *prima facie* support for the argument that under a disclosure scenario, audit firms tend to manage nonaudit revenue.

3.3. *Voluntary Disclosure of 1991 Non-audit Service Fee*

Although the Companies Act 1989 (Disclosure of Remuneration for Non-Audit Work) 1991 Regulations required disclosure of non-audit service fees for years ending on or after September 1992, some companies voluntarily disclosed non-audit service for year ending 1991 also. Out of the final sample of 156 companies, 106 voluntarily disclosed non-audit service fee for 1991 also. A comparison of the changes in audit and non-audit service fee for the voluntarily disclosing companies and the non-disclosing companies is presented in Table 3.

Table 1. Descriptive Statistics, Mean (Standard Deviation) for the Years 1991–1994 ($N = 156$).

Variables	1991	1992	1993	1994
Audit fee	268.74 (442.80)	269.69 (441.26)	286.57 (499.97)	275.57 (451.56)
Non-audit services fee	121.23 ^a (183.13)	156.16 (274.85)	156.59 (251.15)	149.39 (234.81)
Ratio of non-audit services to audit fee	0.62 ^a (0.41)	0.85 (1.18)	0.81 (0.88)	0.77 (0.75)
Net sales	298663.90 (654474.22)	305416.40 (661183.82)	327070.83 (687855.95)	346896.02 (708121.68)
Total assets	235416.38 (483005.58)	254320.88 (527116.19)	254650.35 (516072.26)	270790.11 (546366.91)
Ratio of receivables to total assets	0.27 (0.14)	0.27 (0.14)	0.27 (0.14)	0.29 (0.15)
Ratio of inventories to total assets	0.20 (0.15)	0.20 (0.15)	0.20 (0.15)	0.21 (0.16)
Ratio of foreign sales to total sales	0.22 (0.27)	0.26 (0.28)	0.26 (0.28)	0.28 (0.28)

Note: The amounts presented are nominal amounts in £'000.

^aBased on 106 observations.

Table 2. Descriptive Statistics on the Change in Audit Fee for Years 1991–1994 ($N = 156$).

Variables	Mean (Std. Dev.)		Amount (% Change)	Mean (Std. Dev.)		Amount (% Change)	Mean (Std. Dev.)		Amount (% Change)
	1991	1992		1992	1993		1993	1994	
Audit fee	268.74 (442.80)	259.32 (424.29)	−9.42 (−3.5)	259.32 (424.29)	272.92 (476.16)	13.60 (5.2)	272.92 (476.16)	255.16 (418.11)	−17.76 (−6.5)
Non audit fee	121.23 ^a (183.13)	117.08 ^a (151.01)	−4.15 (−3.4)	150.16 ^b (264.28)	149.13 (239.19)	−1.03 (−0.7)	149.13 (239.19)	138.32 (217.42)	−10.81 (−7.2)
Net sales	298663.90 (654474.22)	293669.61 (635753.68)	−4994.29 (−1.7)	293669.61 (635753.68)	311496.03 (655100.90)	17826.42 (6.1)	311496.03 (655100.90)	321200.02 (655668.22)	9703.99 (3.1)

Note: The amounts shown in the table are *real* audit fees, *real* non-audit services fees and *real* net sales in £'000.

^aBased on 106 observations.

^bBased on 156 observations.

Table 3. Difference Between Voluntarily Disclosing and not Disclosing Companies.

Variables	Mean (Std. Dev.)		Amount (% Change)	Mean (Std. Dev.)		Amount (% Change)	Mean (Std. Dev.)		Amount (% Change)
	1991	1992		1992	1993		1993	1994	
Panel A: Companies that voluntarily disclosed non-audit service fee for 1991 (<i>N</i> = 106)									
Audit fee	242.23 (386.33)	235.18 (370.55)	−7.05 (−2.9)	235.18 (370.55)	239.80 (389.49)	4.62 (1.9)	239.80 (389.49)	230.38 (361.23)	−9.42 (−3.9)
Non-audit fee	121.23 (183.13)	117.08 ^d (151.01)	−4.15 (−3.4)	117.08 (151.01)	120.95 ^e (176.62)	3.87 (3.3)	120.95 (176.62)	120.86 (175.16)	−0.09 (0.0)
Non-audit fee/audit fee	0.62 (0.41)	0.70 ^a (0.68)		0.70 (0.68)	0.67 ^b (0.61)		0.67 (0.61)	0.69 ^c (0.68)	
Net sales	254861.21 (589316.37)	245355.33 (545289.12)	−9505.88 (−3.7)	245355.33 (545289.12)	262224.56 (554139.41)	16869.23 (6.9)	262224.56 (554139.41)	268168.82 (540585.23)	5944.26 (2.3)
Panel B: Companies that did not disclose non-audit service fee for 1991 (<i>N</i> = 50)									
Audit fee	324.94 (543.75)	310.51 (520.86)	−14.43 (−4.4)	310.51 (520.86)	343.14 (620.27)	32.63 (10.5)	343.14 (620.27)	307.70 (518.87)	−35.44 (−10.3)
Non-audit fee	NA	220.29 ^d (405.82)		220.29 (405.82)	208.88 ^e (329.80)	−11.41 (−5.2)	208.88 (329.80)	175.34 (285.89)	−33.54 (−16.1)
Non-audit fee/audit fee	NA	1.14 ^a (1.81)		1.14 (1.81)	1.08 ^b (1.23)		1.08 (1.23)	0.99 ^c (0.94)	
Net sales	391525.60 (773169.57)	396095.89 (790964.42)	4570.29 (1.2)	396095.89 (790964.42)	415951.54 (826525.57)	19855.65 (5.0)	415951.54 (826525.57)	433626.15 (845397.36)	17674.61 (4.2)

Note: The amounts shown in the table are real audit fees, real non-audit services fees and real net sales in £'000.

^aPairs are significantly different at 0.10 level.

^bPairs are significantly different at 0.05 level.

^cPairs are significantly different at 0.05 level.

^dPairs are significantly different at 0.10 level.

^ePairs are significantly different at 0.10 level.

Companies that voluntarily disclosed 1991 non-audit service fees tend to be smaller and have lower audit fees as compared to companies that did not disclose 1991 non-audit service fee, although the difference is not statistically significant at conventional levels. However, the non-disclosing companies purchase significantly higher amounts of non-audit services from the incumbent auditors and have a significantly higher ratio of non-audit service fee to audit fee. A comparison of the trends presented in Panel A and Panel B reveals that vis-a-vis voluntarily disclosing companies, the non-disclosing companies have decreased their purchases of non-audit services from incumbent auditors resulting in declining ratio of non-audit service fee to audit fee over the three year period between 1992 and 1994. For instance, it can be noted that between 1993 and 1994, while the disclosing and the non-disclosing companies experienced a decrease of about 4% and 10% in audit fees respectively, the disclosing companies continued to purchase the same amount of non-audit services but the non-disclosing companies experienced a reduction of about 16% in non-audit service fee. The ratio of non-audit fee to audit fee decreased from 1.14 in 1992 to 0.99 in 1994 for the non-disclosing companies. However, there was very little change in the ratio (from 0.70 in 1992 to 0.69 in 1994) for the disclosing companies. These results provide some limited evidence of the effectiveness of the disclosure mandated by the Companies Act 1989 (Disclosure of Remuneration for Non-Audit Work) Regulations 1991.

3.4. Level of Audit Fee and Non-audit Service Fee Seven Years Later

We also compared the audit fees, non-audit services fee and the ratio of non-audit services fee to audit fee for a panel of companies seven years later (i.e. in 2001). The results are presented in [Table 4](#). For the panel of 49 companies for which data could be obtained for 1994 as well for 2001, the audit service fee increased from £322,168 in 1994 to £367,897 in 2001, the non-audit services fee registered an even greater increase from £170,994 in 1994 to £424.169 in 2001. Consequently, the ratio of non-audit services fee to audit fee increased from 0.77 in 1994 to 1.15 in 2001. This suggests that the effect of the disclosure requirement, if any, was rather short-lived.

3.5. Relationship Between Changes in Audit Fee and Non-audit Service Fee

To further understand the relationship between the increase/decrease in audit fee vis-à-vis the increase/decrease in non-audit service fee, we conducted difference regression along the lines of [Maher et al. \(1992\)](#) and [Iyer and Iyer \(1996\)](#).

Table 4. Descriptive Statistics Mean (Standard Deviation) for the Years 1994 and 2001 ($N = 49$).

Variables	1994	2001
Audit fee	322.17 (472.98)	367.90 (543.98)
Non-audit services fee	170.99 (206.22)	424.17 (818.44)
Ratio of non-audit services to audit fee	0.77 (0.79)	1.15 (0.85)

Note: The amounts presented are nominal amounts in £'000.

The difference regression model is expressed as follows:

$$\begin{aligned} \text{DIFFEE} = & \alpha + \beta_1 \text{DIFSAL} + \beta_2 \text{DIFREC} + \beta_3 \text{DIFINV} + \beta_4 \text{DIFFOR} \\ & + \beta_5 \text{DIFNAF} + \varepsilon \end{aligned} \quad (1)$$

where: DIFFEE is \ln FEE (natural log of external audit fee paid by the auditee) for year t minus \ln FEE for year $(t - 1)$; DIFSAL is \ln SAL (natural log of sales) for year t minus \ln SAL for year $(t - 1)$; DIFREC is REC (ratio of accounts receivable to total assets) for year t minus REC for year $(t - 1)$; DIFINV is INV (ratio of inventories to total assets) for year t minus INV for year $(t - 1)$; DIFFOR is FORGN (ratio of foreign sales to total sales) for year t minus FORGN for year $(t - 1)$; DIFNAF is \ln NAFEE (natural log of fee for nonaudit services) for year t minus \ln NAFEE for year $(t - 1)$; and ε is the error term.

Three individual regressions are performed representing the difference between the years 1991/1992; 1992/1993; and 1993/1994. Results are presented in [Table 5](#).⁹

Table 5. Relationship Between Changes in Audit Fee and Changes in Non-audit Service Fee.

Independent Variables	1991/1992		1992/1993		1993/1994	
	Coefficient	<i>t</i> -Statistic (<i>p</i> -Value)	Coefficient	<i>t</i> -Statistic (<i>p</i> -Value)	Coefficient	<i>t</i> -Statistic (<i>p</i> -Value)
Intercept	-0.041	-2.25 (0.03)	-0.026	-1.57 (0.12)	-0.059	-2.88 (0.01)
DIFSAL	0.199	1.92 (0.05)	0.315	4.66 (0.00)	0.449	4.22 (0.00)
DIFREC	0.554	1.53 (0.13)	0.474	1.21 (0.23)	-0.340	-0.74 (0.45)
DIFINV	0.247	0.45 (0.66)	-0.237	-0.58 (0.57)	0.026	0.06 (0.95)
DIFFOR	0.002	1.86 (0.07)	-0.002	-1.15 (0.25)	-0.001	-0.67 (0.50)
DIFNAF	0.040	1.57 (0.12)	0.043	2.56 (0.01)	0.049	2.74 (0.01)
Number of observations	106		156		156	
Model <i>F</i> -statistic	3.60 (0.01)		6.57 (0.01)		6.33 (0.01)	
Model Adjusted R^2	0.11		0.15		0.15	

Note: Dependent Variable = DIFFEE.

It can be seen from the table that change in the audit fee between any two consecutive years is significantly positively related to change in nonaudit service fee between the years. The coefficients across the years are comparable with a consistent explanatory power (adjusted R^2 of 11%, 15%, and 15% respectively.¹⁰ While it does not conclusively rule out the existence of “price predation,” we do not see any evidence of audit fee discounts allowed to clients for increased non-audit service fees.

4. DISCUSSION AND CONCLUSION

4.1. Summary

Pursuant to the recent SEC rule (SEC, 2000), companies are required to disclose audit and nonaudit fee paid to incumbent auditors in their proxy statements. The Companies Act in the United Kingdom has required a similar provision since 1992. In this paper, we examined the effect of the Companies Act disclosure requirement on audit fee and non-audit service fee in the United Kingdom. Overall, the real value of non-audit services purchased by companies held steady between 1992 and 1994 while the ratio of non-audit service fee to audit fee experienced a marginal decrease from 0.70 in 1992 to 0.69 in 1994. The change is rather dramatic for companies that did not voluntarily disclose non-audit service fee for 1991. These companies tended to have significantly higher non-audit fee/audit fee ratio and the decline in the ratio is more pronounced, from a high of 1.14 in 1992 to 0.99 in 1994. This is indicative that the disclosure requirement was effective, in a limited capacity, in curtailing the amount of non-audit services purchased from incumbent auditors at least in the short run.

We also examined the audit fees, non-audit services fee and the ratio of non-audit services fee to audit fee for a panel of companies seven years later (i.e. in year 2001). We found that while audit fee showed a modest increase in 2001 as compared to 1994, non-audit service fees increased dramatically over the same period. The ratio of non-audit service fee to audit fee also showed a dramatic increase from 0.77 in 1994 to 1.15 in 2001. This suggests that the effect of the disclosure requirement, if any, was short-lived.

We also examined the relationship between audit fee changes and non-audit service fee changes by tracking a panel of companies over a four-year period. Based on a sample of 156 companies we found that changes in audit fee are positively related to changes in non-audit service fee. Since our model did not reveal any audit fee discounts associated with increased non-audit service fees, at least *prima facie*, there is no evidence of “price predation” in the market for audit services.

4.2. Limitations

This study must be viewed as descriptive study that simply delineates the behavior of audit and non-audit service fees over a four-year period. We have not identified factors that determine the purchase of non-audit services. Consequently, we make no claims regarding the cause and effect of audit fee changes vis-à-vis non-audit service fee changes. Also, while the difference regression models are significant, there is still much unexplained variance indicating the possibility of omitted variables such as changes in internal controls, changes in auditors' risk assessment, etc. (Iyer & Iyer, 1996; Maher et al., 1992). Finally, since the study is based in the United Kingdom, the generalizability of the results to other markets is limited. It is interesting to speculate whether the disclosure requirement, mandated by SEC in the United States, would have a similar effect, since the audit markets in both countries have several similarities such as domination by the Big 4 firms and the self-regulation of the profession. These and other limitations must be carefully considered in making inferences from this study.

NOTES

1. <http://www.sec.gov/rules/final/33-7919.htm>
2. <http://www.sec.gov/rules/proposed/34-42994.htm>
3. For example, Parkash and Venable (1991), Firth (1997), and NERA (1992).
4. Revision of the Commission's Auditor Independence Requirements, June 30th, 2000 (Release Nos. 33-7870; 34-42994; 35-27193; IC-24549; IA-1884; File No. S7-13-00] (File name: 34-42994.htm). page 9.
5. Revision of the Commission's Auditor Independence Requirements. November 21st, 2000. Effective Date: February 5th, 2001. (Release Nos. 33-7919; 34-43602; 35-27279; IC-24744; IA-1911; FR-56; File No. S7-13-00) (File name: 33-7919.htm). page 69.
6. Such disclosure was also supported by the Cadbury Committee which was set up to develop proposals for better corporate governance practices and several shareholder groups including the National Association of Pension Funds. (The Financial Times. September 28th, 1991, p. 4).
7. Since non-audit service fees were required to be disclosed only for years ending on or after September 30th, 1992, the sample consists of firms having year-ends September 30th to December 31st each year.
8. We deflated audit fees and non-audit service fees by the appropriate retail price index, which is published periodically in *Accountancy*, The Journal of ICAEW.
9. We also inserted a dummy variable DISCLOSE (= 1 if the company voluntarily disclosed nonaudit service fee for 1991, 0 otherwise) in the regression. The variable was not significant and the results remained unchanged.
10. For the 1991/92 regression the coefficient of DIFNAFEE shows a positive sign but is not significant at conventional levels. We attribute this to the lower sample size (106 companies instead of 156 companies) thereby decreasing the efficiency of the estimator.

This is borne out by the fact that the coefficient of DIFNAFEE for 1991/92 is comparable to the coefficients for the other years but the standard error is much larger.

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THE EVOLVING ROLE OF IS AUDIT: A FIELD STUDY COMPARING THE PERCEPTIONS OF IS AND FINANCIAL AUDITORS

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ABSTRACT

The study describes and contrasts information systems (IS) and financial auditors' perceptions of the current and future role of IS auditing within the largest accounting/professional services organizations (the Big Five). We conducted a field study of 20 senior managers and partners among the then Big Five firms in the United States to better understand how the IS audit function is expected to change. We find that IS and financial auditors have different perceptions about the current and future relationship between IS and financial audit and differ in their opinions of clients' expectations for future audit services.

INTRODUCTION

The traditional audit model has undergone significant change during the last decade. The change in the financial audit's focus is attributed to market pressures, including saturation, competitive pricing, and increased training and technology

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(Eilifsen et al., 2001). The audit has taken on a risk management focus, and audit engagement teams increasingly include information system specialists (Winograd et al., 2000). Concurrently, the profession has moved toward offering additional systems assurance services (Arnold et al., 2000; O'Donnell et al., 2000). For example, O'Donnell et al. (2000) suggest that there has been a paradigm shift in assurance services, which focuses on the internal control systems throughout an information system's life cycle.

The largest public accounting/professional services organizations typically consider both financial and IS auditing as part of "assurance" or "risk-management" services. Skills needed to provide systems assurance are similar to those needed to provide IS support to the financial audit. IS auditors usually provide both audit support and perform systems assurance services, such as network attack and penetration testing, business continuity planning, and electronic commerce (eCommerce) related work.

Bagranoff and Vendirzyk (2000) report that financial audit support accounts for less than half of the revenues generated by IS audit practices within the then five largest accounting/professional services firms. They also report rate-of-growth estimates for IS audit services within these firms ranging between 40 and 100%, with a majority of the growth taking place outside of traditional financial audit support. As IS auditors pursue systems assurance, network security and privacy related work, they may perceive IS audit's evolving role differently than do financial auditors.

Although prior studies suggest that IS auditors and financial auditors will perceive the evolving IS audit role differently, none directly address this issue.¹ The primary objective of this study is to examine whether there are differences between IS and financial auditors' perceptions of the evolving role of IS auditing within the largest public accounting/professional services firms. This area of research is both timely and extremely important given the major changes in the information systems assurance/risk assessment environment during the past several years.

Our study makes four contributions to the literature. First, documenting the perceptions of these two groups allows *researchers* to consider the impact of IS auditing on traditional financial audit practice. Second, we provide the *profession* with information concerning current critical issues, such as the perceived importance of the CPA license, additional IS services offerings, and an expected shift in emphasis from financial to IS audit. Third, we provide accounting information systems *educators* with information important to curriculum development. We also alert all three groups to the disparities that exist in perceptions between financial and IS audit professionals.

RESEARCH QUESTIONS

To evaluate how IS and financial auditors perceive the evolution of the IS audit function, we focus on the two major roles of the IS audit practice: (1) its relationship to the financial audit; and (2) the expected growth in the IS audit practice itself (outside of its traditional financial audit support role).

Relationship Between Financial and IS Audit

IS audit's relationship to financial auditing has been described as changing from being a "fly on the back of a giant gorilla" ten years ago, to "driving" the audit today, to "taking over" the audit within the next five years (Bagranoff & Vendirzyk, 2000). Although most auditors would share a consistent view of IS audit's past supporting relationship to the financial audit, it is not clear that they agree on the changing relationship between IS and financial audit. To examine this issue, we pose three specific research questions. The first evaluates how IS and financial auditors describe the relationship between IS and financial audit:

- 1a.** Are there differences between financial and IS auditors' descriptions of the current and predicted relationships between the IS and financial audit functions?

The second specific question, regarding the relationship between IS and financial audit, concerns internal control evaluation. IS audit traditionally concerns itself with the evaluation of general and application controls. The ramifications for risk assessment from a general controls evaluation are sometimes difficult to evaluate. For instance, suppose the IS auditor learns that user IDs are not deactivated on a timely basis when a company terminates employees with dial-in capabilities. What is the likely impact on audit scope of this audit finding? What would be the likely impact of an IS audit finding that a company's disaster recovery plan is out of date? These are general control weaknesses, and it may be difficult for a financial auditor to interpret the impact of these on financial statements. An evaluation of application controls is more easily tied to the financial audit, since application controls relate to specific audit objectives (Hall, 2000). For instance, in an ERP environment, a weakness over data input could cause concern about the accuracy of reported asset amounts.

This focus on general and application controls may be shifting. For example, PricewaterhouseCoopers attempts to understand audit risk by taking a risk management approach that focuses on a client's overall business objectives (Winograd et al., 2000). According to an IS auditor in one of the major international firms,

over half of the financial statement audit work completed in one of its northeastern offices consists of IS control evaluation (O'Donnell et al., 2000). The auditors perform very few substantive tests, consisting of a small amount of accounts receivable confirmations and limited inventory observations, which are both required by U.S. auditing standards, "so that the partner wouldn't stroke out" (O'Donnell et al., 2000, p. 98). This statement implies that a partner, who most likely spent much of his or her career in the financial auditing side of the practice, and an IS auditor may view control evaluation differently. The second specific research question addresses this issue:

- 1b.** Are there differences between financial and IS auditors in their perceptions of IS audit's current and predicted focus on control evaluation?

The third specific question, related to the IS and financial audit relationship, concerns the impact of the IS audit on the financial audit. In an experimental study examining knowledge differences between IS audit specialists and financial auditors, Hunton et al. (2001) find that IS auditors adjusted their risk assessment for a seeded control weakness in an enterprise resource-planning (ERP) environment, but financial auditors did not. However, financial auditors were confident of their ability to assess the increased audit risks in an ERP environment and were not likely to utilize IS auditors when assessing ERP-related risks. Hunton et al. (2001) also find that IS auditors are less confident of financial auditors' ability to assess such risks. These findings suggest possible communication difficulties and misperceptions between the two groups that may impair the effectiveness and value of IS audit work. The following question addresses this issue:

- 1c.** Are there differences between financial and IS auditors in their perceptions of the impact of IS audit findings on the financial audit scope?

Expected Growth and Change in IS Audit Practice

To evaluate the expected growth and change in the IS audit practice within the largest public accounting firms over the next five years, we formulated three exploratory research questions addressing this topic. The first two relate to auditors' perceptions of their clients' future audit-related needs. The third relates to the types of additional services the IS audit practice may offer in the future. The three questions are:

- 2a.** Are there differences in financial and IS auditors' perceptions of their clients' need for audit services in 2005?

- 2b.** Are there differences in financial and IS auditors' perceptions of their clients' need for the services of a CPA in 2005?
- 2c.** Are there differences between financial and IS auditors' perceptions of the additional services to be offered by a firm's IS audit practice in 2005?

RESEARCH DESIGN

Following [Gendron \(2001\)](#), [Hirst and Koonce \(1996\)](#), and [Cushing and Loebbecke \(1986\)](#), we concentrate on the largest accounting/professional services firms to better examine state-of-the-art auditing/assurance practices. We interviewed 20 senior managers and partners from the then Big Five firms. Each participant was a financial auditor or a systems auditor working in one of two different geographic locations: the Cincinnati/Cleveland/Columbus, Ohio and Chicago, Illinois metropolitan areas or the Washington, DC/Richmond area. We used participants from two different locations in each of the Big Five firms to control for geographical differences and differences among the firms, respectively. We limited our participants to those working in the audit/assurance area of each firm and did not include anyone who worked on the purely consulting side of the business.

We conducted all of the interviews between September 1999 and February 2000, either in person or by telephone. Interviews lasted from one hour to two-and-one-half hours. We used a case study protocol instrument to guide the interviews. We pilot tested the protocol instrument with a senior manager in one of the Big Five firms, who had fourteen years experience in IS auditing. We asked about participants' perceptions of the past, current and future relationship between IS and financial audit, IS audit's role in the firm, and expected future changes in the auditing profession (for example, continuous audits, audits of eCommerce, the role of the CPA). As a practical matter, we limited our timeframe from ten years prior to our interviews (1990) to five years in the future (2005).² (We include a copy of the final field study protocol instrument as an appendix to this paper.)

We provided each participant with a preliminary draft of his or her transcribed field study protocol instrument to ensure that our interpretation of a participant's responses reflected his or her opinions. After each participant had reviewed his or her transcribed interview, we compiled a synopsis of the responses for the 20-field study participants. We grouped the responses by question, geographic area and whether a respondent was an IS or a financial auditor.

To more critically examine the issue of whether IS and financial auditors perceive the continuing evolution of IS audit differently, we needed a methodology to objectively categorize the individual responses compiled in the synopsis.

We developed two independent key-word interpretations of each participant's responses to each field-study question. One of the primary researchers involved in the field-study interviews made one interpretation, and an independent coder not involved in the study prior to this point made the second interpretation. A second independent coder without reference to the participants' responses, compared the two different key-word interpretations and developed one standard response to each question. The second primary researcher, with access to the participant's complete responses, reviewed the work of the second independent coder and finalized the key-word response to each of the field-study questions.

We use the finalized key-word response in our analyses to determine patterns within the participants' responses. Within this approach, each individual case can be seen as a replication of an experiment. Individual cases serve two purposes: to replicate the results of an initial case or to vary certain conditions to produce contrasting results (Yin, 1994).

RESULTS

Demographics and Background

From our interviews we learned that implementation of an IS audit practice in the Big Five firms varied in its time frame and scope. The earliest date on which IS audit emerges as a formal function appears to be the early 1970s. This development coincides with the growth of computerization. Some auditors believe their firm's practice started in the early 1980s, with the advent of the personal computer. All agree that the IS audit function was created primarily to support the financial audit. Sometimes the IS audit stood as a separate organizational entity; at other times it was part of the financial audit practice. Up until recently, most of the Big Five firms continued to consider IS audit as a support function to financial audit.³

Today these firms typically have separate IS and financial audit practices within a "risk assurance" group. The IS auditors support the financial audit as needed, but they also offer other assurance services, many of which are consulting-type services.⁴ Increasingly, the team on an audit engagement includes both financial and IS auditors. As one auditor stated, we "...try to align as one team when approaching the client."

Table 1 provides demographic information about our participants. We group them first by auditor type (Financial or IS) and then by location (Midwest or DC/Richmond). The financial auditors in both locations and the IS auditors in the Midwest have similar tenure in their present positions (3–4 years) and within their

Table 1. Demographic Information Describing Field Study Participants.

Firm	Financial Auditors		Information Systems Auditors	
	Midwest	DC/Richmond	Midwest	DC/Richmond
Firm 1	Partner	Partner	Director	Senior Manager
Firm 2	Partner	Senior Manager	Partner	Senior Manager
Firm 3	Senior Manager	Senior Manager	Senior Manager	Senior Manager
Firm 4	Partner	Senior Manager	Partner	Senior Manager
Firm 5	Partner	Partner	Partner	Partner
Average number of years in this position	3.0	3.7	3.8	2.4
Average number of years with this firm	16.4	14.8	15.7	5.4

firms (14–16 years.) The IS auditors in DC/Richmond have been in their respective positions for almost three years but appear more likely to have changed firms. These participants have been with their current firms for approximately five years.

The Relationship Between IS and Financial Audit

Our first group of questions addresses differences in auditors' perceptions of the current and predicted relationships between the IS audit and financial audit functions within large public accounting/professional services firms. As noted earlier, during the past decade, IS audit has changed from being a small support piece of the financial audit to being a driving force in the overall public audit (Bagranoff & Vendirzyk, 2000). Table 2 presents our participants' key-word responses to three questions concerning the relationship between the IS and financial audit. We identify each key-word comment by auditor type (financial or IS) and we group comments displaying similar patterns, appropriate to each question.

Panel A of Table 2 presents the participants' responses to an interview question asking them to describe the current relationship between IS and financial audit. We categorized each response depending on the indicated dominance of either financial or IS audit. We find that financial auditors were more likely to perceive the relationship between the two practices as one in which financial audit dominates or is equally important to IS audit (9 out of 10). Although half of the IS auditors expressed a similar opinion, the other half felt IS was dominant or moving away from financial audit altogether. Although some IS auditors believed that the financial audit dominated IS, none of the financial auditors believed that IS audit was dominant.

Panel B of [Table 2](#) presents the participants' responses to a question asking them to describe the relationship between IS and financial audit in the future. While the responses exhibit a similar pattern to those describing the current relationship between IS and financial audit, there are some interesting differences. Although almost half of the financial auditors believe that financial audit will continue to dominate IS, none of the IS auditors express this opinion. IS auditors overwhelmingly perceive either a future IS audit dominance or a clear move away from the financial audit practice. Comments (including those expressed by some of the financial auditors) indicate the two practices are likely to move beyond "working together" towards true integration. Many believe that the financial audit will become more and more a systems audit.

Our participants' descriptions of the current and future relationship between the two practices imply that there are "sides" when it comes to IS versus financial audit. Financial auditors do not seem to have the same notion of the value of IS audit as do the IS auditors themselves. However, untabulated results of participants' responses to a similar subjective question "*To what extent do you think your firm will move from an emphasis on financial vs. IS audit by 2005*" confirm the growing importance of IS audit to the largest public accounting/professional services firms. Almost all participants expect there to be some shift in focus from financial to IS audit.⁵

The second specific interview question, about the relationship between IS and financial audit, concerns IS audit's focus on control evaluation. Panels C and D of [Table 2](#) present auditors' perceptions of their firms' current and future focus on control evaluation, respectively. We categorize each comment as to its indicated focus on general or application controls. IS and financial auditors' perceptions of IS audit's focus on control evaluation are similar. Almost half of the auditors (both financial and IS) perceive that IS audit's current focus is a mix of general and application controls, and expect this focus to continue into the near future. Over half specifically mentioned a current and continued focus on "risk." This is consistent with a move toward more integrated information systems among businesses. Some auditors specifically mentioned the impact of ERP systems on control evaluation and risk assessment and note that the line between general and application controls is increasingly blurred in an ERP environment. The only distinct difference between the two groups concerns IS audit's future focus. Only financial auditors (albeit a minority) perceive IS audit's control focus to be only on application controls.

The third specific interview question, about the relationship between IS and financial audit, concerns the impact of the IS auditors' findings on the scope of a financial audit engagement. Panel E of [Table 2](#) shows participant's responses classified as to the magnitude of the effect of an IS audit finding. From the comments,

Table 2. IS Audit's Relationship to Financial Audit.

Comment Classification	Auditor Type	Comment Keywords
Panel A: How would you describe your firm's IS audit function in relation to the financial audit function (2000)?		
Financial leads	Financial	Relationship not changed (IT brought into clients where IS plays a major role).
	Financial	Lead financial auditor makes the decision about testing IS controls.
	Financial	Not needed on every job. Financial auditor sets budget.
	Financial	Help financial auditors understand the problems. Look for unusual transactions.
	Financial	Separate practice; financial audit team calls in IT audit during planning stages.
	IS	Financial audit technique now requires a higher level of IT involvement.
	IS	Financial audit would view the IS audit group as part of its practice.
Both equally important	IS	Brought into financial audit when risk is IT related.
	Financial	Much more integrated.
	Financial	Working concurrently with financial. Integrated.
	Financial	Just as important to the whole process. Risk is in IS today.
	Financial	Attached at the hip. Integral part of the audit team.
	IS	Both integral pieces. Work together.
	IS	Absolutely integrated.
IS leads	IS	Understanding the IT infrastructure and how it relates to the financial statements.
	IS	Necessary. More important than financial in some ways.
	IS	Systems auditors better equipped to handle and lead portions of the audit.
	IS	IT audit is "driving the audit."
IS moving away from traditional audit practice	Financial	About 20% of IS audit work supports the (financial) audit division.
	IS	More independent. Audit support roles are only 15–20% of group revenues.
Panel B: How would you describe your firm's IS audit function in relation to the financial audit function (2005)?		
Financial leads	Financial	Traditional support to financial audit will not change.
	Financial	Static model. Lead financial auditor makes the decision about testing IS controls.
	Financial	Audit process won't change much. Still applying the auditor's judgment.

Table 2. (Continued)

Comment Classification	Auditor Type	Comment Keywords
IS leads/takes over	Financial	IS professionals becoming much more involved every year.
	Financial	Audit tests of control no longer done by general audit group. Not able to understand the computer controls. Embedded in software.
	Financial	IS audit may be the financial audit.
	Financial	Financial audit will be IS audit.
	Financial	All will be IS audit. Systems difficult to audit without understanding of IS controls.
	IS	One and the same.
	IS	IS more dominant. Substantive tests not suffice. Evaluating IS controls will be paramount.
	IS	“Takeover.” IS audit will lead the charge.
	IS	Seamless.
	IS	Move together. Will be the one and the same.
	IS	Fundamentally integrated. No split.
IS moving away from traditional audit practice	IS	Indistinguishable. The financial audit must be (an IS audit).
	Financial	IS audit will be serving non-attest clients. Financial audit just one piece of the IS audit business.
	Financial	Future of firm is with technology. Grow assurance practice with IS audit.
	IS	IS audit will be primarily a consulting business.
	IS	Stand alone or part of consulting.
Panel C: How would you describe your firm’s IS audit function’s focus on control evaluation (2000)?	IS	More direct work with clients. Financial auditors will learn to audit the system.
	General controls	Now more focused on control than on risk.
	Financial	General controls often including documentation.
	IS	Some general control evaluation. Focus on risk.
	Application controls	Application controls because that’s where the risks are. Risk-based approach.
Application controls	Financial	Much more application review and a risk focus. Don’t think in terms of general controls.
	IS	Specific focus on certain applications. Application controls becoming more relevant. Focus is more risk-based than control-based.
	IS	Significant applications and processes. More risk than control focus.
	IS	Significant applications and processes. More risk than control focus.
Both	Financial	Mix. Very client specific. Risk with assessment and controls reliance.

Table 2. (Continued)

Comment Classification	Auditor Type	Comment Keywords
	Financial	General but focus on more of them than five years ago. Seeing more and more application controls now for assurance purposes.
	Financial	Mix today between general and application controls. Focus is on risk.
	Financial	More of a focus on application controls in addition to general controls. Broader risk-based approach.
	IS	Mix of general and application control evaluation with a focus on risk. In an ERP environment, unable to separate general and application controls.
	IS	Now focused on the application but also on the underlying general controls.
	IS	Doing general and application reviews.
	IS	Both general and application and risk approach. ERP changes businesses.
	IS	More application controls although general are still important because of ERP-based controls. Risk approach.
Other	Financial	Moving toward systems-based control testing.
	Financial	Audit has gone from a traditional, substantive, very detail oriented type of audit test work to being risk-based.
	IS	Holistic approach to risk. Complete package.
	IS	Integrated control as much as possible.
Panel D: How would you describe your firm's IS audit function's focus on control evaluation (2005)?		
Application	Financial	Application controls and risk approach.
	Financial	More application controls and risk approach.
	Financial	Continued reliance on application controls.
	Financial	Move toward application controls and risk approach.
Both	Financial	Both risk and control and more application controls.
	Financial	More detailed focus on all controls.
	Financial	Blurry line between general and application controls. Risk focus in a different context. Provide systems assurance.
	IS	Less general but still some need for it as a framework for risk assessment. Risk approach.
	IS	Will be doing general and application controls testing throughout the organization.
	IS	Both but risk-based approach overlays this. Hard to distinguish between general versus application controls in eBusiness because there it is both!
	IS	Both general and application. Application controls may be more important in an eCommerce world.

Table 2. (Continued)

Comment Classification	Auditor Type	Comment Keywords
Other	Financial	The focus on “in-the-computer-auditing” will continue to grow. Process oriented.
	Financial	Shift to preventive controls. Focus on risk aversion.
	Financial	Definitely be risk. Both general and specific risk for that particular company.
	IS	More holistic. Evaluate how clients perform against a core set of criteria.
	IS	General and application will be the same, especially in the eBusiness and ERP business areas.
	IS	Focus on highest areas of risk. Emphasis on change and risk. Meaningful risk assessment.
	IS	Focus will remain on risk at the business process level. High-risk areas will be reviewed and evaluated by the IS auditors.
	IS	Process risk.
	IS	Not thought about at this point.
Panel E: How likely is it that the finding of IS auditors on a client engagement will affect the scope of the financial audit?		
No effect	Financial	Doesn't happen much either way.
	Financial	No real scope adjustment based on good controls because the financial auditors don't really know what that means in terms of impact and the IT auditors don't either.
	Financial	Scope does not change. Way of dealing with scope changes. Half the time now.
	IS	Doesn't happen very often. Find compensating controls.
	IS	Doesn't happen much because financial auditors don't really understand reliance and risk.
Some impact	Financial	Rare that an IS audit finding causes a qualified audit. More often audit scope decreased.
	Financial	Not too often that controls are completely bad but the IS auditor report of weaknesses does impact the financial audit scope. Adjust accordingly (up or down).
	Financial	Like to say it won't affect it much. More likely to expand scope than contract it.
	Financial	Consider scope 90% of the time. Affects scope less than 20% of the time. More likely to expand scope.
	Financial	Very likely. 30% of the time now. Scope expanded because of problems/concerns.
	IS	If no issues and risk OK, rely on controls.
	IS	Already does on perhaps six out of 20 audits. Now more likely to increase scope. As IT environments become well managed, will be able to reduce scope.

Table 2. (Continued)

Comment Classification	Auditor Type	Comment Keywords
Major effect	IS	Today 10–20% (increases scope) whereas it was about 0 five years ago. If really strong controls, scope adjustment. Less financial audit work.
	IS	Depends on where the weakness is and the severity of the weakness is. 10–20% of the time. More likely to expand scope.
	IS	True now. Less than 10%. Depends on nature of financial audit. If controls cannot be relied upon, scope will change. If no problems, no real reduction in scope.
	Financial	Happens 100%. Controls lacking or company working in an environment where the risk is high, then will definitely change scope. Reduce if IS control environment clean.
	Financial	Listen to them 100% of the time. Great controls can really cut back on audit work.
	IS	90% of the time it affects the scope. Much of this is positive as good controls reduce scope. Controls so bad (scope expands) 10% of the time.
	IS	Have a big impact – 50–60%.
	IS	Happens frequently. Best audit engagements are joint efforts.

it appears that there are no significant differences between the two groups in terms of the expectations of the impact of IS audit findings on the scope of a financial audit. Although half of the IS auditors and half the financial auditors perceive some impact, no clear consensus exists on whether scope is more likely to be expanded or contracted due to IS audit findings. These perceptions could relate to the current state of IS controls among audit clients or a lack of understanding between the two groups as to how an IS audit finding translates to the financial audit.

Expected Growth and Change in IS Audit Practice

Our second group of questions addresses predicted changes in IS audit practice during the next five years. Table 3 presents our participants' key-word responses to three questions concerning the expected growth and change in IS audit practice. We again identify each key-word comment by auditor type (financial or IS) and we group comments displaying similar patterns, appropriate to each question, if possible.

Table 3. Expected Growth and Change in IS Audit Practice.

Comment Classification	Auditor Type	Comment Keywords
Panel A: What will be your client's need for audit services in 2005?		
Financial audit focus	Financial	Public companies will still need an audit opinion. Public mindsets not change dramatically.
	Financial	Audit services still required. May be done by government employees.
	Financial	Financial audit continues as a compliance function.
	Financial	Same for financial audit but use more IS audit services, especially related to the Internet.
	Financial	Always require financial audit unless government no longer requires. Need audits of eCommerce.
	Financial	Still needed but may be of a different character. SEC not changing audit requirements.
	Financial	Financial statement audits won't go away. Annual financial audits not timely enough.
	IS	Financial audit needed in limited capacity.
	IS	Need for financial audit will still be there. Quicker/faster turnaround.
	IS	Demand audits at a minimum of a monthly basis. Some on a daily basis. Same need for assurance and comfort.
Broader focus	Financial	IS audit important from an eCommerce perspective. More companies needing audits.
	Financial	More focused through risk-based audit approach. Other types of financial audit work will decrease. Security work will be more important.
	Financial	Need for assurance of data on a continuum.
	IS	Depends on valuation within the financial markets. If value placed on integrity and security of systems, in addition to the financial statement, will need a security and integrity audit.
	IS	Need for more IS audit services. Financial audit won't change much.
	IS	Greater need. Less ability for clients to develop their own people (i.e. internal audit).
	IS	Need for real time assurance, continuous auditing, security outsourcing.
	IS	IS audits growing outside of the financial arena and into (assuring) information of any type.
	IS	Focus on reliability of systems not how fair the financial statements are.
	IS	Financial audits will become less valuable. Need for on-line, real time perspective. Greater desire for attestation of other items of interest to financial markets.

Table 3. (Continued)

Comment Classification	Auditor Type	Comment Keywords
Panel B: What will be your client's need for the services of a CPA in 2005?		
Financial audit focus	Financial	Primarily for financial audit.
	Financial	SEC and banks still require a financial audit.
	Financial	Need formal audit opinion on financial statements from licensed CPAs.
	Financial	The sign off (attest) accreditation process still necessary. Attest to the financial data (so long as SEC still mandates).
	IS	Systems people won't understand FASBs and impact on business of certain transactions.
	IS	If CPA vision changes, then profession will continue to expand. If not, relegated to signing off on financial statements.
Broader focus	Financial	To do additional attest services.
	Financial	Need for some type of certification. Could be CPA supplemented with others.
	Financial	CPAs will be expected to provide additional services. General public will view the CPA as competent to perform these services.
	Financial	Audit committees expect to see B-to-B assurances.
	Financial	Clients confused as to what a CPA can offer. Need to educate them.
	Financial	Will need them. CPAs are getting better at analyzing/ understanding information. They are advisors.
	IS	Incorporating consulting practices with the audit services. How this affects independence will impact CPA as a profession.
	IS	AICPA is pushing in the right direction by broadening the CPA scope of services. Other assurance and business risk services will be needed.
	IS	The traditional CPA certification will be nice to have but not a requirement. Certification of various types will be a plus, such as CISA.
	IS	Will continue to grow. Accountants best positioned to help companies get to where they want to go.
	IS	Will not be traditional. Is going to have to be a CPA that also understands financial audit systems, how systems integrate, how they work, and how to audit the systems.
	IS	If the profession evolves, no one is better positioned to provide attestation services on a different set of information.
	IS	Many services will be outside of the traditional role of a CPA. Role of CPA will change but limited by SEC/AICPA regulations.
	IS	No response.

Table 3. (Continued)

Comment Classification	Auditor Type	Comment Keywords
Panel C: What additional services do you think your firm's IS audit practice is likely to offer by 2005?		
	Financial	Outsourcing-security or audit. Assurance market with respect to Web sites.
	Financial	More eCommerce and security.
	Financial	Assurances in other areas. Increase in agreed upon procedures. IS portion of services will increase.
	Financial	New service lines. eBusiness (e.g. services such as WebTrust).
	Financial	Strategic services. Mix of consulting and IS audit.
	Financial	More consulting and value based consulting. Will need assurance services in the eCommerce area. Third party assurances. More outsourcing.
	Financial	Everything. Whatever the client wants. Need to respond to what the market dictates.
	Financial	IT and financial audit services plus consulting. Clients will outsource a lot of their work.
	Financial	Assurance over information in ways that we haven't even thought about yet.
	Financial	Internet world will generate some new services.
	IS	Completely different from now. Assurance services with a focus on business problems. Before geared toward technical problems.
	IS	Data analysis. eCommerce. More enterprise-wide risk and security assessment work.
	IS	All around eBusiness. Risk assessment. Operational assessments related to IT.
	IS	eCommerce assurances. Integration of ERP systems. Web-enabled services. Data mining/data modeling type services.
	IS	Continuous audit. Embedded modules for financial statement audits. Attack and penetrate analysis. Security issues. Use of AI and expert systems.
	IS	Transaction assurance and secure EC.
	IS	Web Trust definitely. Reviews/provide assurances of other than financial systems. System development consulting services. Need someone to evaluate whether controls are being compromised.
	IS	More assurance. Privacy. eCommerce.
	IS	Encryption packets. More secure transactions. More real time opinions on financial results. Non-traditional measures included in annual reports.
	IS	E-business (safe/confidential) and services that relate broadly to security, privacy issues.

Panel A of Table 3 presents participant perceptions of clients' future need for audit services categorized as to the degree each comment focused on a financial audit. The majority of the financial auditors perceive that the need for future audit services would continue to focus on the financial audit. The majority of the IS auditors interpreted the term "audit services" more broadly. A few indicate that the financial markets will demand assurances on various types of information. Some (from both groups) perceive that audits (especially financial audits) need to become more timely.

Panel B of Table 3 presents participant perceptions of clients' future need for CPA services, again categorized as to the degree each comment focused on a financial audit. The financial auditors appear more hopeful about the future for CPA services. IS auditors saw many of the services clients will need as being outside the scope of CPAs.

Panel C of Table 3 presents participant perceptions of future services that IS audit practices are likely to offer. Responses varied widely, disallowing classification by auditor type. As might be expected, IS auditor responses were much more specific in nature. Many of the suggested new services are related to assurance, including security and eCommerce assurances. Other services, however, are broader and are more consulting-oriented, such as outsourcing.

Additional Analysis

To increase the internal validity of our study, we also asked several objective questions about our participants' levels of agreement with the following statements:

- (1) IS audit is becoming more important.
- (2) The audit of general versus application controls is very important.
- (3) A finding of a weakness in general controls is likely to affect the scope of the audit.
- (4) A finding of a weakness in application controls is likely to affect the scope of the audit.
- (5) My firm will utilize a continuous audit approach significantly in the next five years.

Except for the first question, these statements include the generic term *audit* and do not explicitly distinguish the financial audit from IS audit support to the financial audit. We asked participants to describe their level of agreements as: Strongly Agree, Moderately Agree, Undecided, Moderately Disagree and Strongly Disagree.

Table 4. Participants Objective Responses Related to Auditing.

Auditor Type	Strongly Agree	Moderately Agree	Undecided	Moderately Disagree	Strongly Disagree
Panel A: IS audit is becoming more important					
Financial	8	1	0	1	0
IS	9	1	0	0	0
Panel B: The audit of general vs. application controls is very important					
Financial	1	5	1	3	0
IS	2	2	0	4	2
Panel C: A finding of a weakness in general controls is likely to affect the scope of the audit					
Financial	4	5	0	1	0
IS	1	5	0	4	0
Panel D: A finding of a weakness in application controls is likely to affect the scope of the audit					
Financial	6	4	0	0	0
IS	2	7	0	1	0
Panel E: My firm will use a continuous audit approach significantly in the next five years					
Financial	5	3	0	2	0
IS	8	2	0	0	0

Table 4 presents participants' responses to these five objective questions. Responses are grouped by auditor type (financial or IS) and level of agreement. An overwhelming majority of IS and financial auditors believe that IS audit is becoming more important. Six out of ten financial auditors believe general controls are more important than application controls, while six out of ten IS auditors disagree. Financial auditors are more likely to agree that a finding of a general control weakness is likely to affect the scope of the audit than are IS auditors. Both agree that a weakness in application controls will affect audit scope. Consistent with the expressed need for more timely audits, the majority of both groups of auditors agree that a continuous audit approach will be used within the next five years, although financial auditors are somewhat less confident that such an approach will be used in the future.

CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

We investigate the perceptions among auditors about the evolution of the IS audit function, by focusing on the two major roles of the IS audit practice:

(1) its relationship to the financial audit; and (2) the expected growth in the IS audit practice itself (outside of its traditional financial audit support role). We gather responses to both open-ended subjective questions and five objective questions.

Both groups overwhelmingly agree that IS audit is becoming more important. However, financial auditors describe the current and future relationship between the two practices differently. Financial auditors are more likely to indicate that the financial audit will continue to dominate the IS audit. IS auditors see a growing IS dominance over the financial audit. Although financial auditors perceive the audit of general controls to be more important than IS auditors do, both groups believe that IS audit's focus on control evaluation includes (and will continue to include) a mix of general and application controls with a growing focus on "risk assessment." In evaluating the expected growth of the IS audit practice itself, financial auditors are more likely to interpret audit services and the need for services provided in terms of the financial audit, while IS auditors are more likely to take a broader view.

Expectations of both groups concerning the impact of IS audit findings on the scope of a financial audit are difficult to assess. Both groups objectively agree that findings of weaknesses in general and applications controls are likely to impact audit scope. Subjectively, when the finding of the weakness is specifically attributed to IS audit, responses diverge. This lack of consistency between objective and subjective responses is consistent with the finding by [Hunton et al. \(2001\)](#) that financial auditors were confident of their ability to assess the increased audit risks in an ERP environment and were not likely to utilize IS auditors when assessing ERP-related risks. Financial auditors may not depend on IS auditors to identify general control weaknesses that affect financial audit scope. Similarly, financial auditors perceive that the IS audit is becoming more important, but many are reluctant to give up control of the financial audit.

[Hunton et al. \(2001, p. 27\)](#) suggest that future research should "examine these potential organizational conflicts and ways to mitigate them to better accomplish audit objectives." Advances in technology make it possible for increased IS auditing and practices such as continuous audit to increase the quality and efficiency of audits. Audit failures at Enron (as well as at Waste Management and MicroStrategy) will undoubtedly raise questions concerning the current practice of auditing ([Hilzenrath, 2001](#)). As firms struggle with the major changes occurring in this environment, understanding differences in perspectives between these two groups is critically important to accounting researchers, practitioners, and educators. More research is needed to understand these differences and determine how best to resolve them so that financial and IS auditors work together to improve audit practice.

NOTES

1. For example, [Solomon et al. \(1999\)](#) finds that industry specialists have more knowledge about a firm's non-financial statement errors in their industry specializations than do non-industry specialists. [Hooks et al. \(1994\)](#) find that audit, tax and consulting partners (in the then Big Six firms) differ significantly on the approach they consider most valuable in making practice development contacts. Audit and tax partners favor contacts from outside sources, while consultants place more value on contacts that arise within their respective firms.

2. Given the rapid changes taking place in audit practice, particularly those driven by advances in technology, it would be highly speculative to predict more than five years out. Our interview subjects, while senior in their firms, still could not, for the most part, recall more than ten years in the past.

3. For a detailed discussion of the field study participants' perceived changes in IS audit practice from 1990 to 2000 and their predicted changes from 2000 to 2005, please see the related article, [Bagranoff and Vendrazyk \(2000\)](#).

4. For example, Ernst & Young's Assurance and Business Advisory Services include Information Systems Assurance and Advisory Services (IS auditors). KPMG's Assurance and Advisory Services include Information Risk Management (IS auditors).

5. Although not specifically presented as a formal research question in this paper, we asked the respondents why they thought the relationship between IS and financial audit was changing. Most participants provided more than one reason. The most common reasons were market changes, the growth of eCommerce, changing technology, and client expectations. Among financial auditors, four out of ten specifically mentioned changing technology as a reason for change; among IS auditors, six of ten specifically mentioned eCommerce.

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APPENDIX

Field Study/Interview Instrument

The Evolution of IS Audit within Big Five Firms

The practice of IS Audit within large public accounting (professional services) organizations has been evolving over the past two decades. The purpose of this study is to trace that evolution and to determine anticipated changes in focus and structure of the practice during the next several years.

Interviewee: _____

Firm: _____

Phone: _____ Fax: _____

E-Mail: _____

(1) What is your position?

- (2) How long have you been in this position?
- (3) How long have you been with the firm?
- (4) What are your primary responsibilities?
- (5) To whom do you report?
- (6) Who reports to you?
- (7) When did your firm first form an IS audit function?
- (8) Is your firm's IS audit function integrated with its financial audit practice, or is it a separate unit? Please explain the organization of this activity. Why do you think it is organized the way it is?
- (9) How would you describe your firm's IS audit function 10 years ago – in terms of its:
 - (a) relationship to financial audit
 - (b) services it provides to clients and within the firm
 - (c) focus on control evaluation (general versus application; risk versus controls)
 - (d) use of technologies
 - (e) educational background and skill sets of employees
 - (f) size of practice in terms of human resources and revenues
- (10) How would you describe your firm's IS audit function 5 years ago – in terms of its:
 - (a) relationship to financial audit
 - (b) services it provides to clients and within the firm
 - (c) focus on control evaluation (general versus application; risk versus controls)
 - (d) use of technologies
 - (e) educational background and skill sets of employees
 - (f) size of practice in terms of human resources and revenues
- (11) How would you describe your firm's IS audit function today – in terms of its:
 - (a) relationship to financial audit
 - (b) services it provides to clients and within the firm
 - (c) focus on control evaluation (general versus application; risk versus controls)
 - (d) use of technologies
 - (e) educational background and skill sets of employees
 - (f) size of practice in terms of human resources and revenues
- (12) If the IS audit function has changed over the past 5–10 years, what do you think is the major reason(s) for the change?
- (13) How do you see your firm's IS audit function 5 years from now – in terms of its:

- (a) relationship to financial audit
 - (b) services it provides to clients and within the firm
 - (c) focus on control evaluation (general versus application; risk versus controls)
 - (d) use of technologies
 - (e) educational background and skill sets of employees
 - (f) size of practice in terms of human resources and revenues
- (14) If you believe that the IS audit function will change over the next 5 years, what do you think are the major reasons for the needed changes?
- (15) Where do you think your clients will be in 5 years with respect to:
- (a) Their need for audit services (both financial and IS)?
 - (b) Their need for the services of a CPA?
 - (c) The services they expect from a Big Five firm?
- (16) What additional services do you think your firm's IS audit practice is likely to offer during the next 5 years?
- (17) To what extent do you think your firm will move from an emphasis on financial versus IS audit during the next 5 years?
- (18) How likely is it that the finding of IS auditors on a client engagement will affect the scope of the financial audit? (What percent of times do you think this happens?)
- (19) Please state the level to which you agree or disagree with the following statements:
- | | | | | | |
|---|----|----|---|----|----|
| (1) IS Audit is becoming more important. | SA | MA | U | MD | SD |
| (2) The audit of general versus application controls is very important. | SA | MA | U | MD | SD |
| (3) A finding of a weakness in general controls is likely to affect the scope of the audit. | SA | MA | U | MD | SD |
| (4) A finding of a weakness in application controls is likely to affect the scope of the audit. | SA | MA | U | MD | SD |
| (5) My firm will utilize a continuous audit approach significantly in the next five years. | SA | MA | U | MD | SD |

Key: SA = strongly agree; MA = mildly agree; U = undecided; MD = mildly disagree; SD = strongly disagree.

Thank you for your time!

THE DECISION-FACILITATING ROLE OF MANAGEMENT ACCOUNTING SYSTEMS ON MANAGERIAL PERFORMANCE: THE INFLUENCE OF LOCUS OF CONTROL AND TASK UNCERTAINTY

Vincent K. Chong and Ian R. C. Eggleton

ABSTRACT

This study examines the three-way interaction between task uncertainty, locus of control and management accounting systems (MAS) affecting managerial performance. MAS was defined in terms of the extent to which managers use broad scope MAS information for managerial decisions. The results of this study support a three-way interaction between task uncertainty, locus of control and management accounting systems affecting managerial performance. Specifically, under low task uncertainty situations, the results reveal that the use of more broad scope MAS information by “internal” managers is detrimental to their performance, while the extent of use of broad scope MAS information has no effect on the performance level of the “external” managers. In addition, the results reveal that “internal” managers who make more use of broad scope MAS information for managerial

decisions under low task uncertainty performed less well than their “external” counterparts. In contrast, under high task uncertainty situations, the results suggest that “internal” managers improve their performance when they make more use of broad scope MAS information for managerial decisions, while “external” managers are insensitive to the degree of use of broad scope MAS information for managerial decisions. In addition, the results reveal that “internal” managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations only marginally outperform their “external” counterparts. Contrary to our expectations, this difference is not statistically significant. The theoretical and practical contributions of our findings are discussed.

INTRODUCTION

Management accounting systems (MAS) play a decision-facilitating role through the generation and provision of information for managerial decision-making purposes. It has been suggested that the use of management accounting information is intended to enhance the quality of managerial decisions, resulting in better-informed action choices (Sprinkle, 2003). The existing literature has recognized the importance of individual-task interactions relating to the use of managerial accounting information in determining managerial performance (e.g. Newell & Simon, 1972; Simon, 1980). Specifically, it has been argued that decision-making behavior is a function of task characteristics, decision-maker characteristics, and the interaction among these characteristics (Hogarth, 1993; Peters, 1993; Solomon & Shields, 1995).

To date, the accounting literature on MAS design has tended to examine the impact on managerial performance of task characteristics (e.g. task uncertainty) and decision-maker characteristics (e.g. personality traits) independently. Some studies (e.g. Chong, 1996; Mia & Chenhall, 1994) have focused on the importance of task characteristics and MAS design on managerial performance; whilst other studies (e.g. Chong, 1998; Fisher, 1996) have examined the influence of personality traits and MAS design on managerial performance. For example, Chong (1996) examined the effect of task uncertainty and the extent of managers' use of broad scope MAS information on managerial performance. Chong found that under high task uncertainty situations, increased use of broad scope MAS information led to improved performance, while under low task uncertainty situations, greater use of broad scope MAS information led to information overload, which was dysfunctional to managers' performance. However, Chong did not consider the potential impact of personality traits of managers on this

relationship, despite existing evidence to suggest that personality traits can have a significant influence on the manner in which managers process and use accounting information (see Benbasat & Dexter, 1979; Ferris & Haskins, 1988; Gul, 1984; Hopwood, 1974). Fisher (1996), on the other hand, examined the interactive effect of perceived environmental uncertainty (PEU) and the personality trait of managers' locus of control on their perceived usefulness of MAS information.¹ Fisher, however, did not examine whether task characteristics interacted with these two variables to influence managerial performance. Rather, she merely hypothesized that as PEU increased, "internals" would perceive broad scope information that was timely to be more useful than would "externals."

Thus, despite the recognition of individual-task interactions on the use of managerial accounting information in the existing literature, no studies have attempted to consider the joint effects of task uncertainty (a task characteristic), locus of control (a decision-maker characteristic) and the extent of use of broad scope MAS information affecting managerial performance. This gap in the accounting literature constitutes the motivation for this study.

The remainder of the article is structured as follows. In the next section, we review the relevant literature and formulate our hypotheses. In the following two sections we describe, respectively, our research method and our results. In the final section we discuss our results and formulate our conclusions, and note the limitations of our study and opportunities for future research.

LITERATURE REVIEW AND FORMULATION OF HYPOTHESES

The Decision-Facilitating Role of Management Accounting Systems

The primary role of MAS is to provide managerial accounting information to facilitate managers' decisions. Prior studies (e.g. Abernethy & Guthrie, 1994; Chong, 1996; Chong, 1998; Mia, 1993; Mia & Chenhall, 1994) have provided empirical evidence of how the decision-facilitating role of MAS can enhance managerial performance, subject to an appropriate "fit" existing between contextual variables, such as environmental and task uncertainty, and the design of the MAS. These studies have defined MAS design in terms of its information characteristics, such as breadth of scope, timeliness, level of aggregation and extent of integration (see Chenhall & Morris, 1986). Of these, our study focuses only on the breadth of scope characteristic, which incorporates the sub-dimensions of focus, quantification and time horizon (Chenhall & Morris, 1986; Gordon & Narayanan, 1984; Larcker, 1981), which has been identified by accounting researchers (e.g. Abernethy &

Guthrie, 1994; Chong, 1996; Chong, 1998; Chong & Chong, 1997; Mia, 1993; Mia & Chenhall, 1994) as having particular significance in facilitating managerial decisions.

MAS have traditionally had fairly simple designs, providing largely narrow scope information focusing on ex post financial information relating primarily to matters internal to the organization. In contrast, modern MAS have more complex designs and may incorporate a plethora of broad scope information in addition to historical financial accounting data. Such information may include, for example, demographic trends, economic indicators, market volume and the organisation's share thereof, competitors' costing and pricing strategies, customers' preferences and satisfaction levels, and a variety of production related efficiency and human resource management performance indicators. Often assemblages of this broad scope information are presented in integrated reporting formats such as balanced scorecards (Kaplan & Norton, 1992, 1993, 1996). Moreover, in addition to providing *ex-post* information, modern MAS can often generate ex ante information relating to the likelihood of future events (e.g. war, climate changes, new technologies), which may have a significant impact on the organization's competitiveness and future performance. The provision of this broad scope information has the potential to enhance the quality of managerial decisions and to facilitate their evaluation and revision in light of emerging events.

For the purpose of theory and hypotheses development in this study, the breadth of scope of MAS information is conceptualized along the continuum of the extent to which managers' use less or more broad scope MAS information in making their decisions.

Task Uncertainty and the Decision-Facilitating Problem

According to Galbraith's (1973, 1977) information processing theory, when there is a "misfit" or "mismatch" between decision-makers information processing requirements and information processing capabilities, task uncertainty occurs. Galbraith (1977, p. 36) suggested that "the greater the task uncertainty, the greater the amount of information that must be processed among decision-makers during task execution in order to achieve a given level of performance." Thus, the presence of task uncertainty increases the complexity of the decisions confronting managers, thereby affecting the decision-facilitating role of the MAS. When the degree of task uncertainty is high, managers will require more broad scope MAS information to cope with the complexity of the task environment. Thus, it is contended that the extent of the decision-facilitating problem is reflected in the level of task uncertainty.

Payne (1976) indicates that decision complexity is directly related to the number of alternative actions amongst which the decision maker must select and the number of information cues relating to those action alternatives. Hence, when managers are confronted by low task uncertainty the decision facilitating role of the MAS is straight-forward, as managers can interpret the task environment relatively easily and make decisions on a fairly narrow range of information (Chong, 1996). In contrast, when the managers are faced by a complex decision involving a larger number of alternative action choices and/or a large number of information cues, the MAS must be capable of providing broad scope information if it is to successfully fulfil its decision-facilitating role. A mismatch between the information needs of managers and the capabilities of their MAS may result in the managers suffering either from information overload or information underload. Information overload is most likely to occur in low task uncertainty situations when the MAS, in addition to providing relevant narrow scope information, also provides redundant and/or irrelevant broad scope information (see, e.g. Gaeth & Shanteau, 2000). A direct consequence of information overload is a reduction in decision quality and hence, quite likely, in managerial performance (see e.g. Chong, 1996; Gul, 1991; Gul & Chia, 1994; Tushman & Nadler, 1978). Information underload is most likely to occur in high task uncertainty situations when the MAS provides insufficient information (i.e. narrow scope information) to meet the broad scope information needs of the decision maker. This may result in managers using simpler, possibly sub-optimal decision strategies and heuristics, which may result in systematic judgmental biases, thereby reducing the quality of their decisions and consequently their performance (see e.g. Payne, 1976; Tversky & Kahneman, 1974).

The Personality Trait of Locus of Control

In addition to the contextual variable of task uncertainty discussed above, it has also been suggested that individual differences affect how managers use information. In particular, the personality trait of locus of control has been used to explain differences in the way information is perceived and processed (see e.g. Brownell, 1981; Fisher, 1996; Frucot & Shearon, 1991; Hyatt & Prawitt, 2001; Mia, 1987; Tsui & Gul, 1996). Based on Rotter's (1966) social learning theory, internal-external locus of control refers to the degree to which attribution of causality of behavior is made either to oneself or to sources external to oneself. "Externals" are individuals who believe their destinies are controlled by luck or chance, whereas "internals" are individuals who believe they have a lot of control over their destinies (Rotter, 1966).

Prior psychological literature suggests that “internals” tend to seek task-relevant information more actively compared to their “external” counterparts (see e.g. Davis & Phares, 1967; Organ & Greene, 1974; Pines & Julian, 1972; Seeman, 1963; Spector, 1982). Seeman (1963), for example, concluded that the information gathering superiority of “internals” was found only when the information in question was relevant to important goals. He offered two possible explanations: (1) “internals” may recognize the relevance of information for goal attainment more quickly than do “externals”; and (2) “internals” have a clearer sense of their own purposes and values than do “externals,” and therefore tend to be more responsive to opportunities for fulfillment of those purposes. Other prior psychological research indicates that “internals” are more efficient in the utilization of information than “externals” (Lefcourt, 1982; Phares, 1968; Spector, 1982; Wolk & DuCette, 1974). Phares (1968) found that “internals” were superior to “externals” in the use of memorized information for complex problem solving. In another study, Lefcourt (1982) found that “internals” were more inquisitive, curious and overall more efficient processors of information than “externals.” Lefcourt suggested that this might be because “internals” were more ready to perceive the opportunities that would facilitate the realization of their goals, and more apt to recognize the relevance of information for their purposes.

The rationale for the greater information processing capability of “internals” lies in the presumed construct properties of the “internal-external” dimension (Rotter, 1966). “Internals,” who have a higher generalized expectancy that rewards are a function of their own efforts, would be expected to seek task-relevant information more actively and use that information well, since they would be more likely to see acquisition and utilization of relevant information as a pathway toward reinforcement.

The Relationship Amongst Task Uncertainty, Locus of Control and Broad Scope MAS Information

Relying on existing theories and empirical evidence, reviewed above, we predict that managerial performance is a function of the three-way interaction amongst the level of task uncertainty, a manager’s locus of control and the extent to which a manager uses broad scope MAS information for managerial decisions. An appropriate “fit” between these variables is expected to significantly improve managerial performance.

Low Task Uncertainty Situations

We predict that when the level of task uncertainty is low, both “internal” and “external” managers will make less use of broad scope MAS information in

formulating their decisions. It has been suggested that low task uncertainty situations imply the completeness of managers' knowledge of the cause-effect relationship inherent in their tasks (see [Hirst, 1981, 1983; Thompson, 1967](#)). Further, in low task uncertainty situations, it is possible to develop and pre-determine rules, policies, and standards for the performance of a task ([Tushman & Nadler, 1978](#)). Managers who are operating under these conditions may be able to perform the task by relying on the prescribed rules, policies, and standards. They may not need to obtain and process additional broad scope MAS information. Thus, when the level of task uncertainty is low, less use of broad scope MAS information would be appropriate, as managers' existing task cause-effect knowledge enables task completion.

It is premature to specify *a priori* as to who (i.e. "externals" versus "internals") will perform better when less broad scope MAS information is used for managerial decisions under low task uncertainty situations, since the theory in this area is not well developed. However, under these circumstances, the availability of more broad scope MAS information to "external" managers is unlikely to affect their level of performance, as they would be unlikely to incorporate this additional information into their decisions. The reason for this is that they are less apt to recognize the relevance of this information for their decision-making purposes ([Lefcourt, 1982; Zmud, 1979](#)). Thus, it is hypothesized that the performance level of "external" managers is likely to remain unaffected regardless of the extent of their use of broad scope MAS information for managerial decisions in low task uncertainty situations (Cell 1 = Cell 3, see [Fig. 1](#)).

In contrast, the availability of broad scope MAS information to the "internal" managers is likely to result in them attempting to utilize this information in their decisions, due to the "inquisitive and curious" nature of their personality (see [Lefcourt, 1982](#)), potentially resulting in information overload.² As information overload is dysfunctional ([Chong, 1996; Gul, 1991; Gul & Chia, 1994; Tushman & Nadler, 1978](#)), the quality of these managers' decisions would decline and their performance would deteriorate (see [Iselin, 1988](#)). Thus, it is hypothesized that "internal" managers who make more rather than less use of broad scope MAS information for decision making in low task uncertainty situations will perform less well (i.e. Cell 4 < Cell 2, see [Fig. 1](#)). Furthermore, it is hypothesized that "internal" managers who make more use of broad scope MAS information for managerial decisions in low task uncertainty situations will also perform less well than their "external" counterparts (i.e. Cell 4 < Cell 3, see [Fig. 1](#)).

High Task Uncertainty Situations

Under high task uncertainty situations, we argue that it would be appropriate for managers to utilize more broad scope MAS information to cope with the

Task Uncertainty	Broad Scope MAS Information	Externals	Internals
Low	Less	Cell 1	Cell 2
	More	Cell 3	Cell 4
High	Less	Cell 5	Cell 6
	More	Cell 7	Cell 8

Alternative hypotheses:

- H1: Cell 1 = Cell 3
- H2: Cell 4 < Cell 2
- H3: Cell 4 < Cell 3
- H4: Cell 5 = Cell 7
- H5: Cell 8 > Cell 6
- H6: Cell 8 > Cell 7

Fig. 1. A Summary of the Proposed Hypothesized Relationships Between Task Uncertainty, Locus of Control, and Broad Scope MAS Information on Managerial Performance.

complexities of the decision environment (Chong, 1996; Fisher, 1996; Gul & Chia, 1994; Mia, 1993). The use of more broad scope MAS information would help to reduce task uncertainty, thereby enhancing decision quality, which in turn, should improve their performance.

However, it is premature to specify a priori as to who (i.e. “externals” vs. “internals”) would perform better under conditions of high task uncertainty when little broad scope MAS information is available for decision-making, since the theory in this area is also not well developed. However, under conditions of

high task uncertainty, the availability of more broad scope MAS information is unlikely to alter the performance level of “external” managers, as they are less apt to recognize the relevance of this information for their decisions (Lefcourt, 1982; Zmud, 1979). Thus, it is hypothesized that the performance level of “external” managers is likely to remain unaffected regardless of the extent of availability of broad scope MAS information for managerial decisions in high task uncertainty situations (i.e. Cell 5 = Cell 7, see Fig. 1).

In contrast, the availability of more broad scope MAS information to “internal” managers is likely to help them to reduce task uncertainty, thereby enhancing the quality of their decisions, contributing to higher managerial performance. There are several reasons for this. Firstly, “internal” managers will be able to cope more effectively than their “external” counterparts through greater utilization of more broad scope MAS information (Phares, 1968; Spector, 1982; Wolk & DuCette, 1974). Secondly, there is evidence that “internal” managers are more effective at manipulating ambiguous task environments to find the relevant information they need to make sound decisions than their “external” counterparts (Spector, 1982). Thirdly, “internal” managers are also able to “...perform better in situations that allow them to exercise control and to take the actions they believe are appropriate under the circumstances” (Hyatt & Prawitt, 2001, p. 266). Thus, it is hypothesized that “internal” managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations are likely to perform better than their “external” counterparts (i.e. Cell 8 > Cell 7, see Fig. 1). Furthermore, it is hypothesized that “internal” managers who make more rather than less use of broad scope MAS information for managerial decisions in high task uncertainty situations are associated with more positive managerial performance (i.e. Cell 8 > Cell 6, see Fig. 1).

Accordingly, we expect to reject the null hypothesis for the three-way interaction between task uncertainty, locus of control and the extent of managers’ use of broad scope information on managerial performance. That is:

H01. There is no statistically significant three-way interaction between task uncertainty, locus of control and the extent of use of broad scope MAS information affecting managerial performance.

The alternative hypotheses are:

H1. The performance level of “external” managers will not be affected by the extent of their use of broad scope MAS information for managerial decisions in low task uncertainty situations (Cell 1 = Cell 3, Fig. 1).

H2. “Internal” managers who make more use of broad scope MAS information for managerial decisions in low task uncertainty situations will perform less

well than their “internal” counterparts who make less use of broad scope MAS information (Cell 4 < Cell 2, Fig. 1).

H3. “Internal” managers who make more use of broad scope MAS information for managerial decisions in low task uncertainty situations will perform less well than their “external” counterparts (Cell 4 < Cell 3, Fig. 1).

H4. The performance level of “external” managers will not be affected by the extent of their use of broad scope MAS information for managerial decisions in high task uncertainty situations (Cell 5 = Cell 7, Fig. 1).

H5. “Internal” managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations will perform better than their “internal” counterparts who make less use of broad scope MAS information (Cell 8 > Cell 6, Fig. 1).

H6. “Internal” managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations will perform better than their “external” counterparts (Cell 8 > Cell 7, Fig. 1).

METHOD

Sample Selection

A total of 176 manufacturing companies were randomly chosen from *Kompass Australia* (1996) and the names of 225 senior managers were gathered. The criteria for inclusion in the sample were as follows: (1) the companies must have had at least 100 employees;³ and (2) the respondents were required to have responsibility for operations of their business units. Telephone calls were made to each manager to ensure that the above criteria were satisfied and to solicit their participation in the research project. This resulted in 179 managers for inclusion in the sample.⁴ Each participant was sent a questionnaire together with a covering letter and a prepaid self-addressed envelope for the questionnaire to be returned directly to the researchers. Questionnaires were pre-coded to enable non-respondents to be traced and follow-up to be executed. A follow-up letter and another copy of the questionnaire were sent to those who had not responded after three weeks. Of the 179 questionnaires sent, 147 were returned, giving a response rate of 82.12%. Of the 147 responses, 16 were excluded from the study for incomplete responses, resulting in 131 useable responses. We tested for non-response bias by the approach suggested by Oppenheim (1966, p. 34). We found no statistically significant differences in the mean scores of the responses between the early and

late replying respondents. The mean age of the respondents was 47 years. On average, the respondents had worked for their present company for 10 years and had been in their current position for 7 years. The average number of employees in the respondents' areas of responsibility was 137 and the companies had an average of 634 employees.

Measurement of Variables

The Withey et al. (1983) nine-item instrument was used to evaluate task uncertainty. This was selected in preference to Van de Ven and Delbecq's (1974) task uncertainty instrument as a number of prior accounting studies have reported low internal reliability scores (as measured by Cronbach's alpha statistic) for the latter instrument (see e.g. Brownell & Dunk, 1991; Lau et al., 1995; Mia, 1987). Accordingly, respondents were asked to indicate the extent to which they agreed to the nine items on a seven-point Likert-type scale, varying from (1) strongly disagree, to (7) strongly agree. A factor analysis of the task uncertainty scale was conducted to examine its dimensionality. The results indicated that all nine items loaded above the 0.5 level on the first factor, which explained 65.67% of the total variance. Consistent with prior accounting studies that have used this instrument (e.g. Brownell & Hirst, 1986; Chong, 1996; Lau et al., 1995), the scores of the nine items were summed to give a composite measure of task uncertainty. The use of the task uncertainty scale yielded a Cronbach alpha coefficient (Cronbach, 1951) of 0.93, which indicates very high internal reliability for the scale (Nunnally, 1967).

Locus of control was measured using the Chance scale developed by Levenson (1973). Blau (1984, p. 174) argues that this eight-item, six-point Likert-type scale is "a very expedient way to measure locus of control." Further, Blau concluded that the Chance scale was more factorially stable and possessed a higher internal consistency than Rotter's (1966) original Internal-External scale. This scale has been used successfully by other accounting researchers (e.g. Nouri, 1992). A factor analysis confirmed the unidimensional nature of the locus of control construct. The results indicated satisfactory construct validity (Kerlinger, 1964) in which all of the eight items loaded above the 0.5 level on the first factor, which explained 55.44% of the total variance. The use of the locus of control scale yielded a Cronbach alpha coefficient (Cronbach, 1951) of 0.88, which indicates high internal reliability for the scale (Nunnally, 1967).

The extent of use of broad scope MAS information was measured by a six-item, five-point Likert-type scale originally developed by Chenhall and Morris (1986). In Chenhall and Morris's (1986) instrument, the respondents were asked to rate

the *perceived usefulness* of broad scope MAS information. As the link between *perceived usefulness* of broad scope MAS information to managers' performance is likely to be rather weak, the respondents in this study were asked instead to rate *the extent of use* of the broad scope MAS information which was available from their business unit's accounting system when making various managerial decisions. Prior studies (e.g. Chong, 1996; Gul, 1991) have supported the view that it is *the extent of use* of broad scope MAS information that enhances decision effectiveness and ultimately impacts on managers' performance. A factor analysis confirmed the unidimensional nature of the broad scope MAS information construct. The results indicated satisfactory construct validity (Kerlinger, 1964) in which all of the six items loaded above the 0.5 level on the first factor, which explained 72.10% of the total variance. The Cronbach alpha coefficient (Cronbach, 1951) was 0.92, which indicates very high internal reliability for the scale (Nunnally, 1967).

Managerial performance was measured by an instrument using a self-rating scale developed by Mahoney et al. (1963, 1965). This scale has been used extensively and found to be reliable in other management accounting studies (Brownell & Dunk, 1991; Brownell & Hirst, 1986; Chong, 1996; Chong & Chong, 2002; Lau et al., 1995). This nine-dimensional, seven-point Likert-type scale comprises eight items relating to various managerial activities, plus one overall performance dimension. The eight managerial activities are: planning, investigating, coordinating, evaluating, supervising, staffing, negotiating and representing (see Mahoney et al., 1963, 1965). To test for the validity and reliability of the managerial performance scale, analysis was undertaken to ensure that the eight sub-dimensions jointly accounted for at least 55% of the variation in the overall performance rating (see Mahoney et al., 1963, 1965). The overall performance rating was regressed on the ratings of the eight separate managerial activities using multiple regression. The resulting R^2 indicates that the eight separate dimensions explained 63% of the variance in the overall performance rating. These values compare favorably with the claim of Mahoney et al. (1963, pp. 105–107) that the eight separate dimensions should account for approximately 55% of the variance of the overall rating, with the remaining 45% being job-specific. A further test revealed that when the eight sub-dimensions were summed to construct a composite managerial performance score, they were significantly correlated ($r = 0.75$, $p < 0.001$) with the overall performance rating. The above tests strengthen our confidence in the validity and reliability of the Mahoney et al. scale to measure managerial performance. Given these findings, and consistent with prior accounting studies (e.g. Chong, 1996; Chong & Chong, 2002; Lau et al., 1995), we used the overall performance rating of the Mahoney et al. scale as the dependent variable to test our hypotheses.

RESULTS

Descriptive Statistics

Table 1 presents the descriptive statistics for the variables used in this study and the related Pearson correlation matrix.

The descriptive statistics shown in Table 1 indicate, firstly, that the observed ranges for all variables closely match the theoretical ranges of each of the variables measured in our study. Secondly, the observed means all lie a little above the theoretical means for the relevant variables. This is not surprising, given that our sample consists of managers who hold senior positions in the organisations surveyed. Prior literature indicates that individuals having an internal locus of control personality would be considered better suited to managerial positions than are individuals having an external locus of control personality, due to their belief in their ability to exercise control over their environments, and to take appropriate information seeking and utilization behavior (Anderson, 1977; Hyatt & Prawitt, 2001; Miller & Toulouse, 1986a, b; Rotter, 1966). Thus we would expect the mean observed level of locus of control to lie slightly above the theoretical mean of that scale. We would also expect that on average, managers holding such senior positions of responsibility would face higher rather than lower levels of task uncertainty. Thus we would expect the mean observed level of task uncertainty to lie slightly above the theoretical mean of that scale. Given the observed mean

Table 1. Descriptive Statistics and Pearson Correlation Matrix for the Independent and Dependent Variables (n = 131).

Variable	Mean	S.D.	Actual Range		Theoretical Range		Pearson Correlation Matrix			
			Min	Max	Min	Max	TU	LOC	MAS	PERF
Task uncertainty (TU)	4.89	1.77	1.00	7.00	1.00	7.00	1.000			
Locus of control (LOC)	4.54	1.12	1.50	6.00	1.00	6.00	0.336***	1.000		
Broad scope MAS information (MAS)	3.56	1.33	1.00	5.00	1.00	5.00	0.365***	0.309***	1.000	
Managerial performance (PERF)	5.64	1.12	2.00	7.00	1.00	7.00	0.347***	0.033	0.119	1.000

***Significant at p < 0.01 level (two-tailed test).

levels of these two variables, it is not surprising that, on average, managers tend to make somewhat more rather than less use of broad scope MAS information. Finally, the fact that managers on average rate their performance higher than the theoretical mean of the managerial performance scale is consistent with a leniency bias observed in most studies using self-rating performance scales (Prién & Liske, 1972; Thornton, 1968).

The results relating to the level of correlation between pairs of the variables incorporated in our study are also shown in Table 1. These indicate, firstly, that there is a moderate level of positive correlation that is statistically significant between Task Uncertainty and the Extent of Use of Broad Scope MAS Information ($r = 0.365, p < 0.01$). This result is consistent with prior empirical studies. It has been suggested that when the degree of task uncertainty is high, managers will require more broad scope MAS information for managerial decision making to cope with the complexity of the task environment. In contrast, when the degree of task uncertainty is low, managers will require less broad scope MAS information for managerial decisions, as interpreting the task environment is relatively easy (see Chong, 1996; Gul, 1991).

Secondly, the correlation results in Table 1 indicate that there is a moderate level of positive correlation that is statistically significant between Task Uncertainty and Locus of Control ($r = 0.336, p < 0.01$). This result is also consistent with our expectation, which is based on our review of the relevant prior literature. As noted above, individuals with an “internal” locus of control are more suited to undertake managerial tasks than their “external” counterparts (Anderson, 1977; Hyatt & Prawitt, 2001; Miller & Toulouse, 1986a, b; Rotter, 1966). Further, senior managerial positions are likely to involve tasks involving high levels of task uncertainty. Hence, the positive association between managers having higher levels of internal locus of control and higher task uncertainty situations, and vice-versa is not surprising. More specifically, prior literature suggests that “internals,” in contrast to “externals,” are more likely to engage in innovative and pro-active strategies, take higher risks and exhibit entrepreneurial behaviour (Brockhaus, 1982; Durand & Shea, 1974; Miller et al., 1982; Miller, 1983; Miller & Toulouse, 1986a, b; Shapero, 1975). These findings are in line with the frequent observation that innovative and pro-active strategies, risk taking and entrepreneurial behaviour occur in uncertain task environments.

Thirdly, the correlation results in Table 1 indicate that there is a moderate level of positive correlation that is statistically significant between Locus of Control and the Extent of Use of Broad Scope Information ($r = 0.309, p < 0.01$). This result is also consistent with our expectation. Our above review of the relevant literature indicated that “internals” are more active in their search for and use of task-relevant information (i.e. broad scope MAS information) than their “external”

counterparts (Davis & Phares, 1967; Spector, 1982). Understandably, “externals” are less likely than “internals” to so actively seek task-relevant information in conditions of high uncertainty, because they have less confidence than “internals” in their ability to control their task environment, rather attributing outcomes to fate (Miller, 1983).

Test of the Null Hypothesis Relating to the Three-way Interaction

The null hypothesis relating to the three-way interaction was tested using moderated regression analysis based on the following multiplicative model:

$$\begin{aligned} \text{PERF} = & b_0 + b_1\text{TU} + b_2\text{LOC} + b_3\text{MAS} + b_4\text{TU} \times \text{LOC} + b_5\text{TU} \times \text{MAS} \\ & + b_6\text{LOC} \times \text{MAS} + b_7\text{TU} \times \text{LOC} \times \text{MAS} + e \end{aligned} \tag{1}$$

where,

- PERF = Managerial Performance
- MAS = Extent of Use of Broad Scope MAS Information
- TU = Task Uncertainty
- LOC = Locus of Control
- e* = Error Term

Hypothesis H01 states that there is no statistically significant three-way interaction between task uncertainty, locus of control and the extent of use of broad scope MAS information affecting managerial performance. To test this hypothesis, managerial performance was regressed on task uncertainty, locus of control and the extent of use of broad scope MAS information using the regression model presented in Equation (1). Table 2 indicates the results of the multiple regression analyses undertaken to test hypothesis H01. Equation (1A) (a two-way interaction regression model) was used to establish a base adjusted R^2 figure against which the adjusted R^2 of Equation (1B) (a three-way interaction regression model) could be compared to assess the incremental contribution of the three-way interaction to the explanation of the variance associated with managerial performance.

The results reported in Table 2 indicate that the coefficient of the three-way interaction term (b_7) is positive and significant ($t = 3.5341$, $p < 0.0006$). Accordingly, hypothesis H01 can be rejected. The introduction of the three-way interaction term in Equation (1B) results in a substantial increase in adjusted R^2 (from 16.8 to 23.9%) indicating that the three-way interaction between task uncertainty, locus of control and the extent of use of broad scope MAS information improved the predictive ability of the model.

Table 2. Results of Multiple Regression Analysis.

Equation (1A) : $PERF = b_0 + b_1TU + b_2LOC + b_3MAS + b_4TU \times LOC + b_5TU \times MAS + b_6LOC \times MAS + e$
Equation (1B): $PERF = b_0 + b_1TU + b_2LOC + b_3MAS + b_4TU \times LOC + b_5TU \times MAS + b_6LOC \times MAS + b_7TU \times LOC \times MAS + e$

Variables	Coeff.	Equation (1A) (Two-way)			Equation (1B) (Three-way)		
		Est.	t-Value	p	Est.	t-Value	p
Constant	b_0	7.3352 (1.0511)	6.9788	0.0001	0.6819 (2.1343)	0.3195	0.7499
Task uncertainty (TU)	b_1	-0.4267 (0.2091)	-2.0404	0.0434	1.0244 (0.4567)	2.2429	0.0267
Locus of control (LOC)	b_2	-0.3721 (0.2552)	-1.4579	0.1474	1.2495 (0.5198)	2.4040	0.0177
Broad scope MAS information (MAS)	b_3	-0.2899 (0.3564)	-0.8134	0.4176	2.1498 (0.7699)	2.7923	0.0061
TU \times LOC	b_4	0.0851 (0.0472)	1.8039	0.0737	-0.2671 (0.1094)	-2.4410	0.0161
TU \times MAS	b_5	0.0869 (0.0418)	2.0789	0.0397	-0.4101 (0.1462)	-2.8051	0.0058
LOC \times MAS	b_6	-0.0253 (0.0637)	-0.3967	0.6923	-0.5892 (0.1708)	-3.4496	0.0008
TU \times LOC \times MAS	b_7				0.1151 (0.0326)	3.5341	0.0006
Adjusted R^2			0.168			0.239	
R^2			0.207			0.280	
F value			5.3794			6.8225	
p			<0.0001			<0.0001	

Note: Adjusted R^2 explained by three-way interaction term = 7.1%.
 $n = 131$; Standard errors are in parentheses.

Tests of the Alternative Hypotheses

In order to test the alternative hypotheses, task uncertainty was dichotomized at its mean to split our sample into high and low task uncertainty sub-samples.⁵ This allowed us to investigate the two-way interactions between managers' locus of control and the extent of their use of broad scope MAS information under varying levels of task uncertainty, consistent with our alternative hypotheses. To test for differences between groups a 2×2 ANOVA (Locus of Control \times Extent of Use of Broad Scope MAS Information) was undertaken for each task uncertainty sub-sample.

Low Task Uncertainty Situation

The mean Managerial Performance scores for each of the four cells pertaining to the low task uncertainty sub-sample are shown in Table 3, Panel A. The results of the 2×2 ANOVA are shown in Table 3, Panel B. As expected the two-way interaction between Locus of Control and Extent of Use of Broad Scope MAS Information is statistically significant ($F = 6.747$, $p < 0.007$). To test for differences between cells, one-tailed tests involving multiple comparisons of simple means were undertaken using Bonferroni t-tests. The results are shown in Table 3, Panel C. These results form the basis for testing Hypotheses H1, H2 and H3.

Test of Hypothesis H1

Hypothesis H1 states that the performance level of "external" managers will not be affected by the extent of their use of broad scope MAS information for managerial decisions in low task uncertainty situations (Cell 1 = Cell 3, Fig. 1). As expected, the results presented in Table 3, Panel C show that the difference between the mean performance scores in Cell 1 (5.381) and Cell 3 (5.833) is not statistically significant (mean difference = -0.452 , n.s.). This is illustrated in Fig. 2 where the gradual slope of the "externals" line demonstrates the insensitivity of "external" managers' performance to the extent of their use of broad scope MAS information for managerial decisions. These results provide support for hypothesis H1.

Test of Hypothesis H2

Hypothesis H2 states that "internal" managers who make more use of broad scope MAS information for managerial decisions in low task uncertainty situations will perform less well than their internal counterparts who make less use of broad scope MAS information (Cell 4 < Cell 2, Fig. 1). As expected, the

Table 3. Low Task Uncertainty Sub-Sample.

Panel A: Mean Managerial Performance Scores

Broad Scope MAS Information	Externals	Internals
Less	Cell 1 $n = 21$ $\bar{Y} = 5.381$ $\sigma_Y = 1.024$	Cell 2 $n = 14$ $\bar{Y} = 5.643$ $\sigma_Y = 1.081$
More	Cell 3 $n = 6$ $\bar{Y} = 5.833$ $\sigma_Y = 0.983$	Cell 4 $n = 10$ $\bar{Y} = 4.100$ $\sigma_Y = 1.853$

Panel B: Analysis of Variance (ANOVA)

	Sum of Squares	df	Mean Square	F	p (1-Tailed)
Locus of Control (LOC)	5.613	1	5.613	3.669	0.031
Broad scope MAS information (MAS)	3.083	1	3.083	2.015	0.081
LOC \times MAS	10.321	1	10.321	6.747	0.007
Error	71.900	47	1.530		

Panel C: Multiple Comparisons (Bonferroni t -Statistics)

	Mean Difference	Standard Error	p (1-Tailed)
Cells 1 and 2	-0.262	0.427	n.s.
Cells 1 and 3	-0.452	0.573	n.s.
Cells 1 and 4	1.281	0.475	0.029
Cells 2 and 3	-0.191	0.604	n.s.
Cells 2 and 4	1.543	0.512	0.013
Cells 3 and 4	1.733	0.639	0.028

results presented in Table 3, Panel C show that the difference between the mean performance scores in Cell 4 (4.100) and Cell 2 (5.643) is statistically significant (mean difference = 1.543, $p < 0.013$, 1-tailed). (Note that the mean performance score of the “internal” managers is the lowest of the four cells (i.e. Cell 4 < Cell 1, Cell 2 and Cell 3, see Table 3, Panel A)). This result is illustrated in Fig. 2 where the steep negative slope of the “internals” line demonstrates the sensitivity of the “internal” managers’ performance to their extent of use of broad scope MAS

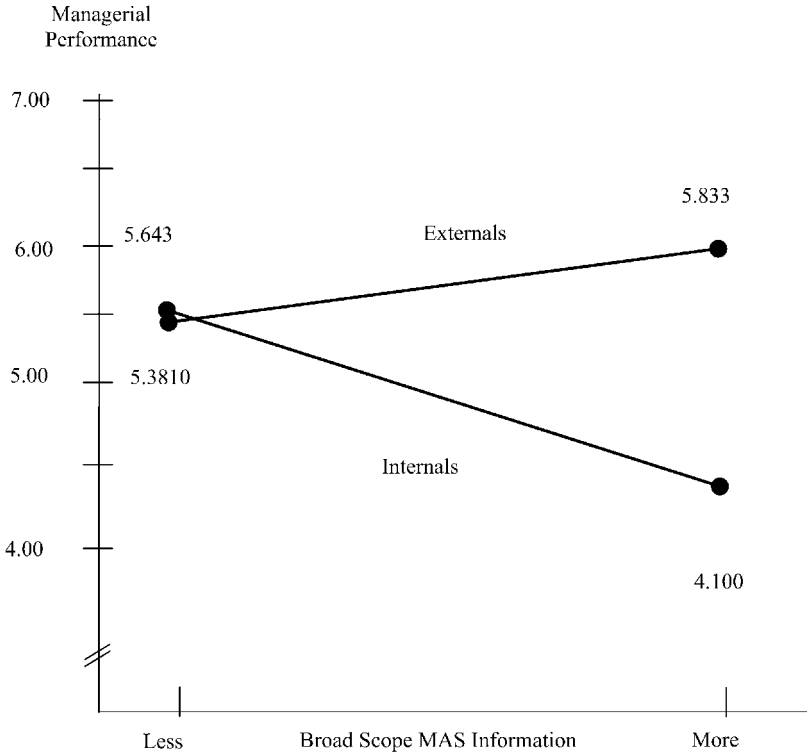


Fig. 2. The Impact of the Interaction Between Locus of Control and the Extent of Use of Broad Scope MAS Information on Managerial Performance – Low Task Uncertainty Sub-Sample.

information in making managerial decisions. This result provides strong support for hypothesis H2.

Test of Hypothesis H3

Hypothesis H3 states that “internal” managers who make more use of broad scope MAS information for managerial decisions in low task uncertainty situations will perform less well than their “external” counterparts (Cell 4 < Cell 3, Fig. 1). The results presented in Table 3, Panel C reveal that the mean performance score of “internal” managers is statistically significantly less than that of their “external” counterparts (Cell 4 = 4.100 < Cell 3 = 5.833, mean difference = 1.733, $p < 0.028$, 1-tailed). This is illustrated in Fig. 2. This result provides strong support for hypothesis H3.

High Task Uncertainty Situation

The mean Managerial Performance scores for each of the four cells pertaining to the high task uncertainty sub-sample are shown in Table 4, Panel A. The results of the 2×2 ANOVA are shown in Table 4, Panel B. The two-way interaction between Locus of Control and Extent of Use of Broad Scope MAS Information is not statistically significant ($F = 1.239$, n.s.). Nevertheless, to facilitate direct tests of hypotheses involving these cell means, one-tailed tests involving multiple comparisons of simple means were undertaken using Bonferroni t-tests. The results are shown in Table 4, Panel C. These results form the basis for testing Hypotheses H4, H5 and H6.

Test of Hypothesis H4

Hypothesis H4 states that the performance level of “external” managers will not be affected by the extent of their use of broad scope MAS information for managerial decisions in high task uncertainty situations (Cell 5 = Cell 7, Fig. 1). As expected, the results presented in Table 4, Panel C show that the mean performance scores between Cell 5 (5.556) and Cell 7 (5.929) are not statistically significant (mean difference = -0.373 , n.s.). This is illustrated in Fig. 3 where the gradual slope of the “externals” line demonstrates the insensitivity of “external” managers’ performance to the extent of their use of broad scope MAS information for managerial decisions. These results provide support for hypothesis H4.

Test of Hypothesis H5

Hypothesis H5 states that “internal” managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations will perform better than their “internal” counterparts who make less use of broad scope MAS information (Cell 8 > Cell 6, Fig. 1). The results presented in Table 4, Panel C show that the mean performance score of “internals” is significantly higher when they use more rather than less broad scope MAS information for managerial decisions (Cell 8 = 6.140 > Cell 6 = 5.286, mean difference = -0.854 , $p < 0.004$, 1-tailed). (Note that the mean performance score of the “internals” who use more broad scope MAS information is the highest of the four cells (i.e. Cell 8 > Cell 5, Cell 6 and Cell 7, see Table 4, Panel A)). This result is illustrated in Fig. 3 where the steep positive slope of the “internals” line demonstrates the sensitivity of the “internal” managers’ performance to their extent of use of broad scope MAS information in making managerial decisions. This result provides strong support for hypothesis H5.

Test of Hypothesis H6

Hypothesis H6 states that “internal” managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations will

Table 4. High Task Uncertainty Sub-Sample.

Panel A: Mean Managerial Performance Scores					
Broad Scope MAS Information	Externals	Internals			
Less	Cell 5 $n = 9$ $\bar{Y} = 5.556$ $\sigma_Y = 1.014$	Cell 6 $n = 14$ $\bar{Y} = 5.286$ $\sigma_Y = 0.611$			
More	Cell 7 $n = 14$ $\bar{Y} = 5.929$ $\sigma_Y = 1.269$	Cell 8 $n = 43$ $\bar{Y} = 6.140$ $\sigma_Y = 0.639$			
Panel B: Analysis of Variance (ANOVA)					
	Sum of Squares	df	Mean Square	F	p (1-Tailed)
Locus of Control (LOC)	0.012	1	0.012	0.019	0.446
Broad scope MAS information (MAS)	5.429	1	5.429	8.064	0.003
LOC \times MAS	0.834	1	0.834	1.239	0.135
Error	51.171	76	0.673		
Panel C: Multiple Comparisons (Bonferroni t -Statistics)					
	Mean Difference	Standard Error	p (1-Tailed)		
Cells 5 and 6	0.270	0.351	n.s.		
Cells 5 and 7	−0.373	0.551	n.s.		
Cells 5 and 8	−0.584	0.301	n.s.		
Cells 6 and 7	−0.643	0.310	n.s.		
Cells 6 and 8	−0.854	0.252	0.004		
Cells 7 and 8	−0.211	0.252	n.s.		

perform better than their “external” counterparts (Cell 8 > Cell 7, Fig. 1). As can be seen in Table 4, Panel A, the mean performance of “internal” managers (Cell 8 = 6.140) is greater than that of their “external” counterparts (Cell 7 = 5.929). However, the results shown in Table 4, Panel C reveal that this difference is not statistically significant (mean difference = -0.211, n.s.). This is illustrated in Fig. 3. Thus, hypothesis H6 cannot be supported. This result is surprising given our expectation that “internal” managers would be able to perform more effectively than their “external” counterparts, in high task uncertainty situations, through

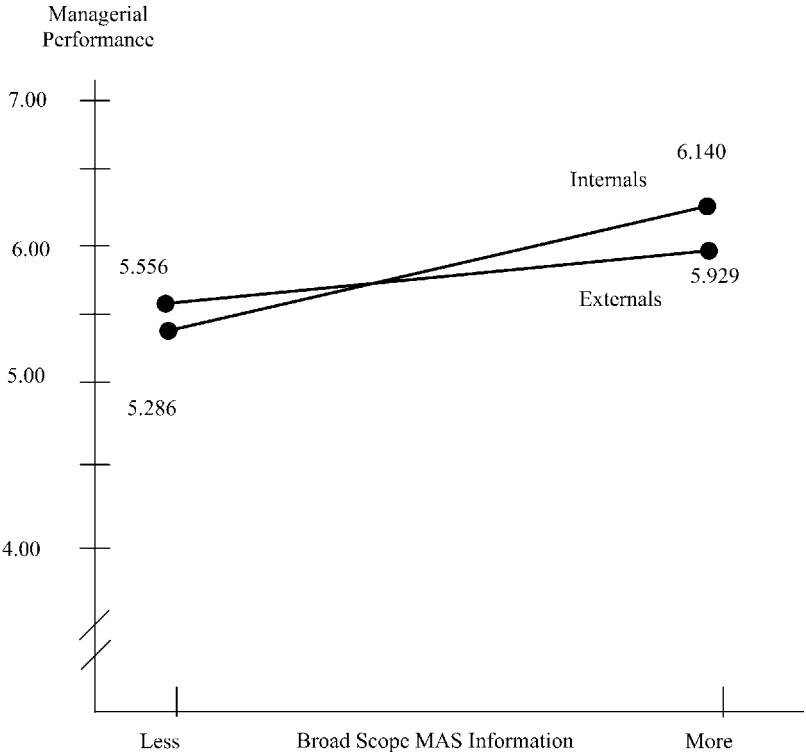


Fig. 3. The Impact of the Interaction Between Locus of Control and the Extent of Use of Broad Scope MAS Information on Managerial Performance – High Task Uncertainty Sub-Sample.

greater utilization of broad scope MAS information in their decision-making processes.

DISCUSSION AND CONCLUSIONS

The results of this paper suggest that managerial performance is a function of the interaction between the level of task uncertainty (a task characteristic), a manager's locus of control (a personality variable) and MAS design (a control subsystem variable). These results are consistent with our theoretical expectations and the findings of prior studies that suggested that decision-making behavior is

a function of task characteristics, decision-maker characteristics and the interaction amongst these characteristics (Hogarth, 1993; Peters, 1993; Solomon & Shields, 1995).

Our results suggest that the impact on managerial performance of the two-way interaction between managers' locus of control and the extent of their use of MAS broad scope information depends on the level of task uncertainty they confront. Specifically, under conditions of low task uncertainty, "external" managers' extent of use of broad scope MAS information has no statistically significant impact on their level of performance. This is consistent with H1. In contrast, "internal" managers who make more use of broad scope MAS information under these conditions perform less well than their "internal" counterparts who make less use of broad scope MAS information. This supports H2 and is consistent with theoretical propositions and past empirical findings⁶ that "internals" greater "inquisitiveness and curiosity" compared to "externals" (Lefcourt, 1982) may lead to information overload under conditions of low task uncertainty, which is detrimental to their performance. Thus, it would appear that the "internal" managers' greater information search and utilization strategies are counterproductive under these conditions. Further, as hypothesized (H3), this results in the performance of these "internal" managers being statistically significantly lower than that of their "external" managerial counterparts under conditions of low task uncertainty.

Under high task uncertainty conditions, our results indicate that the performance of "external" managers does not differ regardless of the extent of their use of broad scope MAS information for managerial decision-making purposes, but that "internal" managers improve their performance by making more use of broad scope MAS information under these conditions. These results confirm H4 and H5, respectively. They also provide empirical evidence to support Galbraith's (1973, 1977) information processing theory and Rotter's (1966) social learning theory. Most importantly, the results also lend further support for the findings of prior empirical studies (e.g. Chong, 1996; Gul, 1991; Gul & Chia, 1994; Mia, 1993; Mia & Chenhall, 1994). However, with respect to H6, although our results reveal that "internal" managers who make more use of broad scope MAS information for managerial decisions in high task uncertainty situations outperform their "external" counterparts (Cell 8 = 6.140, see Table 4 and Fig. 3 versus Cell 7 = 5.929, see Table 4 and Fig. 3), this difference in performance fails to reach conventional levels of statistical significance (i.e. $p < 0.05$). This result is somewhat surprising given our theoretical arguments in this paper, as well as the results of prior psychological studies, which suggest that "internals" are more efficient in the utilization of information than "externals" (see e.g. Lefcourt, 1982; Phares, 1968; Spector, 1982; Wolk & DuCette, 1974).

Contributions of Our Study

The results of our study have both theoretical implications and practical relevance. The next two sections elaborate upon these two contributions.

Theoretical Contributions

In developing a comprehensive theory of MAS design, it is essential that the theory incorporate the source of demand for managerial accounting information. As noted earlier, we argue that the effect of managers' use of management accounting information on their performance is affected by task characteristics (here, the level of task uncertainty) and personal characteristics (here, the personality variable of locus of control) (Hogarth, 1993; Newell & Simon, 1972; Peters, 1993; Simon, 1980; Solomon & Shields, 1995). This study contributes to the existing literature on MAS design by integrating contingency theory (as reflected in the task uncertainty variable) and social learning theory (as reflected in the locus of control variable) to further our understanding of the effect of managers' use of management accounting information on managerial performance.

Firstly, the results of our study indicate that two contingent variables, namely, task uncertainty and locus of control should be considered jointly when examining the impact of managers' use of management accounting information on managerial performance. The results indicate that task uncertainty appears to be an important factor affecting the managerial decision process. This finding is consistent with prior management accounting studies (e.g. Chong, 1996; Chong & Chong, 1997; Gul, 1991; Gul & Chia, 1994; Mia, 1993; Mia & Chenhall, 1994) that have argued that the level of uncertainty in the decision environment (either macro and/or micro-level) should influence the decision-making processes of users of accounting information. The results of this study imply that as the level of task uncertainty increases, managers should process greater amounts of broad scope MAS information if performance is to be maximized. This view is consistent with Galbraith's (1973, 1977) information processing theory.

Our results also indicate that locus of control appears to be an important factor affecting the effectiveness (as measured by performance) of managers' use of a certain MAS information characteristics to facilitate their decision-making processes. This finding is consistent with prior accounting studies that have argued that personality traits have an important influence on the manner in which decision-makers process and use accounting information (see e.g. Hyatt & Prawitt, 2001; Fisher, 1996; Gul, 1984; Tsui & Gul, 1996). Specifically, the results of this study show that while "external" managers' performance is

unaffected by the extent of their use of broad scope information, the extent of use of broad scope MAS information by “internal” managers has a dramatic impact on their performance. As their extent of use of broad scope MAS information increases under low task uncertainty conditions, their performance declines. In sharp contrast, as their extent of use of broad scope MAS information increases under high task uncertainty conditions, their performance increases. Moreover, their performance in each of these instances is, respectively, the poorest and the best of the four Locus of Control X Broad Scope MAS Information combinations investigated here, under both low and high task uncertainty conditions. These findings are largely consistent with [Rotter's \(1966\)](#) social learning theory.

Secondly, our results cast light on, and extend the findings of, two prior studies ([Chong, 1996](#); [Fisher, 1996](#)) on MAS design by predicting and demonstrating a three-way interaction effect amongst task uncertainty, locus of control and broad scope MAS information, affecting managerial performance. We extended [Fisher's \(1996\)](#) study in a number of aspects. First, Fisher, despite [Chenhall and Morris's \(1986, p. 31\)](#) suggestion for future research to examine “the effect of different types of MAS information on managers' performance,” failed to explore the managerial performance effects of matching individuals' personality traits with the MAS information characteristics they perceived to be useful. This study systematically extended Fisher's study by including managers' performance as the appropriate dependent variable. Second, Fisher's results were statistically significant, but in the *opposite* direction to hypothesized. Two plausible explanations for Fisher's unexpected results relate firstly, to her choice of PEU as a moderating variable and secondly, to her choice of the instrument used to measure managers' locus of control. From a conceptual perspective, Fisher's choice of PEU was problematic as PEU was operationalized at the organizational (macro)-level, whilst the impact of managers' locus of control was operationalized at the task/individual (micro)-level. The use of task uncertainty instead of PEU may have been more appropriate ([Chong, 1996](#)). From a methodological perspective, the use of [Rotter's \(1966\)](#) scale to measure managers' locus of control may not have adequately captured the underlying personality construct as “the scale is a generalized and rough measure of the construct” ([Fisher, 1996](#), p. 366; see also [Frucot & Shearon, 1991](#); [Hodgkinson, 1992](#)). To overcome these two limitations, this study measured the decision environment at the task/individual (micro)-level using [Withey et al. \(1983\)](#) measure of task uncertainty, and used an alternative measurement instrument to capture managers' locus of control developed by [Levenson \(1973\)](#). The Levenson's instrument has been used successfully by other accounting (see e.g. [Nouri, 1992](#)) and non-accounting studies (e.g. [Blau, 1984](#)). [Blau \(1984\)](#) concluded that the Levenson's scale was more factorially stable and possessed a

higher internal consistency than Rotter's (1966) original Internal-External scale. In addition, this study also systematically extended Chong's (1996) study by incorporating the personality variable of locus of control as another variable moderating the relationship between MAS design and managerial performance, in addition to task uncertainty.

In summary, the results of our study provide additional empirical evidence for the recognition of individual-task interactions in the human information processing research paradigm, and further support the theoretical argument of prior studies (e.g. Hogarth, 1993; Newell & Simon, 1972; Peters, 1993; Simon, 1980; Solomon & Shields, 1995) that decision-making behavior is a function of task characteristics, decision-maker characteristics, and the interaction among these characteristics.

Practical Contributions

The results of this study have practical implications for the selection and placement of managers as well as for the effective design of MAS. An organization is only as strong as the people it comprises. Thus, decisions made about whom to select and reject for organizational membership, and the placement of those selected to appropriate positions, are critical to the company's ability to derive competitive advantage through its human resources. Bowen et al. (1991), for example, argue that firms should look at individuals in terms of their long-term potential to contribute to the organization, as opposed to a short-term focus on meeting the requirements of one specific job. As such, the emphasis should be on matching the potential employees' personal attributes and characteristics to those of the organizational culture and task environment. Additionally, organizational MAS (and broader MIS) should be designed to facilitate the differing information needs of employees varying on relevant personality traits, particularly locus of control. We concur with Fisher's (1996, p. 367) observation that "clarification of the role of individual differences in dealing with information under varying conditions of uncertainty will lead to more effective use and design of MIS information."

With respect the latter, our results suggest that organisations may benefit from an investigation of the feasibility of building into their MAS a locus of control instrument which, once activated by an end user of MAS information, would display information in terms of scope (and possibly other attributes) and content in a manner compatible with the end-users' locus of control. Whilst the particular information alternative presented to "external" managers would be unlikely to affect their performance, the results of our study indicate that it may significantly impact on the performance of "internal" managers.

LIMITATIONS OF OUR STUDY AND FUTURE RESEARCH OPPORTUNITIES

Our study has a number of limitations that should be noted. First, our study did not consider other variables, which might be significant to the design of effective MAS and their impact on managers' performance. For example, at the organizational (macro)-level, the variables that potentially affect MAS design and organizational/managerial performance include: their external environment (such as PEU (e.g. Chong & Chong, 1997; Gul & Chia, 1994; Khandwalla, 1972; Mia, 1993)) and intensity of market competition (e.g. Mia & Clarke, 1999); the organizations' structure (e.g. Chia, 1995; Gul & Chia, 1994); the organizations' strategies (e.g. Abernethy & Guthrie, 1994; Chong & Chong, 1997; Fisher & Govindarajan, 1993; Langfield-Smith, 1997), and their managerial style (e.g. Colson, 1980). At the individual (micro)-level, another potential variable is decision-makers' cognitive styles (see e.g. Awasthi & Pratt, 1990; Gul, 1984). In addition, as international trade continues to grow and global competition becomes more intense, this line of research should be extended and replicated in other countries as national culture has been shown to be an important variable which affects the design of effective MAS (e.g. Frucot & Shearon, 1991; Harrison, 1992, 1993; Lau et al., 1995, 1997). It is acknowledged that had omitted variables been included in our study these could have generated different results. However, in order to keep the scope of this study manageable, these potentially relevant variables were not included. Thus, it would be valuable to conduct future research to develop a more comprehensive model, which incorporated these variables.

Second, our sample comprised only senior-level managers drawn from large manufacturing companies in the Perth and Sydney metropolitan areas; consequently, the results are potentially generalizable to the Australian managerial populations, but are restricted to a similar level of management. In particular, generalizing the results to non-manufacturing industries should be viewed with caution. Future research may extend and replicate this work focusing on other industries such as the financial services and retailing sectors.

Third, the use of self-rating scales, used by us to measure managers' perceptions of their performance, are likely to have higher mean values (a higher leniency error) and a restricted range (lower variability error) in the observed score compared to more objective methods (Prien & Liske, 1972; Thornton, 1968). Gul (1991, p. 60) argued, "managers' perception of their own performance may not capture the actual performance of the firm. Where possible, performance should therefore be measured in terms of objective measures such as return on investment (ROI) or return on assets (ROA)." Given the difficulty of obtaining access to

such data at the business unit level, future research might usefully incorporate superiors' ratings of their managers to compare with the managers' self-ratings as a means of assessing the validity of the construct. In addition, the use of a self-rating scale to ask managers from different companies about their extent of use of the broad scope MAS information may depend on their perceptions about the construct which may not be the same or similar for all subjects.

Finally, this study is only able to show associations among the variables studied. While theory and prior literature suggest that the independent variable (MAS) precedes the dependent variable (i.e. managerial performance) such an assumption is entirely theory-driven and cannot be imputed from the cross-sectional survey methodology we used. Therefore, the potential for reverse or reciprocal causality cannot be ruled out. Cross-sectional analysis does not provide confirmatory evidence of causal relationships. Further research using a longitudinal methodology would allow empirical testing of the direction of causality. In addition, the use of laboratory experiments or case studies focusing on the variables of interest would strengthen the underlying theory. Despite the above limitations, the results of this study contribute to relevant theory and extend existing knowledge of the management accounting literature in the area of management accounting systems (MAS) design, and provide a useful basis for subsequent theoretical development in the field and related empirical tests thereof.

NOTES

1. "External" locus of control managers are individuals who believe their destinies are controlled by luck or chance, whereas "internal" locus of control managers are individuals who believe they have a lot of control over their destinies (Rotter, 1966).

2. According to Rosen and Schneck (1969, p. 13), information overload is defined as "the amount of information input which is greater than that which the organization or its decision makers can adequately handle." For a further discussion on information overload, see Rosen and Schneck (1969).

3. This paper requires the companies selected to be organized on a work-unit basis because the measurement instrument for task uncertainty is designed to use on a work-unit basis (see Chong, 1996; Withey et al., 1983). Companies with less than 100 employees are not likely to be organized on a work-unit basis (see Brownell & Dunk, 1991).

4. Forty-six managers were not included in the final sample for a number of reasons. First, some failed to meet the criteria. Second, others could not be contacted. Third, some had retired or left the companies. Finally, some of the companies had ceased operations or moved.

5. Similar results were obtained when the data was split based on median values.

6. See for example, Tushman and Nadler (1978), Gul (1991), Gul and Chia (1994), and Chong (1996); see also Schroder et al. (1967), Newell and Simon (1972), Keller and Staelin (1987), Chewning and Harrell (1990), and Iselin (1988, 1990, 1993).

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CHANGE IN STRATEGY AND MCS: A MATCH OVER TIME?

Ralph Kober, Juliana Ng and Byron Paul

ABSTRACT

This paper examines the relationship between strategy and MCS over time to study whether MCS changes when there is a change in strategic typology. This was achieved through the use of a questionnaire, supplemented with documentation review and interviews, in a public sector organization that had experienced a strategic change. The results showed that, as strategy changed, the MCS also changed. There was a significant increase in the use of both formal and informal control mechanisms over the period examined, which is consistent with [Simons \(1987\)](#). Furthermore, the manner in which some controls were used became more interactive.

1. INTRODUCTION

The aim of this paper is to examine the relationship between strategy and MCS over time. It is generally recognized in contingency theory that, for enhanced performance, there needs to be a match between an organization's management control system (MCS) and its strategy. By extension, the contingency framework suggests that when strategy changes, the MCS also changes. While contingency research highlights the importance of achieving a match between strategy and MCS, much of the literature to date has concentrated on cross-sectional analysis, thus providing a static representation of the relationship, and precluding an

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examination of the relationship when a strategic change occurs. This paper aims to fill this gap. As such, the research question is to see if an organization that changes its strategic typology also changes its MCS to match. The research site is a public sector organization that recently experienced a change in strategic typology. This paper takes the form of a retrospective analysis of the Pre-change, Change, and Post-change time periods and uses interviews, a review of formal documentation, and a questionnaire to examine the research question.

This paper contributes to the extant literature in several ways. First, prior literature has not examined the relationship between strategy and MCS when a change in strategic typology occurs. A case study approach, like the one we adopt in this paper, facilitates a dynamic and comprehensive examination of contingency relationships (Sim & Teoh, 1997) and hence provides insights into the relationship between changes in strategy and the evolution of the MCS. Second, this paper provides some evidence on the generalizability of contingency relationships to the public sector. Atkinson et al. (1997) acknowledge the need to investigate the applicability of concepts derived in the private sector to the public sector.

The remainder of this paper is structured as follows. In the next section, we provide a brief literature review. In Section 3, we develop the hypotheses for this study, discuss the research design, and include a brief description of the organization selected for this study. Section 4 presents the results of this study. Finally, in Section 5 we provide the conclusion, limitations of the study, and future research avenues.

2. PRIOR LITERATURE

Contingency theory argues that there is no universally appropriate control system that applies to all situations. Govindarajan and Shank (1992) recognized that the effectiveness of MCS depended on achieving a match between MCS and strategy. Thus, the appropriateness of different MCS mechanisms is contingent on the circumstances surrounding the organization.

A number of studies have examined the relationship between strategy and MCS, primarily focusing on empirical evidence from organizations in the private sector. These studies, however, have reported conflicting results, as we discuss next. While a number of strategic typology frameworks have been advanced in the literature, this paper uses the Miles and Snow (1978) strategic typology framework as the basis for the discussion of the conflicting results.¹

Miles and Snow (1978) identified four strategy types and posited the relationship between the different strategies and MCS. The strategy types (Defender, Analyzer, Prospector & Reactor) formed a continuum of viable strategies from

Table 1. Miles and Snow (1978) Strategic Typologies.

Defender	Stable environment; limited product range or market development; competes through low cost or high quality; efficiency paramount; centralized structure. Functional organizational structure. Simple, sequential relationships between sub-units, repetitive operation, and absence of non-routine decisions.
Prospector	Always seeking new product and market opportunities; uncertain environment; flexible structure. Marketing and research and development important. Product innovation and industry leadership important. Overlapping project teams and shared resources. Focuses on problem finding. Flexible structures and processes facilitate response to and creation of change. Broadly defined jobs and few standard operating procedures. Decentralized, results-oriented control.
Analyzer	Hybrid. Core traditional products; enters new market after viability established; matrix structure.
Reactor	Lacks coherent strategy; structure inappropriate to purpose; misses opportunities. Unsuccessful.

Defender to Prospector.² Miles and Snow (1978) defined Defenders as organizations operating in relatively stable environments and having a narrow product focus. Defenders emphasized cost-efficiency and therefore relied heavily on formal accounting procedures and cost control. At the other end of the continuum, Prospectors sought to differentiate themselves from competitors by focusing on product-market innovation. These organizations therefore placed less emphasis on accounting controls and implemented more flexible structures to take advantage of new market opportunities. The third category, an Analyzer, was viewed as combining characteristics from both Defenders and Prospectors. Table 1 outlines each strategy type and their respective organizational characteristics.

Prior research has provided support for Miles and Snow’s propositions. Fiegen­er (1994) examined the relationship between strategy, management controls, and the effectiveness of these controls using Porter’s (1980) taxonomies. Specifically, he focused on Differentiators, which aim to differentiate their products from those of their competitors (in Miles & Snow’s typology, this is closest to the Prospector strategy) and Cost Leaders, which aim to be the lowest cost producer in the industry (this is likened to Miles & Snow’s Defender strategy as cost minimization is one facet of this strategy). Fiegen­er found that, for Cost Leaders, the MCS was most effective when the control system was tighter. This “tightness” was characterized by more detailed, explicit, and comprehensive control procedures (formalization); more frequent use of controls; greater role specialization (i.e. control tasks carried out by task specialists rather than line managers), and increased upper management supervision.

In Differentiators, Feigener found that looser controls were beneficial to MCS effectiveness. In fact, tighter controls were found to be detrimental to Differentiators' effectiveness. For these organizations, decentralization of control and more informal methods of control were found to be more effective. However, he also noted that loosening all controls may not be optimal. Rather, depending on the strategic orientation of the organization, some controls should be loosened and others tightened.

Miller and Friesen (1982) examined the relationship between control and innovation in Conservative and Entrepreneurial organizations. Conservative organizations are likened to Miles and Snow's Defenders as they are reluctant to engage in innovation unless faced with serious challenges and threats in the environment. Entrepreneurial organizations, on the other hand, actively undertake product innovation, and can be likened to Prospectors in the Miles and Snow typology. Consistent with Miles and Snow, Miller and Friesen (1982) noted that Entrepreneurs have less sophisticated cost controls. They suggested that the apparent lack of formal controls might be due to the existence of strong "clan controls" (Ouchi, 1979), which enabled the organization to engage in innovation.

Simons (1987) examined the differences in the attributes of accounting control systems in organizations pursuing Defender and Prospector strategies, and considered how these differences impact on organizational performance. Contrary to Miles and Snow (1978), Simons found that Prospectors that performed well relied more on their control systems than Defenders. Specifically, there was a heavy emphasis on forecast data, tight budget goals, and output monitoring. Larger Prospectors emphasized frequent reporting and used standardized control systems, which were modified when necessary. However, consistent with Miles and Snow, reliance on cost controls was reduced. For Defenders, Simons reported that performance was negatively related to tight budget goals and output monitoring. Furthermore, the relationship between cost controls and performance was insignificant, which again is inconsistent with Miles and Snow's propositions.

Simons (1990, 1994) may shed some light on these conflicting results. Focusing only on formal controls, he argued that it is the distribution of management's attention among the controls and the manner in which they were used (i.e. diagnostically or interactively³), rather than the category of controls, that was important in supporting different strategies. In Simons' (1990) analysis of two companies, he observed that both the Prospector and the Defender used accounting controls, but that they were used in a more interactive manner in the Prospector. This was supported by Abernethy and Brownell (1999) who found that organizations that shifted towards a Prospector typology were more likely to use budgets interactively.

Miles and Snow (1978), Miller and Friesen (1982), and Fiegener (1994) did not differentiate between the diagnostic and interactive use of controls, and this may have accounted for the mixed results reported in the literature.

3. RESEARCH DESIGN

The objective of this paper is to examine the relationship between strategy and MCS over time. Prior literature suggests that different strategic typologies require different MCS characteristics to enhance performance. For example, Defender organizations operate in fairly stable environments, offer a limited product range, and compete through price or quality differentiation. Prior studies have found that this type of organization is more effective when comprehensive, detailed and explicit management control procedures are used (Fiegener, 1994; Miles & Snow, 1978). Prospector organizations, on the other hand, operate in uncertain environments and are continually seeking new opportunities. These organizations require less formalized procedures (Fiegener, 1994; Miller & Friesen, 1982).

Based on the findings of prior research, we expect that when an organization changes from one strategic typology to another, its MCS will also change. Further, we expect that the MCS will change so as to match the organization's new strategic typology. To determine if there is a match between MCS and strategy, performance measures (both objective and subjective) are obtained.

To examine these issues, we use a case study as this approach enables insights into the relationship between changes in strategy and the evolution of the MCS (Dent, 1990). The research site is The Western Australian Centre for Pathology and Medical Research (operating under the name PathCentre). PathCentre is a public sector agency providing pathology services in Western Australia, and is selected as it experienced a change in strategic focus. This study examines the Change period and the periods just prior to, and after, the change.

To achieve the aims of this study, we used interviews, a review of archival documentation of the organization, and a questionnaire. The questionnaire was the primary source of information for examining whether the organization's MCS characteristics changed when a change in strategic typology occurred. The design of the questionnaire, which we developed with reference to the literature and the interviews, is discussed later. The documentation review and the interviews assisted in establishing a basic understanding of facets of the organization, the changes that occurred, and the strategic direction of the organization. The interviews were conducted with nine senior managers. Seven of these managers were employed by PathCentre prior to the change in strategic typology and the other two managers were employed during the change.

3.1. The Organization

PathCentre was established as a public sector agency in 1995 with the aim of operating on a commercial basis and to actively compete with private sector providers.

Prior to its formation, the “organization” comprised laboratories of three component entities: (i) the pathology department of a large teaching hospital; (ii) the pathology services of the state health department; and (iii) the pathology service elements of a university laboratory. In what was known as “the combined operations,” there were three employers, with employees attempting to work together.

Early in 1994, as a result of political intervention, plans to amalgamate the staff and services of the three previously interdependent entities commenced. The aims of the amalgamation were to simplify management and to “... (provide) the highest quality, cost effective pathology service supported by excellence in teaching and research, to improve the health of the community” (*from mission statement*).

PathCentre properly commenced operations in mid-1995, with just over 600 staff. The newly operational organization was arranged along the lines of eight Departments and Branch Laboratories.⁴ The thrust of the organization’s new strategy was to actively compete for business in the pathology services sector. However, as the organization was still a public sector agency, they were required to continue with their obligation to provide a health service to the Western Australian community who would otherwise not be able to access such services (e.g. the provision of services to geographically isolated communities). Additionally, they had to maintain their commitment to academic research and teaching with the university and the teaching hospital.

Further restructuring occurred at the end of 1995, which was aimed at flattening the organizational structure, decentralizing decision making, and reducing counterproductive practices. Four divisions were to feature in the new structure, replacing former departments. Each division was further comprised of several sections. A Corporate Services Division was also created, encompassing all administrative and financial functions, human resources, information technology, and purchasing and stores.

The restructuring also relieved senior medical staff (doctors) of the immediate managerial and administrative duties, in order to achieve a more commercial organizational structure. Four Managing Scientists were then appointed to managerial positions, overseeing the daily operations of each division. Once the structure was decided, the hiring of personnel was commenced on a top down basis, with staff having to re-apply and compete for their own positions.

3.1.1. Questionnaire Development

Our review of archival data and interviews with senior personnel led to the identification of the change event in the evolution of PathCentre. This occurred in July 1995 when PathCentre commenced operations as a single entity with the aim of competing actively in the pathology services sector. However, the next 18 months saw a state of flux during which staff migration occurred and structures were finalized. Consequently, the Change period for this study was taken from July 1995 to December 1996. For comparability purposes, the 18 months prior to July 1995 were taken as the Pre-change period, and the 18 months after December 1996 were taken to represent the Post-change period. This resulted in the following three time periods:

- Pre-change period (January 1994 to June 1995);
- Change period (July 1995 to December 1996); and
- Post-change period (January 1997 to July 1998).

To determine whether a change in MCS characteristics occurred when there was a change in strategic typology, it was necessary to obtain information for each of these three time periods. The questionnaire was used for this purpose.

In the questionnaire, the variables of interest were: strategic typology, the MCS, and performance (both objective and subjective measures). The identification of each of these variables across the three time periods enabled an assessment of fit between the organization's MCS and strategy. Additionally, since different strategies are associated with differing levels of perceived environmental uncertainty (PEU) (Govindarajan, 1986; Miles & Snow, 1978), the questionnaire included a section on PEU to support the findings on PathCentre's strategic typology. In the questionnaire, we asked respondents to provide information pertaining to the variables of interest for the three time periods. We asked subjects to complete only the time periods relevant to their employment period.

3.2. Measurement of Variables

The questionnaire was divided into sections. Each of the variables (strategy, MCS, performance, and PEU) was individually addressed in the questionnaire, and we collected demographic information in the final section of the questionnaire.

3.2.1. Strategy

The first section of the questionnaire focused on strategy, using Miles and Snow's (1978) strategic typology. In the questionnaire, we provided the Snow and Hrebiniak (1980) descriptions of Defender, Prospector, Analyzer, and Reactor

strategies (see [Appendix 1](#)).⁵ We asked respondents to select the description that most closely described the organization for each of the three time periods studied.

3.2.2. *Management Control System Characteristics*

The questionnaire incorporated 27 items on various management control system characteristics. These items were derived from the instruments used by [Simons \(1987\)](#) and [Miller and Friesen \(1982\)](#), and were adapted to suit the organizational context. Both of the original instruments focused primarily on financial controls, and [Langfield-Smith \(1997\)](#) criticized prior studies for focusing purely on financial controls. She argued that this was not representative of the breadth of controls used by an organization. Based on the information collected from the interviews, it was clear that informal controls were used in PathCentre. Therefore, in this study, we included additional items to measure the strength of culture and the extent of usage of professional controls.

The adapted instrument was in two parts (see [Appendix 2](#)). In Part 1, we required respondents to rate the extent to which the control mechanisms were used in each of the three time periods. These were measured on a five-point scale, ranging from 1 (never/seldom) to 5 (always). Part 2 measured respondents' agreement or disagreement with given statements, on a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).⁶

3.2.3. *Performance*

We required an indication of the performance of the organization in order to gauge if the MCS was effective in supporting strategy. In the questionnaire, we measured performance on a self-rating scale using an adaptation of the instrument developed by [Govindarajan \(1984\)](#). This instrument measured performance along 12 items. However, not all of these items were applicable to PathCentre. In addition, several other items of performance were identified as important to the organization based on our interviews and the review of documentation. This resulted in a total of 11 items of performance (see [Appendix 3](#)). We asked managers to indicate the importance that they believed PathCentre placed on each of the performance items, using a scale ranging from 1 (not important) to 7 (extremely important).⁷ Respondents were then asked to rate the performance (organizational/divisional) on a five-point scale ranging from 1 (poor) to 5 (outstanding) for each of the items.⁸

Managers' perceptions of both divisional and organizational performance were collected in the questionnaire. As senior managers would be in a position to rate organizational performance, we asked this group to provide an indication of organizational performance. This was done for all three time periods. We asked senior and lower-level managers involved directly with any of the divisions to rate the performance of their divisions. However, divisional performance was only

measured for the Change and Post-change periods, as the divisions were not in existence in the Pre-change period.

3.2.4. *Perceived Environmental Uncertainty*

Measures of PEU were captured across the three periods using the instrument developed by [Gordon and Narayanan \(1984\)](#).⁹ PEU was measured on seven items (see [Appendix 4](#)) and we required respondents to state their agreement with statements pertaining to these items, on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). For each time period, these items were also aggregated to obtain a composite measure of PEU.

3.2.5. *Subjects*

With the assistance of PathCentre's Corporate Services section, we identified 93 staff who the organization considered to have managerial responsibilities. These were staff who were above a specified award level, were in charge of subordinates and who had decision making authority which could affect the organization. We mailed the questionnaire to these 93 staff, using PathCentre's internal mail system. Prior to the mail-out, a memorandum was distributed internally by the Financial Controller and Operations Manager, informing potential respondents of the research project. Each questionnaire was distributed with a covering letter introducing the project and a reply-paid envelope. We assured respondents of the confidentiality of their responses in both the covering letter and the introductory page of the questionnaire. Furthermore, respondents were assured that their responses would only be viewed by us, and that we would aggregate and report all information in summary form. We conducted a second mail-out approximately four weeks after the first mail-out to individuals who had not responded.

A total of 64 useable¹⁰ questionnaires were received. This represented a 69% response rate. A profile of the respondents is presented in [Table 2](#). The mode age group for the respondents was 45–49 years. On average, these managers had been with the organization for 17 years, with a mean of approximately 11 years of managerial experience. The respondents had been in their current position for an average of 6.5 years. Twenty three percent of respondents were from the senior and corporate services levels, while the remaining 77% were lower-level managers. Two of the respondents joined during the Change period, and five in the Post-change period.

Respondents who had been with the organization prior to its formation were asked to indicate the component entity they had worked for. Of the 55 (86% of the 64% respondents) who responded to this question, 38 (69%) originated from the state health department, nine (16%) from the teaching hospital, and eight (15%) from the university.

Table 2. Profile of Questionnaire Respondents.

Sample size	93
Number of respondents	
1st mail-out	49
2nd mail-out	15
Total respondents	64
Demographics	
Age group (mode)	45–49 years
Average number of years with organization	17 years
Average number of years managerial experience	11 years
Average number of years in current position	6.5 years
Number of respondents by managerial level	
Senior and corporate services	15
Lower-level managers	49
Number of respondents employed by time period	
Pre-change period	57
Change period	59
Post-change period	64
Number of respondents employed in the Pre-change period by component entity ^a	
State health department	38
Teaching hospital	9
University department	8

^a Only 55 of the 57 respondents employed in the Pre-change period responded to this question.

To test for the possibility of a response bias, we conducted a comparison of responses across different levels of the organization and across the four Divisions. Response rates for senior and lower-level managers were similar (68 and 69%, respectively). The response rates were also similar across the Divisions. Further, an analysis of early and late respondents was performed. The analysis revealed a few differences in the two mail-outs but these differences were less than that expected by chance. Given these results, there is reason to believe that response bias will not impact on the findings of this study.

4. RESULTS

We used non-parametric, matched-pairs statistical tests to analyze the data.¹¹ The results of this study are presented as follows. First, we present the results as a longitudinal analysis, which looks at changes in the individual variables of interest across the three time periods (Pre-change period, Change period,

and Post-change period). This facilitates an examination of whether the control mechanisms changed when strategy changed. Then, we present a summary of the results for each time period. This summary brings together, by time period, the responses from the questionnaire and information provided during the interview phase, and is used to establish whether the hypotheses are supported.

4.1. Strategy

The questionnaire responses on strategic typology across the three time periods are presented in Table 3. In the Pre-change period, the majority of respondents (56%) perceived the existence of a Reactor strategy. We found support for this in the interviews. Under the Pre-change structure, there was no consistent product-market orientation, and there was a general reluctance to make decisions, resulting in sluggish decision making and a lack of control.

The strategic orientation of the Change period was not as clear. No clear strategy type emerged from the questionnaire responses, but a high proportion of respondents selected the Analyzer (36%) and Prospector (31%) strategies. This finding was consistent with the repeatedly expressed view during the interviews that there were extremely high levels of uncertainty among employees during the Change period with respect to where the organization was heading. Nevertheless, the fact that the two highest choices were Analyzer followed by Prospector, suggests to us that employees were aware of the drive for competitiveness and higher levels of innovation.

Table 3. Frequencies of Strategic Typologies Selected by Respondents Across Periods.

	Pre-Change (January 1994 to June 1995)		Change (July 1995 to December 1996)		Post-Change (January 1997 to July 1998)	
	<i>N</i>	% of Valid Responses	<i>N</i>	% of Valid Responses	<i>N</i>	% of Valid Responses
Reactor	30	56	15	26	5	8
Defender	12	22	4	7	5	8
Analyser	2	4	21	36	15	24
Prospector	10	18	18	31	38	60
Total	54	100	58	100	63	100
Missing observations						
Not employed during period	7		5		—	
Non-respondents	3		1		1	

In the Post-change period, the questionnaire results showed that the majority view was that the organization was operating as a Prospector (60%). This majority view is consistent with comments that we received during the interviews. Given the resource constraints faced by the organization, maintaining low costs were imperative to survival. Furthermore, as prices were regulated, and minimum accreditation standards ensured that all providers met a basic level of quality, the main basis of competition was the range of services provided. The organization competed through its wide range of services, many of which were unique, and its high levels of expertise in various areas. Finally, being the only pathology service provider engaged in research made it the leader in innovation, supporting the Prospector viewpoint.

We sought further evidence to corroborate the above findings. Since different strategies are associated with differing levels of PEU (Govindarajan, 1986), information on PEU was collected to provide support that the organization had changed its strategic typology from a Reactor to a Prospector.

Table 4 presents the results on PEU for the three time periods. We measured each question for PEU on a scale of 1 (strongly disagree) to 7 (strongly agree). From Table 4, it can be seen that in five of the seven items, there were significant increases in mean scores over the Pre-change period to Post-change period. The Pre-change period was characterized by relatively low levels of PEU, reflecting the protected environment of a Reactor. PEU increased to higher levels in subsequent periods. In the Change period, PEU was significantly higher than in the Pre-change period, as would be expected given the state of flux in this transitional period. In the Post-change period, there was an overall increase in PEU, consistent with the shift towards a Prospector typology (Govindarajan, 1986).

The organization's annual reports also provide evidence to support that PathCentre was pursuing a Prospector typology in the Post-change period. They showed that the organization was actively extending its range of tests and services in all functional areas. As noted by the CEO in the 1998/1999 annual report, it is an objective of PathCentre to provide a comprehensive range of services. The organization was also entering into new markets with respect to geographical location and customer base (e.g. workplace drug testing). The annual reports also showed an emphasis on research activities aimed at developing new detection methods and other tests.

4.1.1. Management Control System Characteristics

In the questionnaire, we included 27 items on various control system characteristics. We then grouped these items into nine control mechanisms as shown in Table 5.¹² The items within each grouping are also displayed in Table 5.

Table 4. Perceived Environmental Uncertainty Across Periods.

Items	Level of Perceived Environmental Uncertainty			Significance of Wilcoxon Signed Ranks Test		
	P1 ^a	P2	P3	P1 vs. P2	P2 vs. P3	P1 vs. P3
Bidding for clients						
Mean	3.24	4.68	5.72	<0.001	<0.001	<0.001
Std. Dev.	1.95	1.61	1.34			
N	54	57	64			
Competition for human resources						
Mean	3.39	4.16	4.76	<0.001	<0.001	<0.001
Std. Dev.	1.47	1.27	1.42			
N	54	58	63			
New services						
Mean	3.31	4.53	5.51	<0.001	<0.001	<0.001
Std. Dev.	1.41	1.15	1.24			
N	54	57	63			
Environmental dynamism						
Mean	4.44	6.07	6.14	<0.001	<0.001	ns
Std. Dev.	1.71	1.15	1.22			
N	55	58	64			
Predictability of competitor actions						
Mean	3.78	3.81	3.56	ns	ns	0.040
Std. Dev.	1.55	1.53	1.62			
N	55	58	64			
Predictability of customer preferences						
Mean	3.35	3.32	3.10	0.033	ns	0.007
Std. Dev.	1.53	1.47	1.65			
N	54	57	63			
External constraints						
Mean	5.31	6.19	5.88	ns	0.003	0.004
Std. Dev.	1.56	1.02	1.42			
N	54	58	64			
Composite PEU (aggregation of individual items)						
Mean	3.84	4.67	4.94	<0.001	<0.001	<0.001
Std. Dev.	0.88	0.64	0.72			
N	51	54	61			

Note: Items rated on a seven-point scale from (1) “strongly disagree” to (7) “strongly agree.”

^aP1 represents the Pre-change period (January 1994 to June 1995); P2 represents the Change period (July 1995 to December 1996); P3 represents the Post-change period (January 1997 to June 1998).

Table 5. Management Control System Groupings and Components of Each Grouping.

Results monitoring

These controls focus on outputs. Pre-defined standards for outputs are set and performance is measured against these standards (Ouchi, 1977).

- Formal reports
- Outputs related to inputs consumed
- Evaluation of performance relative to competitors
- Written explanations in budget reports for changes between periods
- Trends between periods closely monitored

Cost controls

These refer to the financial measures used to ensure the efficient and effective execution of operations.

- Cost centers
- Variance analysis
- Tight budget goals

Bureaucratic controls

These involve the monitoring of subordinates, the setting of standard operating procedures and rules, and establishing lines of authority within the organizational hierarchy (Ouchi, 1979).

- Procedure manuals
- Formal appraisal of personnel
- Internal financial audit
- Internal quality audits
- External quality audits

Communications/integrative mechanisms

These refer to the horizontal and vertical communications that can be either formal or informal.

- Importance of informal communications
- Interdisciplinary meetings
- Vertical communications
- Horizontal communications

Resource sharing

These refer to the control resulting from the working relationships with other divisions/sections.

- Interdisciplinary workgroups
- Resource sharing

Tightness of controls

These refer to the level of monitoring exerted over operations.

- Adherence to rules, policies, and plans
- Virtually all activities monitored by management control systems

Professional controls

These refer to the values, judgment, and ethics internalized by members of the same profession resulting in the need for less monitoring.

- Managers have high degree of autonomy/discretion
- Lower-level personnel have high level of autonomy

Table 5. (Continued)

Organizational culture
<i>These refer to informal social structures that support the other control mechanisms in the organization (Ouchi, 1979).</i>
● Shared values, beliefs, and norms
● Committed to organization’s objectives and values
Tailoring of controls to specific user needs
<i>These refer to the presentation and information content tailored to meet division/section requirements.</i>
● Detailed control reports
● High tailoring of management control systems

The results for control mechanisms are presented in Table 6. As mentioned earlier, responses are reported using a five-point scale. The questionnaire responses reveal that there were significant increases in the usage of all MCS mechanisms from the Pre-change to Post-change periods. The following discussion reports on MCS usage in each of the three time periods.

According to the interviewees, there were some control mechanisms in place during the Pre-change period, but these controls were not perceived as important because of the protected environment in which the organization operated during this period. These sentiments were reflected in the questionnaire responses pertaining to the extent to which various control mechanisms were used. The questionnaire results showed that the control mechanisms rated considerably low, as can be seen from Table 6. The highest scores were for “culture” (2.70), “cost controls” (2.67) and “professional controls” (2.61). However, these scores were below the mid-point (3) of the rating scale used. The perception of “culture” and use of “professional controls” were consistent with the comments we received during the interviews that there was a lack of formal controls, and employees were required to conduct their responsibilities largely of their own accord. The score that “cost controls” received could reflect the funding constraints faced by the organization at the time.

Furthermore, “resource sharing” and “results monitoring” were the two lowest ranking mechanisms (1.75 and 1.85, respectively). Given that the three component entities were separate yet interdependent, the low level of resource sharing is not surprising as it would be difficult to coordinate such arrangements, especially in light of the bureaucratic constraints surrounding the public sector.

Table 6 shows that there were significant increases in the use of eight of the nine mechanisms in the Change period. However, “cost controls” was the only mechanism scoring above “3.” The emphasis on “cost controls” in the Change

Table 6. Management Control System Usage Across Periods.

Mechanisms	Management Control System Usage			Significance of Wilcoxon Signed Ranks Test		
	P1 ^a	P2	P3	P1 vs. P2	P2 vs. P3	P1 vs. P3
Results monitoring						
Mean	1.85	2.33	2.96	<0.001	<0.001	<0.001
Std. Dev.	0.55	0.66	0.84			
N	54	57	63			
Cost controls						
Mean	2.67	3.35	3.92	<0.001	<0.001	<0.001
Std. Dev.	0.97	0.85	0.89			
N	55	58	64			
Bureaucratic controls						
Mean	2.15	2.48	3.43	<0.001	<0.001	<0.001
Std. Dev.	0.70	0.78	1.00			
N	55	58	64			
Communications/integrative mechanisms						
Mean	2.28	2.62	3.13	0.013	<0.001	<0.001
Std. Dev.	0.77	0.77	0.81			
N	55	58	64			
Resource sharing						
Mean	1.75	2.32	2.88	<0.001	<0.001	<0.001
Std. Dev.	0.71	0.80	0.93			
N	54	57	63			
Tightness of controls						
Mean	2.34	2.82	3.37	<0.001	<0.001	<0.001
Std. Dev.	0.82	0.74	0.78			
N	55	58	64			
Professional controls						
Mean	2.61	2.98	3.54	0.010	<0.001	<0.001
Std. Dev.	0.94	0.79	0.83			
N	54	58	64			
Organizational culture						
Mean	2.70	2.56	3.17	ns	<0.001	0.005
Std. Dev.	1.14	0.93	0.83			
N	54	57	63			
Tailoring of controls to specific user needs						
Mean	2.05	2.48	3.15	0.001	<0.001	<0.001
Std. Dev.	0.81	0.74	0.85			
N	53	56	61			

Note: Mechanisms rated on a five-point scale, ranging from (1) “never” to (5) “always.”

^aP1 represents the Pre-change period (January 1994 to June 1995); P2 represents the Change period (July 1995 to December 1996); P3 represents the Post-change period (January 1997 to June 1998).

period was consistent reflects with the new organization's attempt to gain control of costs and increase efficiency. For example, from the interviews, we noted that during this period monthly budget reports were introduced and were discussed during managers' meetings. Interviewees saw this as the beginning of a more participatory style of budgeting.

During the interviews, we were repeatedly told that there was a substantial decrease in employee morale following the formation of the new organization. There was a great deal of animosity caused by the changes, which is evidenced by the drop in the score for "culture." This was the only mechanism where a decrease in intensity was experienced (though not significantly) in the transition from Pre-change to Change.

Returning to [Table 6](#) for the results of the Post-change period, it can be seen that all mechanisms increased in intensity, with changes from the Change to the Post-change period being statistically significant ($p < 0.001$). Similar to the previous period, "cost controls" ranked the highest, due to the continued emphasis on tight budgetary controls and the increased input in budget development which required managers to participate in the development of their division's budgets. The high degree of "professional controls" was again apparent. The high rating for "professional controls" reported across the three time periods is not surprising given PathCentre's continued emphasis on research and teaching. This finding is consistent with [Abernethy and Brownell \(1997\)](#) who suggested that organizations with a high degree of research and development activity tend to rely heavily on professional controls.

There was also an increase in the use of "bureaucratic controls" in the Post-change period. This is consistent with the increased use of standards and quality monitoring in line with the move toward a higher level of laboratory accreditation, which involved rigorous codification of procedures and stringent quality controls. From the interviews and documentation review, we were aware that an extensive program of internal quality audits was implemented. Formal procedures were established so that each division had a Quality Officer, whose role included acting on customer complaints. These actions were introduced as a means of achieving product differentiation, thus assisting PathCentre in its pursuit of commercialization.

4.1.2. Performance

Based on the interviews and prior literature, we identified eleven items which were important to assessing PathCentre's performance. These items are listed in [Table 7](#). We asked respondents to indicate the importance the organization placed on various performance measures and to indicate perceived performance for each of these items. We discuss the importance placed on each of the performance items first. These results are presented in [Table 7](#) for the Change and Post-change

Table 7. Importance Placed on Performance Items.

Items	Importance of Performance Items		Significance of Wilcoxon Signed Ranks Test
	P2 ^a	P3	P2 vs. P3
Meeting budget targets			
Mean	5.53	5.98	0.004
Std. Dev.	1.43	0.81	
N	57	64	
Increasing efficiency			
Mean	5.36	6.09	<0.001
Std. Dev.	1.58	0.99	
N	56	64	
Cost reductions			
Mean	5.79	5.92	ns
Std. Dev.	1.29	0.82	
N	57	64	
Meeting customer needs			
Mean	5.46	6.31	<0.001
Std. Dev.	1.39	1.02	
N	56	64	
Quality control/assurance			
Mean	5.70	6.53	<0.001
Std. Dev.	1.31	0.69	
N	57	64	
Product development			
Mean	4.96	5.50	<0.001
Std. Dev.	1.48	1.46	
N	54	62	
Academic research and teaching			
Mean	4.93	5.36	0.001
Std. Dev.	1.62	1.64	
N	54	61	
Market development			
Mean	5.00	6.16	<0.001
Std. Dev.	1.50	1.13	
N	58	64	
Expanding services			
Mean	4.62	5.52	<0.001
Std. Dev.	1.25	1.17	
N	58	64	

Table 7. (Continued)

Items	Importance of Performance Items		Significance of Wilcoxon Signed Ranks Test
	P2 ^a	P3	P2 vs. P3
Technological leadership			
Mean	5.17	5.83	<0.001
Std. Dev.	1.31	1.22	
N	58	64	
Personnel training and development			
Mean	5.05	5.61	<0.001
Std. Dev.	1.58	1.55	
N	58	64	
Overall performance			
Mean	5.59	6.32	<0.001
Std. Dev.	1.33	0.78	
N	56	63	

Note: Items rated on a seven-point scale, ranging from (1) “not important” to (7) “extremely important.”
^aP2 represents the Change period (July 1995 to December 1996); P3 represents the Post-change period (January 1997 to June 1998).

periods. Importance was measured on a seven-point scale, ranging from 1 (not important) to 7 (extremely important).

Table 7 indicates that the importance placed on the performance measures increased significantly across all items, except for “cost reductions.”¹³ In the Change period, there was a greater emphasis on financial controls, such as “cost reductions” and “meeting budgets.” The rankings for the Post-change period indicate that greater importance was placed on non-financial measures of performance, which is consistent with the key attributes of a Prospector typology.

Managements’ perceptions of organizational and divisional performance, which were elicited from the questionnaire, are presented in Table 8. We asked managers to rate performance on a scale of 1 (poor) to 5 (outstanding). The analysis of organizational performance over the Pre-change to Post-change periods reveals that there were significant increases in the items used to measure performance, with the exception of “academic research and teaching.” This exception is not surprising given that PathCentre has always pursued and maintained a high level of research and teaching.

The divisional performance scores in Table 8 represent the combined scores for all divisions.¹⁴ Overall, the results suggest that managers believed that performance had improved over the three periods, and as evident from the table, most changes were statistically significant. The table also reveals a move towards

Table 8. Perceptions of Organizational and Divisional Performance Across Periods.

Items	Organizational Performance			Sig. of Wilcoxon Signed Ranks Test			Divisional Performance		Sig. of Wilcoxon Signed Ranks Test
	P1 ^a	P2	P3	P1 vs. P2	P2 vs. P3	P1 vs. P3	P2	P3	P2 vs. P3
Meeting budget targets									
Mean	2.58	3.00	3.67	0.034	0.011	0.009	3.22	3.71	<0.001
Std. Dev.	1.08	1.00	0.72				0.99	0.71	
N	12	13	15				51	56	
Increasing efficiency									
Mean	2.25	3.23	4.20	0.012	0.002	0.002	3.02	3.85	<0.001
Std. Dev.	1.06	0.73	0.41				0.96	0.80	
N	12	13	15				50	55	
Cost reductions									
Mean	2.17	3.38	3.67	0.014	ns	0.007	3.25	3.45	ns
Std. Dev.	1.11	0.77	0.62				0.98	0.90	
N	12	13	15				51	55	
Meeting customer needs									
Mean	2.17	2.92	3.73	0.014	0.004	0.005	2.86	3.75	<0.001
Std. Dev.	1.03	0.67	0.46				0.95	0.92	
N	12	12	15				50	56	
Quality control/assurance									
Mean	3.25	3.69	4.60	0.034	0.010	0.011	3.06	3.73	<0.001
Std. Dev.	1.22	0.85	0.51				1.10	1.09	
N	12	13	15				51	56	
Product development									
Mean	2.83	3.23	3.87	ns	0.007	0.010	2.92	3.22	0.002
Std. Dev.	1.11	0.60	0.64				1.20	1.37	
N	12	13	15				48	54	

Academic research and teaching									
Mean	3.42	3.62	4.00	ns	ns	ns	3.15	3.45	0.003
Std. Dev.	1.08	0.87	0.65				1.07	1.19	
N	12	13	15				48	53	
Market development									
Mean	1.83	2.54	3.60	0.021	0.002	0.003	2.56	3.23	<0.001
Std. Dev.	0.94	0.52	0.51				1.26	0.97	
N	12	13	15				52	56	
Expanding services									
Mean	2.83	3.15	3.73	0.046	0.020	0.026	2.96	3.41	<0.001
Std. Dev.	1.11	0.69	0.59				1.27	0.91	
N	12	13	15				52	56	
Technological leadership									
Mean	3.08	3.38	3.87	ns	0.008	0.015	3.12	3.32	0.001
Std. Dev.	1.24	0.77	0.64				1.42	1.15	
N	12	13	15				52	56	
Personnel training and development									
Mean	2.17	2.54	3.21	ns	0.034	0.010	2.54	2.98	<0.001
Std. Dev.	0.83	0.97	0.80				1.43	1.07	
N	12	13	14				52	56	

Note: Items rated on a five-point scale, ranging from (1) "poor" to (5) "outstanding."

^aP1 represents the Pre-change period (January 1994 to June 1995); P2 represents the Change period (July 1995 to December 1996); P3 represents the Post-change period (January 1997 to June 1998).

higher levels of product-market innovation, which is consistent with the perceived shift to Prospector strategy.

Given the potential problems associated with self-rating scales, performance indicators published in PathCentre's annual reports were also collected.¹⁵ These confirm the overall results reported in this section. Specifically, there was a 61% gain in efficiency (measured as the number of specimens per full-time equivalent staff member), and a 20% reduction in the total cost per specimen since PathCentre was formed. Furthermore, the organization's market share increased by 30% in a period when the market only increased by 7%.¹⁶

4.2. Summary of Major Findings

Taking the results by time period, the organization in the Pre-change period pursued a Reactor strategy, and had low levels of PEU. This is consistent with the protected environment in which the organization operated. As we noted from the interviews, during this period, the aim of the organization was to merely survive. In the Pre-change period, "professional controls" and "culture" dominated, and there was a lack of formal controls, with the exception of "cost controls." The interview data supported these results. Interviewees acknowledged that the organization relied mostly on professional controls and a task-oriented culture to govern the laboratory practices and help maintain the strong orientation towards research and teaching. Interviewees also stated that, during this time period, controls were input based and, although there were some controls, they were difficult to manage given the existence of the three separate component entities. There were large inefficiencies and performance was poor by commercial standards. Consistent with [Snow and Hrebiniak \(1980\)](#), the Reactor managed to survive by virtue of the protected environment in which it operated.

In the Change period, no strategic typology dominated, with most respondents selecting either Analyzer or Prospector. At this time, the changes in the environment and within the organization led to higher levels of PEU. Interviewees' comments were consistent with these findings. Interviewees noted that staff were unsure as to what was expected of them and the direction that the organization was heading. The interviews also revealed that the increased formalization of controls during this period marked a move to increase efficiency and reduce costs. Meetings were aimed at overcoming resistance to change, communicating new goals, and fostering a commercial culture whilst reducing uncertainty. During this period, the questionnaire responses showed that there was an increase in performance.

In the Post-change period, the questionnaire responses suggested that the organization was operating as a Prospector, and had a higher PEU. The high

level of PEU in this period was consistent with the environment expected by an organization pursuing a Prospector typology (Khandwalla, 1972; Sim & Teoh, 1997). In the Post-change period, “cost controls” and “professional controls” continued to dominate, with an increase in the usage of “bureaucratic controls,” “control tightness” and “communications.” A comprehensive budgeting system was implemented, supported by regular meetings and increased responsibility to meet the budget at all levels. Interviewees noted that these procedures were aimed at increasing the awareness of the managerial implications of various decisions, and to encourage a more business-like approach to management. The questionnaire results showed that performance in the Post-change period significantly improved from previous periods. Objective measures of performance obtained from PathCentre’s annual reports also confirmed these results.

These results, summarized in Table 9, indicate that when an organization changes its strategic typology, its MCS also changes. The study shows that PathCentre changed its strategic typology from a Reactor to a Prospector, and that its MCS characteristics changed over the same time period.

In addition to showing that a change in strategy is associated with a change in MCS, the study provides evidence of a match between the new strategic typology and the changed MCS. This was achieved using both objective and subjective measures of performance which showed that, over the three time periods, there was an improvement in performance.

While our results show that a change in strategic typology is matched with a change in MCS characteristics, it is interesting to note that the MCS mechanisms used in the Post-change period are inconsistent with Miles and Snow (1978) who argued that Prospectors would not rely on accounting controls, and Fiegen (1994) who concluded that tight controls were detrimental to the effectiveness of Prospectors. Our findings, however, are consistent with Simons (1987) who found that Prospectors relied on accounting controls.

A possible explanation for the inconsistency in prior research was provided by Simons (1990, 1994), who noted that it was the manner in which accounting controls were used, rather than the category of controls, that was important in supporting different strategies. Specifically, Simons (1990) observed that Prospectors and Defenders might use the same type of controls, but Prospectors used these controls in a more “interactive” manner. The use of controls in this manner involved the active participation of senior management in the monitoring and decision making processes of the organization, through regular two-way discussion and open debate on the organization’s operations and direction.

Our study provides some evidence to support Simons’ (1990, 1994) assertions. Specifically, the four MCS mechanisms that increased the most over the three periods were: “bureaucratic controls,” “cost controls,” “resource sharing,” and

Table 9. Summary of Findings Across Periods.

	Pre-Change (January 1994 to June 1995)	Change (July 1995 to December 1996)	Post-Change (January 1997 to July 1998)
Strategy	Reactor.	Undecided but largely Prospector or Analyzer.	Prospector.
Perceived environmental uncertainty	Low-Moderate.	Medium-High.	Medium-High.
Management control system	Professional and clan (culture) controls dominant. Lack of formal controls.	Increased formalization. Mainly cost controls. Strong professional controls.	High formalization: bureaucratic controls and cost controls. Supported by professional and clan controls.
Performance goals	Mainly quality and research goals. Lack of emphasis on market development.	Emphasis strongest for cost reductions and increasing efficiency. Quality and research related goals.	Predominant goal is meeting customer needs. Other goals maintained.
Divisional performance	Not Applicable.	Highest performance in cost reductions and meeting budget.	Highest performance in increasing efficiency meeting customer needs.
Organizational performance	Poor performance commercially. High performance in research, quality and technology.	Highest performance still in traditional areas. Increased commercial viability.	Excellent performance in terms of efficiency. Traditional areas maintained.

“results monitoring.” Our interviews with senior managers indicated that, over the three time periods, the manner in which these four mechanisms were used became more interactive. Specifically, “bureaucratic controls” were used as a means to achieve and maintain a high level of quality. Over the three time periods, there were increased discussions and feedback to ensure that any operational problems were quickly identified and corrected, and to ensure there was continued improvements in quality. “Cost controls” and “results monitoring” were used to increase efficiency. Monthly meetings involving senior managers and heads of divisions

were held during which financial and non-financial reports and operational issues were discussed, and actions decided. The organization restructured its budgetary process, from a centrally determined budget to a process whereby the Divisions were involved in setting their own budgets through negotiations with senior managers. Finally, “resource sharing” increased over the time periods with the formation of some interdisciplinary workgroups. These workgroups consisted of staff from different cognate areas who used similar testing procedures, and thus avoided a duplication of infrastructure. The formation of the workgroups was the result of the initiative of subordinates and occurred because of the feedback and support from senior managers.

Common to all four MCS mechanisms was the increase in feedback and dialogue across the different levels of the organization. These examples illustrate that it is the way in which control mechanisms are used, rather than the category of controls, that is important in supporting different strategies. As [Simons \(1990, p. 140\)](#) noted, “rather than focusing on what the organization already understands and does well, (interactive) systems direct organizational attention to emerging threats and opportunities” and, hence, assists the Prospector in pursuing its strategy.

5. CONCLUSIONS

This study examines the relationship between strategy and MCS over time using a public sector agency. More specifically, we investigate whether an organization that changed its strategic typology also changed its MCS. Further, we examine whether the changed MCS matches the new strategic typology.

Based on a review of archival data and interviews, three time periods in PathCentre’s history were identified, and a questionnaire was developed and distributed to senior and lower-level management. This questionnaire sought to obtain indications of the perceived strategy, PEU, MCS characteristics, and divisional and organizational performance.

We found that, as the organization shifted strategy (from Reactor to Prospector) and experienced an increase in PEU, MCS also changed. Furthermore, performance improved, suggesting that there was an appropriate “fit” between MCS and strategy. Focusing on the changes to the MCS, there was a significant increase in the use of all control mechanisms over the three time periods. This is inconsistent with [Miles and Snow \(1978\)](#) and [Fiegener \(1994\)](#), but consistent with [Simons \(1987\)](#). Furthermore, the manner in which some controls were used became interactive. This result lends support for [Simons \(1990, 1994\)](#) who argued that the manner in which controls were used, and the attention given by management to these controls, could impact on the effectiveness of MCS in supporting different strategies.

Several limitations of this study should be mentioned. As with any case study, the generalizability of the findings is limited due to the presence of various organization-specific characteristics. Second, the use of a questionnaire, while allowing a broad range of constructs to be studied, necessarily compromises the depth of investigation. However, interviewing key personnel helped compensate for this limitation. Finally, this was a retrospective study which asked members of the organization to give their perceptions of various constructs over time. [Flamholtz et al. \(1985\)](#) argued that perceptions were important as they affected behavior. However, as this was a retrospective study, it relied on participants' recall of events in the time periods studied, and this may be a limitation of the study. It would be interesting to repeat a similar study in an organization that is currently considering changing its strategic direction. Questionnaires could then be distributed to complement the timing of the change.

Given the findings of this study, further research into other public sector organizations could yield some interesting results on the strategies pursued by other organizations and would aid the generalizability of contingency relationships. More importantly, a study of how the regulatory and resource constraints surrounding these organizations affect their strategies and MCS would be of great value.

Future research could also examine the different usage of controls (i.e. diagnostic and interactive) of organizations pursuing different strategies. Although this paper provided support for the interactive use of controls by a Prospector, it might be a case-specific situation and other research could adopt a cross-sectional analysis to investigate this issue further.

Finally, the results of this paper show that there is a match between MCS and strategy which enhances performance. What is not clear, though, is whether the MCS changes as a consequence of a change in strategy, or if the MCS facilitates a change in strategy. [Hopwood \(1987\)](#) and [Dent \(1990\)](#) suggest the latter, but this relationship merits further investigation.

NOTES

1. Other frameworks have been developed (e.g. [Miller & Friesen, 1982](#); [Porter, 1980](#)), but the [Miles and Snow \(1978\)](#) strategic typology is adopted in this paper for several reasons. First, it provides the richest description of organizational characteristics associated with each strategy ([Dent, 1990](#)). Second, the typology has been subjected to considerable psychometric assessment ([Abernethy & Guthrie, 1994](#); [Hambrick, 1983](#); [Shortell & Zajac, 1990](#); [Snow & Hambrick, 1980](#)). [Langfield-Smith \(1997\)](#) suggests that other frameworks can be integrated under the Miles and Snow framework. While she acknowledges that this is not a perfect fit, there are similarities between the typologies. Since this paper adopts the Miles and Snow typology, and given the different typologies that have been used in prior

research, this paper provides the closest Miles and Snow's classification as a reference point when reviewing prior literature.

2. The Reactor typology is generally only considered to be a viable strategy in highly regulated industries (Snow & Hrebiniak, 1980).

3. Within the formal control system, Simons defined diagnostic controls as "formal feedback used to monitor organizational outcomes" while interactive controls were defined as "formal systems used by top managers to regularly and personally involve themselves in the decision activities of subordinates" (Simons, 1994, pp. 170–171).

4. This arrangement was essentially an amalgamation of the previous disciplines that operated under "the combined operations." A manager of Business Services headed all matters involving financial services and other central administrative functions.

5. Archival data suggested that the organization could have been a Reactor in the Pre-change period. Consequently, the descriptions of Snow and Hrebiniak were used.

6. It was not possible to use a single scale to measure all individual MCS components because of the nature of some of the questions. Consequently, two separate measurement scales were required. The range of values for each scale was chosen to maintain consistency throughout the questionnaire.

7. The original instrument used a five-point scale. However, a seven-point scale was considered more appropriate as it allowed for a greater range and variability of the responses. Furthermore, an expanded scale was used to maintain consistency in the scales used in the questionnaire.

8. This differed to the original instrument, which asked respondents to rate performance *relative to the expectations of their superiors*. It was believed that making an assessment of the superior's expectations would cause the respondent to automatically rate performance based on these expectations, and that was not the intention of this study.

9. As the original instrument was more suited to a general manufacturing setting, some items had to be reworded in a manner appropriate to the pathology services sector.

10. Two questionnaires were excluded from the sample as the respondents provided responses for time periods prior to their employment at PathCentre.

11. The Lilliefors and Shapiro-Wilks tests suggested that the data were not normally distributed.

12. The 27 items (presented in Appendix 2) were grouped by common themes to arrive at the nine control dimensions. Factor analysis was then used to substantiate these groupings. The scree test (Cattell, 1966) indicated that nine groupings were appropriate. Furthermore, 70% of the items factored into the specified groupings. This suggested that it was appropriate to use the nine control dimensions.

13. The insignificant increase in emphasis on cost reductions is not surprising given that it was the most important dimension in the Change period.

14. It is acknowledged that a combined measure of the organization's four divisions may lack accuracy since each division may not have performed uniformly across each dimension. However, this combined measure is used solely to provide an approximation of the overall performance gained across divisions. In essence, divisional performance was used here as a proxy for organizational performance.

15. Since PathCentre receives a block grant from the Government to conduct tests for all public hospitals, and the amount received is fixed irrespective of volume, measures such as Return on Assets are not appropriate.

16. This was during a period when there were no major capital acquisitions and no competitors withdrew from the market.

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APPENDIX 1: STRATEGIC TYPOLOGY

We provided respondents with the following descriptions of four organizational types, and asked them to select the organizational type that they thought most closely described PathCentre in each time period.

Type 1

This type of organization attempts to locate and maintain a secure niche in a relatively stable product or service area. The organization tends to offer a more limited range of products or services than its competitors, and it tries to protect its domain by offering higher quality, superior service, lower prices, and so forth. Often this type of organization is not at the forefront of developments in the industry – it tends to ignore industry changes that have no direct influence on current areas of operation and concentrates instead on doing the best job possible in a limited area.

Type 2

This type of organization typically operates within a broad product-market domain that undergoes periodic redefinition. The organization values being “first in” in new product and market areas even if not all of these efforts prove to be highly profitable. The organization responds rapidly to early signals concerning areas of opportunity, and these responses often lead to a new round of competitive actions. However, this type of organization may not maintain market strength in all areas it enters.

Type 3

This type of organization attempts to maintain a stable, limited line of products or services, while at the same time moving out quickly to follow a carefully selected set of the more promising new developments in the industry. The organization is seldom “first in” with new products or services. However, by carefully monitoring the actions of major competitors in areas compatible with its stable product-market base, the organization can frequently be “second in” with a more cost-efficient product or service.

Type 4

This type of organization does not appear to have a consistent product-market orientation. The organization is usually not as aggressive in maintaining established products and markets as some of its competitors, nor is it willing to take as many risks as other competitors. Rather, the organization responds in those areas where it is forced to by environmental pressures.

APPENDIX 2: MANAGEMENT CONTROL SYSTEM CHARACTERISTICS

Questions pertaining to PathCentre's MCS were separated into two parts.

Part 1

For each time period, we asked respondents to indicate the extent to which the following MCS items were used in PathCentre.

Response scale:

- (1) Never/seldom
- (2) Occasionally
- (3) Half the time
- (4) Frequently
- (5) Always

Items:

- (1) Informal communications (e.g. meetings, interpersonal contacts) in passing information up and down the hierarchy.
- (2) Formal reports (e.g. management reports, monthly performance reports).
- (3) Cost centers for cost control.
- (4) Budget variance analysis.
- (5) Procedure manuals.
- (6) Formal appraisal of personnel.
- (7) Internal audit groups for checking *financial information systems* and reports.
- (8) Internal audit groups for checking *accreditation standards* (i.e. quality standards) for operations.
- (9) External audits for checking *accreditation standards* (i.e. quality standards) for operations.

- (10) Interdisciplinary meetings (i.e. meetings between people from different disciplines to exchange information).
- (11) Interdisciplinary workgroups/teams (e.g. people from different divisions working together on a project/task).
- (12) Management control reports relating outputs with inputs consumed (e.g. costs per test, output per labor hour).
- (13) Evaluation of performance in any period by comparing PathCentre's results with those of competitors in the pathology services sector.
- (14) Written explanations in budget reports for changes between current year results and the results of previous years.
- (15) Resource sharing (i.e. different divisions sharing the same equipment/reagents/personnel).

Part 2

For each time period, we asked respondents to indicate the extent to which they agreed/disagreed with the following statements.

Response scale: 1 (strongly disagree) to 7 (strongly agree)

Statements:

- (1) There is a strong emphasis on adherence to rules, policies, or plans.
- (2) Management control systems are used to monitor virtually all tasks in your sub-unit.
- (3) You have a high degree of discretion and autonomy in making decisions and responding to new unanticipated opportunities or challenges.
- (4) Lab personnel are awarded a high degree of autonomy in exercising judgment in carrying out tasks (i.e. self-regulation, low levels of monitoring).
- (5) There is a strong sense of shared values, beliefs, and norms within Path-Centre.
- (6) Employees are committed to PathCentre's objectives and values.
- (7) Information is well communicated from top management to lower levels.
- (8) Information is well communicated across divisions.
- (9) Information included in control reports is always accurate.
- (10) The trend between last period's actual results and the results of the current period is monitored closely by senior managers.
- (11) You are faced with tight budget goals.
- (12) Management control systems are tailored to suit differing individual and divisional/sectional needs.

APPENDIX 3: PERFORMANCE MEASURES

For each time period, respondents were asked to indicate the importance that they believed PathCentre attached to the following performance dimensions. Respondents were also asked to rate the perceived performance on each dimension.

Response scale: For importance, 1 (not important) to 7 (extremely important);
For performance, 1 (poor) to 5 (outstanding)

Dimensions:

- (1) Meeting budget targets.
- (2) Increasing productivity/achievement of operating efficiencies.
- (3) Cost reductions.
- (4) Meeting customer needs (e.g. quick turnaround, accurate results).
- (5) Quality control/assurance (e.g. NATA accreditation).
- (6) New product development (i.e. applied research, development of new tests).
- (7) Academic research and teaching.
- (8) Market development (i.e. increasing market share, getting new customers).
- (9) Increasing the range of services/tests provided.
- (10) Technological leadership.
- (11) Personnel training and development.

APPENDIX 4: PERCEIVED ENVIRONMENTAL UNCERTAINTY

For each time period, respondents were asked to indicate the extent to which they agreed/disagreed with the following statements.

Response scale: 1 (strongly disagree) to 7 (strongly agree)

Statements:

- (1) Bidding for clients among pathology service providers is intense.
- (2) Competition for human resources among pathology service providers is intense.
- (3) Many new services (e.g. new tests, quicker turnaround) were offered/introduced.
- (4) The external environment (economic, regulatory, and technological) facing PathCentre is dynamic (i.e. continually changing).

- (5) The market activities of your competitors are unpredictable.
- (6) The tastes and preferences of your customers (e.g. doctors, hospitals) are hard to predict.
- (7) The legal, political, and economic constraints surrounding PathCentre is considerable.

DO AUDITORS ASSESS THE SYSTEMATIC MARKET RISK IN THEIR AUDIT PRICING DECISIONS? INTERNATIONAL EVIDENCE

Jussi Nikkinen and Petri Sahlström

ABSTRACT

This study investigates whether auditors assess the systematic market risk in their audit pricing decisions. According to the audit pricing model of [Simunic \(1980\)](#), the audit fee is a function of the audit effort and the auditor's client specific risk. Since an auditor has several clients, the systematic risk of a firm should be taken into account in audit pricing. To empirically investigate this issue across different environments, data from Denmark, Hong Kong, Malaysia, Norway, Singapore, South Africa, and the United Kingdom are analyzed. The results of statistical tests show that the market-based risk measure explains auditing fees in addition to the risk measures based on accounting information. However, the performance of the model differs across countries. Moreover, the impacts of the variables in explaining audit fees vary across countries. These findings are in accordance with the proposition of [Cobbins \(2002\)](#) according to which cultural sensitive and market specific variables could potentially have a significant impact on audit fees paid.

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1. INTRODUCTION

This study investigates various risk measures in audit pricing context. According to the audit pricing model of [Simunic \(1980\)](#), the audit fee is a function of the audit effort and the auditor's client specific risk. The model is widely supported by the subsequent empirical research (see, e.g. [Francis & Simon, 1987](#); [Menon & Williams, 2001](#); [Palmrose, 1986](#); [Pong & Whittington, 1994](#); [Simon, 1995](#)). It has been documented that audit fees are positively related, for example, to various accounting-based risk measures. On the other hand, since an auditor has several clients, the portfolio theory of [Markowitz \(1952\)](#) provides a theoretically solid approach to measure client specific risk using stock market data.

The purpose of this study is to investigate whether auditors assess the systematic market risk in their audit pricing decisions. Since auditing is a business in which the auditor must assume the risk of an uncertain rate of returns, audit fees should reflect this risk (see [Simunic & Stein, 1996](#)). While the relevance of a risk measure in audit pricing models is unquestionable, there exists no clear-cut answer as to which one or more of several possible risk measures should be used. Moreover, while the empirical results regarding generic variables such as auditee size and complexity contribute consistently to the audit fees across different environments, the results regarding risk seem to vary across different markets ([Cobbins, 2002](#)). To empirically investigate whether the auditors assess the systematic market risk in their audit pricing decisions across different environments, data from seven audit markets, Denmark, Hong Kong, Malaysia, Norway, Singapore, South Africa, and the United Kingdom are analyzed within the same model.

This paper contributes to the existing literature in the following two ways. First, while the earlier literature typically uses accounting information-based risk measures (see, e.g. [DeFond, Francis & Wong, 2000](#); [Menon & Williams, 2001](#); [Niemi, 2002](#); [Simunic & Stein, 1996](#), for a review see [Cobbins, 2002](#)), this study investigates the usefulness of the market-based risk measures using data from seven audit markets. This is important since, unlike accounting-based risk measures, the market-based measures are not widely used despite their desirable properties. One advantage of market-based risk measures is that they are forward looking, whereas accounting-based measures are backward looking. In addition, the latter are subject to differences in accounting practices.

Second, the study contributes the earlier literature by investigating whether the audit fees are similarly determined across seven countries with differences in historical, cultural, institutional, and other market-based factors. While according to [Cobbins \(2002\)](#) the earlier literature tends to suggest that there may be differences in audit pricing across different environments, he also points out that "to a large extent, the examination of this dimension is not materialized." Consequently, this

study examines the issue under the same research design thus making possible a direct comparison of the results from different markets.

The results of the study have important implications for researchers and practitioners in the area of auditing. While most audit pricing studies take the risk into account by including accounting based risk measures such as debt to equity ratio, quick ratio and current ratio, it is not customary to use market-based risk measures such as beta in audit pricing models although a strong theoretical ground for the use of beta exists. Moreover, betas are readily available or can be easily calculated on the most of the markets. Consequently, forward-looking market-based risk measures, which are not subject to accounting practices, may turn out to be useful both in audit pricing studies and in the actual audit pricing decisions.

The rest of the study is organized as follows. The following section discusses the role of risk in audit pricing. [Section 3](#) describes the data. Research methodology used is presented in [Section 4](#). [Section 5](#) provides the results of the statistical analysis. Conclusions are given in [Section 6](#).

2. EFFECT OF FIRM'S RISK ON AUDIT FEES

The final income of an audit project is unknown since an auditor faces the possibility that the financial statements contain undetected material misstatements, which may be observed after an audit report has been published. Such an observation may result in direct and indirect costs. Examples of these costs are loss of auditor reputation, loss of the client and costly litigation. As a consequence, auditors should take into account the possibility of these future costs in addition to the amount of work hours used when pricing their services (see [Simunic & Stein, 1996](#)).

The client's risk has an effect on both of these components. Since the probability that the firm will be re-audited and misstatements revealed is higher in a case of bankruptcy, the expected future loss increases as the probability of bankruptcy increases. To avoid litigation in a case of bankruptcy, the auditors will increase their effort to detect misstatements for firms with a high probability of bankruptcy. As a consequence, the auditors should take risk into account in the pricing of audit fees. Therefore, a positive relationship between audit fees and client's risk should exist. The findings of several previous studies support this hypothesis (see, e.g. [Simunic & Stein, 1996](#) for a review).

The theoretical framework for the use of firm characteristics in the risk measurement is based on studies according to which certain firm specific characteristics are connected to risk. [Hamada \(1972\)](#), [Lev \(1974\)](#), [Gahlon and Gentry \(1982\)](#) and [Chung \(1989\)](#), among others, show that the firm risk is a positive function of the financial leverage, operating leverage and business risk of a firm. Since the audit

fee is a positive function of risk, it should be positively related to these risk factors. On the other hand, in the empirical modeling of the audit pricing different kind of risk measures have been proposed. For example, various liquidity, profitability and leverage ratios have been used (see [Cobbin, 2002](#) for a review). Typically these risk measures used vary across studies and the ability of a particular risk measure to explain audit fees may also be inconsistent from one study to another.

A possible reason for these mixed results is that an auditor faces a portfolio selection problem as does an investor since the auditor has several clients, not just one. As a consequence, as [Markowitz \(1952\)](#) shows, only the systematic risk of a firm should affect the selection problem. The previously used risk measures, e.g. leverage and profitability ratios, may also contain unsystematic risk components which should not be taken into account in the auditing price decision. Therefore, these risk measures may be biased. Based on this, the risk measures that should be used are those that measure only the systematic risk component of the firm. The capital asset pricing model developed by [Sharpe \(1964\)](#), [Lintner \(1965\)](#) and [Mossin \(1966\)](#) suggests that the correct measure for the systematic risk of a firm is the beta. Therefore, the beta should capture the effect of client risk in audit pricing correctly. The betas are usually estimated from the stock market returns by using the [Sharpe \(1964\)](#) market model. These market-based estimates are called market betas since the stock market information is used in the estimation.

While the systematic risk is hypothesized to have an effect on audit fees, several other factors affecting the audit fees have to be taken into account in the model construction. Firm size and the complexity of the auditing process are the most important among these (see, e.g. [Bamber, Bamber & Schoderbek, 1993](#); [Cobbin, 2002](#)). The size of the client increases the auditing fee. The complexity of the auditing process increases the level of auditor effort, thereby increasing the price of audit service.

Based on the outlined framework of risk in audit pricing, there should exist a positive relationship between the audit fee and the systematic risk, i.e. market beta. Moreover, since the findings of previous studies show that the various risk measures based on the accounting information can be used to explain audit fees, a set of these variables detected in previous studies is included in the model. In addition, a risk measure based on stock market and accounting information, i.e. price to book ratio, is included since previous evidence suggests that it is related to stock returns, i.e. price to book is a risk proxy priced by investors in stock markets (see, e.g. [Fama & French, 1995, 1996](#)). This construction allows investigation of the role of different risk measures as determinants of audit fees. Furthermore, factors affecting the audit fees, i.e. firm size and the complexity of the auditing process are included in a model when investigating the role of risk in audit pricing.

3. DATA DESCRIPTION

The sample consists of firms from Denmark, Hong Kong, Malaysia, Norway, Singapore, South Africa, and the United Kingdom. The selection of the countries is based on the availability of accounting fees in the publicly available *Worldscope* database. The sample covers different kinds of market, allowing an investigation of whether market specific and cultural factors have a significant effect on the level of audit fees paid and on the magnitude of the impacts of audit fee determinants. In particular it is possible to investigate whether market-based risk measures have a similar effect on audit fees in different environments. The sample covers listed firms from the selected countries during the period 1992–2000. Firms belonging to the financial services industry, i.e. firms having the SIC codes 6000–6999, are excluded from the sample due to their unique characteristics. All observations having missing information in any of the variables are likewise excluded. Original currencies are used in the study. The financial ratios and monthly stock returns are retrieved from the publicly available *Worldscope* database.

The variables used to explain audit fees contain a measure of systematic risk estimated using stock market information, a risk measure based on both, market and accounting information, several risk measures based on pure accounting information suggested in the literature (see [Cobbin, 2002](#)), and the control variables, auditee size and auditee complexity. Risk measure based on pure market information is the market beta (BETA), i.e. the systematic risk of a firm. The betas are estimated using monthly stock and market return of the corresponding country over a two-year period before the end of each fiscal year by applying the market model of [Sharpe \(1964\)](#). Price to book ratio (PBV) is used as a risk measure based on accounting and market information. Beginning of the year values are used to construct the ratio as in the case of the other variables constructed using balance sheet items. The findings of previous studies suggest that risk measures based on accounting information can be used to explain audit fees. Therefore, debt to equity ratio (DE), quick ratio (QR) and return on investments (ROI) are used in this study. To control for auditee size (SIZE), the natural logarithm of total assets of the firm is used and to control for auditing complexity (ACP), the percentage of foreign sales to total sales is used (see, e.g. [Cobbin, 2002](#)). Moreover, to be consistent with previous literature the dependent variable, audit fees (FEE), is defined as the natural logarithm of the audit fees.

[Table 1](#) presents summary statistics for the sample used in the analysis. When comparing the statistics across countries it should be kept in mind that only the variables that are deflated are comparable, since the values are expressed in original currencies. It is also worth noting that there seems to be some variation in the average of betas. Moreover, [Table 1](#) shows that the number of observations varies

Table 1. Summary Statistics of Variables and Number of Observations.

Variable	Denmark	Hong K.	Malaysia	Norway	Singapore	S. Africa	UK
Panel A: Mean and number of observations							
FEE	2.436	2.848	0.274	2.785	0.598	3.641	0.948
ASSETS	4.775	8.466	1.666	11.735	1.196	3.604	1.094
BETA	0.628	0.764	1.144	0.956	1.242	0.652	0.726
PBV	2.585	1.610	2.649	2.376	1.981	2.493	3.875
ACP	51.661	45.351	8.581	53.250	38.750	5.845	26.010
DE	0.769	0.557	0.793	0.891	0.627	0.460	0.556
QR	1.304	1.356	1.264	1.501	1.195	1.087	1.116
ROI	0.107	0.082	0.092	0.091	0.071	0.180	0.152
Sample size	269	863	950	165	568	281	3869
Panel B: Standard deviation							
FEE	4.828	3.814	0.680	4.943	3.584	5.475	2.415
ASSETS	8.768	26.540	4.018	24.869	3.319	5.610	5.130
BETA	0.741	0.565	0.545	0.667	0.510	0.409	0.827
PBV	3.037	2.901	3.373	1.624	2.604	3.326	5.806
ACP	36.566	32.815	18.934	30.732	29.930	14.343	29.043
DE	0.713	0.681	1.148	0.751	0.750	0.806	0.768
QR	1.405	1.584	1.390	1.836	0.821	0.899	1.502
ROI	0.163	0.222	0.150	0.180	0.156	0.194	0.263

Notes: All values are in local currency.

The variables are defined as follows: FEE = audit fees (000,000); ASSETS = total assets (000,000,000); BETA = market beta; PBV = market price to book ratio; ACP = percentage of foreign sales to total sales; DE = book value of interest bearing debt to equity; QR = quick ratio: ratio of current assets less inventories to current liabilities; ROI = profit before interest and tax to total invested capital.

considerably across countries. The largest country sample (the U.K.) has 3,869 observations while the smallest (Norway) includes 165 firm-year observations.

4. RESEARCH METHODOLOGY

To investigate the performance of hypothesized risk measures in explaining the natural logarithm of audit fees for firm i at year t , $FEE_{i,t}$, the following one way fixed effects equation is estimated separately for each country:

$$\begin{aligned}
 FEE_{i,t} = & \alpha + \sum_{k=92}^{99} \beta_k^1 D_k^{\text{year}} + \beta^2 \text{BETA}_{i,t} + \beta^3 \text{PBV}_{i,t} + \beta^4 \text{DE}_{i,t} + \beta^5 \text{QR}_{i,t} \\
 & + \beta^6 \text{ROI}_{i,t} + \beta^7 \text{SIZE}_{i,t} + \beta^8 \text{ACP}_{i,t} + e_{i,t}
 \end{aligned} \tag{1}$$

where the dummy D_k^{year} has a value of one at year k and otherwise zero, i and t denote respectively firm and year. Correspondingly, $BETA_{i,t}$, $PBV_{i,t}$, $DE_{i,t}$, $QR_{i,t}$, $ROI_{i,t}$, $SIZE_{i,t}$ and $ACP_{i,t}$ denote the market beta, price to book ratio, debt to equity ratio, quick ratio, return on investments, natural logarithm of total assets, and the proxy for auditing complexity, i.e. the percentage of foreign sales to total sales for firm i at year t . This model specification allows intercepts, i.e. the level of auditing fees, to vary over years since [Menon and Williams \(2001\)](#) document that audit fees have varied over time. No dummy variable is used for the last year of the sample to avoid the dummy variable trap.

The theory presented in [Section 2](#) suggests that the coefficient of market-based risk measure, $BETA_{i,t}$, should be positive. Moreover, the coefficient of market and accounting information-based risk measure, $PBV_{i,t}$, is expected to be positive. The variables $DE_{i,t}$, $SIZE_{i,t}$ and $ACP_{i,t}$ are expected to have positive coefficients while the coefficients of $QR_{i,t}$ and $ROI_{i,t}$ are expected to be negative. We have no expectations regarding the intercept term.

To test whether the intercepts vary over years the F -test is used (see, e.g. [Baltagi, 1995](#)). With respect to possible multicollinearity, the analysis of variance inflation factors (VIF) indicates that the multicollinearity problem is not present (see, e.g. [Judge, Hill, Griffiths, Lütkepohl & Lee, 1988](#), pp. 868–871). The [Weisberg \(1985\)](#) outlier test shows that outliers do not have any effect on the regression results. Therefore, only the results using the raw data are reported. The White's and the Breusch-Pagan tests indicate that the error variances are heteroscedastic. Therefore, the [White \(1980\)](#) heteroscedasticity consistent covariance matrix is used in the estimation of the standard errors.

To investigate whether explanatory variables have the same effect on the audit fees across countries, the following fixed effects equation is estimated:

$$\begin{aligned} FEE_{i,t} = & \alpha + \sum_{k=92}^{99} \beta_k^1 D_k^{\text{year}} + \sum_{l=1}^6 \beta_l^2 D_l^{\text{country}} + \sum_{l=1}^6 \beta_l^3 D_l^{\text{BETA}} BETA_{i,t} \\ & + \sum_{l=1}^6 \beta_l^4 D_l^{\text{PBV}} PBV_{i,t} + \sum_{l=1}^6 \beta_l^5 D_l^{\text{DE}} DE_{i,t} + \sum_{l=1}^6 \beta_l^6 D_l^{\text{QR}} QR_{i,t} \\ & + \sum_{l=1}^6 \beta_l^7 D_l^{\text{ROI}} ROI_{i,t} + \sum_{l=1}^6 \beta_l^8 D_l^{\text{SIZE}} SIZE_{i,t} + \sum_{l=1}^6 \beta_l^9 D_l^{\text{ACP}} ACP_{i,t} + e_{i,t} \end{aligned} \quad (2)$$

where, D_k^{year} and D_l^{country} are year and country dummies and other variables are defined as above. D_l^{BETA} , D_l^{PBV} , D_l^{DE} , D_l^{QR} , D_l^{ROI} , D_l^{SIZE} , and D_l^{ACP} are the country

dummy variables for $BETA_{i,t}$, $PBV_{i,t}$, $DE_{i,t}$, $QR_{i,t}$, $ROI_{i,t}$, $SIZE_{i,t}$ and $ACP_{i,t}$. To avoid the dummy variable trap, no dummy variables are used for the last year (2000) and for one country (U.K.). Equation (2) allows for time and country effects in the intercept and country effects in the slope coefficients. Similarly to the time effect in the intercept, the equality of each slope coefficient across countries is tested using the F -test. The possibility of multicollinearity and heteroscedasticity is detected as described earlier. Based on this, the White (1980) heteroscedasticity consistent covariance matrix is used in the estimation.

5. EMPIRICAL RESULTS

The results of investigating systematic market risk and other risk proxies in audit pricing are reported in Table 2. The figures in the table are the estimation results of model (1). The results with yearly dummies allowing the intercept to vary over years are reported if F -test rejects the equality of coefficients of the dummy variables, otherwise the results without dummies are reported (see Baltagi, 1995). Inequality occurs in only one estimation, suggesting that the specification of the one way fixed effect model is adequate for Norway. The explanatory power of the model varies across countries, suggesting that the explanatory ability of the model is not the same in all the countries investigated. The highest explanatory power is observed in the U.K. (0.76) and the lowest in Norway (0.39). With respect to the estimated coefficients of the market based risk measure, the results indicate that the beta is positive and statistically significant at the five per cent level in Hong Kong, Malaysia, Norway and the U.K. while the other countries exhibit insignificant coefficients for the beta. The fraction of significant coefficients is lower for the price to book ratio. Moreover, the other risk measures based on accounting information exhibit one to four significant coefficients depending on the variable in question. The coefficients of the control variables, i.e. size and auditing complexity are highly significant and they have expected signs, which is in accordance with the earlier studies (see, e.g. DeFond, Francis & Wong, 2000; Menon & Williams, 2001; Simunic & Stein, 1996). These results suggest that the market based-risk measure explains auditing fees in addition to the risk measures based on accounting information. However, the performance of the model seems to differ across countries. Especially in Denmark, Singapore and South Africa the various risk measures perform poorly. This may be an indication that risk is not taken into account when pricing auditing services in those countries.

The empirical results of the consistency of coefficients across countries are reported in Table 3. In Panel A, the estimation results of model (2) are reported. All coefficients but that of return on investments have expected signs and they

Table 2. Risk Measures Explaining Audit Fees.

Variable	Prediction	Denmark	Hong K.	Malaysia	Norway	Singapore	S. Africa	UK
Intercept	?	0.0779 (0.884)	0.7574 (0.007)	-3.1229 (0.000)	0.6178 (0.390)	-1.1874 (0.001)	-0.5833 (0.369)	-2.0848 (0.000)
BETA	+	0.0392 (0.606)	0.0924 (0.038)	0.2585 (0.000)	0.2397 (0.031)	-0.0673 (0.281)	0.0906 (0.562)	0.0634 (0.000)
PBV	+	0.0334 (0.067)	-0.0001 (0.993)	0.0051 (0.508)	0.0174 (0.728)	0.0198 (0.104)	-0.0002 (0.991)	0.0147 (0.000)
DE	+	-0.1841 (0.019)	0.0666 (0.087)	-0.0363 (0.137)	-0.2148 (0.031)	0.0175 (0.701)	0.1254 (0.108)	0.0637 (0.000)
QR	-	-0.0041 (0.916)	-0.0386 (0.016)	-0.0477 (0.010)	-0.0310 (0.453)	-0.0574 (0.153)	-0.2297 (0.001)	-0.0375 (0.000)
ROI	-	-0.4088 (0.228)	-0.2705 (0.022)	-0.3382 (0.055)	-0.2609 (0.561)	-0.1480 (0.475)	-0.1246 (0.707)	-0.0549 (0.239)
SIZE	+	0.4826 (0.000)	0.4411 (0.000)	0.5724 (0.000)	0.4433 (0.000)	0.5187 (0.000)	0.5619 (0.000)	0.6223 (0.000)
ACP	+	0.0020 (0.208)	0.0049 (0.000)	0.0184 (0.000)	-0.0009 (0.719)	0.0076 (0.000)	0.0152 (0.001)	0.0100 (0.000)
No. of obs		269	863	950	165	568	281	3869
Adj. R^2		0.44	0.44	0.62	0.39	0.51	0.49	0.76
F-statistics		30.97	98.39	219.17	16.43	84.17	39.77	1740.15
Probability		0.000	0.000	0.000	0.000	0.000	0.000	0.000
F-test		0.99	0.65	0.44	8.28	0.94	0.7	0.53
Probability		0.436	0.716	0.877	0.000	0.479	0.674	0.810

Notes: The White (1980) heteroskedasticity consistent covariance matrix is used.

P-values of the *t*-test are in parentheses.

F-test: test for fixed effects, i.e. equality of intercepts over time.

The results with yearly dummies are reported if the F-test rejects the equality of intercepts over time.

The variables are defined as follows: BETA = market beta; PBV = market price to book ratio; DE = book value of interest bearing debt to equity; QR = quick ratio: ratio of current assets less inventories to current liabilities; ROI = profit before interest and tax to total invested capital; SIZE = natural logarithm of total assets; ACP = percentage of foreign sales to total sales.

Table 3. Estimation Results of Eq. (2): Country Effects.

Panel A: Estimation Results			
Variable	Prediction	Coefficient	Prob. of <i>t</i> -stat.
Intercept		-1.9425	0.000
BETA		0.0680	0.000
PBV		0.0146	0.000
DE		0.0654	0.000
QR		-0.0399	0.000
ROI		-0.0506	0.272
SIZE		0.6107	0.000
ACP		0.0103	0.000
Adj. R^2		0.79	
No. of obs		6965	
Panel B: Tests for Equality of the Coefficients Across Countries			
Variable		<i>F</i> -stat	Prob.
Intercept: year		1.88	0.069
Intercept: country		27.46	0.000
BETA		3.93	0.001
PBV		1.10	0.362
DE		6.54	0.000
QR		3.25	0.003
ROI		1.11	0.352
SIZE		18.88	0.000
ACP		29.72	0.000

Notes: The White (1980) heteroskedasticity consistent covariance matrix is used.

The variables are defined as follows: BETA = market beta; PBV = market price to book ratio; DE = book value of interest bearing debt to equity; QR = quick ratio; ratio of current assets less inventories to current liabilities; ROI = profit before interest and tax to total invested capital; SIZE = natural logarithm of total assets; ACP = percentage of foreign sales to total sales.

are statistically highly significant. However, the main interest of model (2) is to investigate the equality of the impacts of the variables across countries, i.e. equality of the country dummy variables. The results of the *F*-test testing the equality of the coefficients are reported in Panel B. The results indicate that the model allowing country variation in the intercept term is adequate while the equality of the yearly dummies is not rejected. With respect to the risk measures, the equality is rejected for BETA, DE and QR indicating that the impacts of these variables on the audit fees vary across countries. On the other hand, equality is not rejected in the case of PBV and ROI. However, the coefficient of the ROI is not significant in Panel A,

indicating that the ROI has no impact on the audit fees. With respect to the control variables, the equality of the impact across countries is rejected for both variables. In general, these results suggest that the impacts of the variables in explaining audit fees vary across countries. This also holds for the market based risk measure, which is not affected, for example, by differences in accounting practices. These findings are in accordance with the proposition of Cobbin (2002), according to which culturally sensitive and market specific variables could potentially have a significant impact on the level of audit fees paid.

6. SUMMARY AND CONCLUSIONS

This study examines whether auditors assess the systematic market risk in their audit pricing decisions. According to the audit pricing model of Simunic (1980), the audit fee is a function of the audit effort and the auditor's client specific risk. Consequently, audit fees should reflect the client specific risk. However, there exists no clear-cut answer which one or more of several possible risk measures should be used. Moreover, the empirical results regarding risk seem to vary across different markets. A possible reason for these mixed results is that an auditor faces a portfolio selection problem as does an investor. Thus, as Markowitz (1952) shows, only the systematic risk of a firm should affect the selection problem.

To empirically investigate whether auditors assess the systematic market risk in their audit pricing decisions across different environments, data from Denmark, Hong Kong, Malaysia, Norway, Singapore, South Africa, and the United Kingdom are analyzed. The results of statistical tests suggest that in some countries the market-based risk measure explains auditing fees in addition to the risk measures based on accounting information. However, the performance of the model seems to differ across countries, which may indicate that the risk is not taken into account when pricing auditing services. Moreover, the impacts of the variables in explaining audit fees vary across countries. This also holds for the market-based systematic risk measure. These findings are in accordance with the proposition of Cobbin (2002) according to which culturally sensitive and market specific variables could potentially have a significant impact on the level of audit fees paid.

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TRENDS IN ACCOUNTING DOCTORAL DISSERTATIONS: 1991–2000

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ABSTRACT

Repeated calls for change in accounting programs and various pressures on the profession emphasize the importance of academic reflective adaptation. Yet, curricula remain largely unchanged. One possible explanation may lie in the training of accounting educators. Doctoral programs focus on research culminating in dissertations. Assuming academics will tend to align career teaching and research interests consistent with their doctoral training, we examine doctoral dissertations in accounting over the ten-year period of 1991 through 2000.

Trends based on topic, research methodology, country of origin, and university are examined. The United States dominates and 14 major institutions continue to produce the preponderance of dissertations. Dissertation topics proportionally have not changed, nor has the predominant research methodology employed over the last decade. A strong emphasis on financial accounting topics utilizing publicly available databases persists. This is particularly so in the schools identified as the most prestigious. Implications for the crisis in accounting education are discussed.

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INTRODUCTION

For more than a decade, various sources have described a crisis taking place in accounting scholarship and education (e.g. [AECC, 1990](#); [Albrecht & Sack, 2000](#); [Demski, 2001](#)). The [Accounting Education Change Commission \(1990\)](#) noted “the current content of professional accounting education, which has remained substantially the same over the last 50 years, is generally inadequate for the future accounting professional. A growing gap exists between what accountants do and what accounting educators teach.” [Albrecht and Sack \(2000\)](#) similarly argue “universities like the fact that bureaucracies protect and insulate them from the real world. Such protection allows universities to withstand change and not worry about such issues as student placement and competition.” This is manifest in a growing gap between practice and academic research and teaching has widened. The recent focus on accounting relevancy and related issues precipitated by the events surrounding the collapse of Enron and related auditing irregularities further emphasize the existence of a problem.

Given the crisis of public confidence in the profession, and significant changes in the accounting profession, accounting academia faces a challenge of maintaining and advancing relevancy. Unfortunately, accounting doctoral programs continue to develop narrow research agendas, which inevitably carry into the classroom ([Albrecht & Sack, 2000](#)). Further, accounting journals “struggle with an intertemporal sameness, with incremental as opposed to discontinuous attempts to move our thinking forward” ([Demski, 2001](#)). More attention needs to be focused on such issues as technology, globalization, corporate governance, ethics, and new business models.

This paper reports on trends in accounting doctoral dissertations over the ten-year period of 1991 through 2000. We believe that the topic and methodological design of doctoral dissertations are valid indicators of the types of research that will be conducted by scholars post-dissertation. Data were obtained from the database *ProQuest – Dissertation Abstracts* as of August 2001. The 2,292 accounting dissertations listed in that period were examined based on (A) topic, (B) research methodology, (C) country of origin, and (D) university affiliation.

The main findings of our research appear to be consistent with general impressions shared among academicians. Financial accounting continues to be the main research topic, and the empirical research method utilizing publicly available databases is the predominant methodology. Universities in the United States continue to dominate in number of dissertations produced, with a large concentration among a few Ph.D. granting universities.

Trends indicate a slight increase in the number of dissertations in behavioral accounting research areas. Other research methodologies, including case study

and experiment, also increased modestly. Although the United States is by far the leading producer of doctoral dissertations, Australia and New Zealand have emerged as important as Europe in producing accounting dissertations.

The remainder of the paper is organized in four sections. The first section describes the background and prior literature. The next section describes the methods employed in categorizing each of the areas analyzed. The third section describes the results of the study. The final section concludes and discusses limitations, implications, and areas for further research.

BACKGROUND AND PRIOR LITERATURE

Brown (1996) emphasizes the importance of influential accounting researchers, Ph.D. granting institutions, and faculties on topics and methodologies selected for publication in top research journals. These influences help define what subjects and research methods will be employed by those entering academia, and thus doctoral dissertations. Many highly ranked journals in accounting have traditionally encouraged capital markets research. This type of research lends itself to econometric/empirical techniques using public databases. Further, conferences and promotion policies have a strong influence on the types of research generated (Beaver, 1996). At the extreme, Schipper (1994) notes that empirical-archival methods are the only acceptable methods for conducting research into the standard-setting process.

Lukka and Kasanen (1996) observe that the accounting research community is centered in the United States. Further, Lee and Williams (1999) note that an elite group of accounting researchers in the United States exists that maintains control of the American Accounting Association (AAA) and the editorial boards of the leading U.S. accounting journals. This constrains the type of research that makes its way into the journals regarded as being in the “top tier” of accounting literature and often discourages serious attempts at other types of research.

There have been no major shifts in accounting research areas in over a quarter of a century (Beaver, 1996). The large majority of top-tier research in the past has dealt with financial accounting and capital markets and has employed publicly available databases for data. Beaver further notes that the increased availability of and access to public databases is likely to generate even more research of this type. However, if other outlets for research and their perceived quality increase, academics will be more likely to engage in other types of research (Prather & Rueschhoff, 1996).

A study by Yuce and Simga-Mugan (1997) examines accounting dissertations from 1990 to 1995. In this unpublished paper, the authors categorize dissertations

based on research topics, countries, and schools. Our research is an extension of Yuce and Simga-Mugan's work. We examine dissertations through the year 2000 and have modified the coding of the dissertations, in terms of both topics and methodologies. The next section describes our research method and the variables identified in the study.

Method and Description of Variables

Every accounting dissertation recorded between 1991 through 2000 was reviewed. Abstracts were extracted from the *ProQuest – Dissertation Abstracts* database for the period, and those identifying “accounting” as a main subject were isolated. These 2,292 abstracts were then classified based on main topic, research methodology, country, and university affiliation. Descriptions of the topic and research methodology categories are described in following sections.

Topics

Dissertations were divided into seven major topic areas, each of which had several sub-categories. The seven major topic areas that we have identified are: financial accounting, managerial accounting, auditing, taxation, accounting education, governmental accounting, and other areas (including accounting information systems). These topic areas were further divided into several sub-topic areas. Our categorization is based on prior studies (Brown, 1996; Yuce & Simga-Mugan, 1997). Since all studies help to construct accounting theory, we did not consider “accounting theory” as a separate topic. In the category “other” are listed several unrelated topics which, although important areas of research, comprise a relatively small number of dissertations overall.

Research Methods

Based on previous studies (e.g. Prather & Rueschhoff, 1996), dissertations are also categorized based on the primary research methodology used. Methodology categories are:

- empirical from public databases,
- empirical from private sources (self-designed),
- experimental,
- cases and field studies,
- descriptive, and
- theory and models

Empirical research is based on observation or experience. Here this type of research is referred to as empirical-public data and empirical-own data. The difference is that the former uses information that is publicly available and was collected by other parties, while the latter uses information collected by the researcher through a self-designed and single-purpose questionnaire.

An experiment in the social sciences involves people and direct access by the researcher to the subjects. According to [Wallace \(1991\)](#) this implies that the researcher collects evidence that arises from actual judgments made by the subjects in a controlled environment.

Case method is a terminology brought from educational and social science research. This method entails the complete analysis and understanding of the situation and its particularities related to a small number of entities. We consider research to be case studies when the number of entities analyzed was not larger than five.

In this paper a merely descriptive model without mathematical formalization is named as “descriptive.” A model is some representation of reality that is simpler than what is being emulated but is expected to have some explanatory power. [Wallace \(1991\)](#) says that models may be descriptive or theoretically derived. Finally, we included in the category of “theories and models” those theses that developed a theory based on a descriptive model.

Country and University

Dissertations are classified by country based on the location of the issuing university rather than the authors’ nationalities. In the ProQuest database, there are few non-United States dissertations (roughly 10%); therefore, this variable may not be very reliable. However, its inclusion in this study helps in following some trends.

Universities are divided into two groups for the purpose of this paper. Using [Brown’s \(1996\)](#) classification, one group is made up of the more prolific universities, the 14 schools that have granted the most doctoral degrees in the last ten years. The other group is made up of another 14 universities that are regarded as “top schools.”

RESULTS

This study examines accounting doctoral dissertations from the *ProQuest – Dissertations Abstracts* for the period of 1991 through 2000. During that period the number of dissertations produced in the field of accounting has decreased steadily by about 50%, from 286 in 1991 to 146 in 2000 (see [Table 1](#)).

Table 1. Main Topic by Year.

Main Topic	Year										Total	Evolution Trend
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000		
1. Financial	124	93	108	95	73	91	93	92	75	56	900	−4.88
accounting	43.36%	37.80%	42.19%	35.98%	32.44%	39.91%	42.66%	38.33%	40.98%	38.36%	39.27%	
2. Managerial	71	52	69	58	60	50	66	61	52	41	580	−1.79
accounting	24.83%	21.14%	26.95%	21.97%	26.67%	21.93%	30.28%	25.42%	28.42%	28.08%	25.31%	
3. Auditing	36	46	33	48	33	38	21	28	23	19	325	−2.52
	12.59%	18.70%	12.89%	18.18%	14.67%	16.67%	9.63%	11.67%	12.57%	13.01%	14.18%	
4. Taxation	22	21	24	25	23	21	15	20	13	12	196	−1.20
	7.69%	8.54%	9.38%	9.47%	10.22%	9.21%	6.88%	8.33%	7.10%	8.22%	8.55%	
5. Education	13	8	9	7	11	8	2	11	7	9	85	−0.31
	4.55%	3.25%	3.52%	2.65%	4.89%	3.51%	0.92%	4.58%	3.83%	6.16%	3.71%	
6. Government	11	7	8	9	6	9	5	7	4	4	70	−0.59
accounting	3.85%	2.85%	3.13%	3.41%	2.67%	3.95%	2.29%	2.92%	2.19%	2.74%	3.05%	
7. Other	9	19	5	22	19	11	16	21	9	5	136	−0.31
	3.15%	7.72%	1.95%	8.33%	8.44%	4.82%	7.34%	8.75%	4.92%	3.42%	5.93%	
Total	286	246	256	264	225	228	218	240	183	146	2,292	−11.61

In terms of main topic areas of the dissertations, the distribution of dissertations has remained almost unchanged over the ten-year period examined, as indicated in [Table 1](#). Between 37.8 and 43.36% of the dissertations published in each of those years (mean = 39.27%) was in the area of financial accounting. An average of 25.31% were in managerial accounting, 14.18% in the field of auditing, 8.55% in taxation, 3.71% in accounting education, 3.05% in governmental accounting, and 5.93% in other areas. There has been a modest decline in financial accounting research. The primary beneficiaries of the financial accounting decline have been managerial accounting and auditing.

[Table 2](#) shows the distribution of doctoral dissertations by sub-categories of topics. The proportion appears to be consistent over the ten-year period analyzed in terms of the sub-categories within each topic area.

More than half of all dissertations over the ten-year period analyzed were empirical and drew data from publicly available databases. Empirical research using private sources was employed in 15.53% of the dissertations, cases and field studies were employed in 6.72%, 3.18% were descriptive, and 7.37% developed theory or models as their methodologies (see [Table 3](#)). Case and field studies exhibit the greatest proportional change (increase) although the total number of all dissertations has declined sharply.

[Table 4](#) illustrates methodology by main topic areas. Although empirical research methods using public databases constitutes over half of all dissertations, in the area of financial accounting, this methodology accounts for almost 92% of all dissertations during the ten-year period analyzed. Other methodologies are more predominant in other topic areas. For example, in the area of governmental accounting, 32.86% of dissertations employed descriptive methods in their design.

[Table 5](#) illustrates quite clearly the dominance of United States universities in terms of the number of doctoral dissertations produced. Approximately 90% of all doctoral dissertations issued during the ten-year period examined originated from American universities. Less than 5% originate in Europe combined. Canada accounts for about 3% of dissertations during the period. Slightly less than 1.5% originate in either Australia or New Zealand (mostly Australia), and less than 1% in South Africa. There appear to be no significant variations in this mix over the ten years analyzed. [Table 5](#) further shows an analysis of topic area by country of origin. U.S. domination in the areas of financial accounting, auditing, and education in proportion to the total number of dissertations from that country is evident. On the other hand, there are proportionally less dissertations from U.S. universities in governmental accounting and other topics.

Empirical methodologies, both using publicly available databases and private databases, in addition to experiments dominate the landscape of American dissertations during the ten-year period studied ([Table 5](#)). There are markedly

Table 2. Secondary Topic by Year.

Main Topic	Secondary Topic	Year										Total
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Financial accounting	Earnings	6	3	7	6	8	9	10	12	7	5	73
	management	2.10%	1.22%	2.73%	2.27%	3.56%	3.95%	4.59%	5.00%	3.83%	3.42%	3.18%
	Disclosure	7	8	8	12	9	9	11	18	8	4	94
		2.45%	3.25%	3.13%	4.55%	4.00%	3.95%	5.05%	7.50%	4.37%	2.74%	4.10%
	Equity and assets	7	7	13	10	6	8	9	8	9	9	86
	valuation	2.45%	2.85%	5.08%	3.79%	2.67%	3.51%	4.13%	3.33%	4.92%	6.16%	3.75%
	Forecasting	23	11	9	14	10	16	9	11	9	7	119
	models	8.04%	4.47%	3.52%	5.30%	4.44%	7.02%	4.13%	4.58%	4.92%	4.79%	5.19%
	Information	21	22	11	7	7	10	17	7	12	9	123
	content	7.34%	8.94%	4.30%	2.65%	3.11%	4.39%	7.80%	2.92%	6.56%	6.16%	5.37%
	Earnings	8	8	19	10	6	5	7	10	7	5	85
	persistence (ERC)	2.80%	3.25%	7.42%	3.79%	2.67%	2.19%	3.21%	4.17%	3.83%	3.42%	3.71%
	Standards	24	15	14	15	12	13	10	7	9	5	124
		8.39%	6.10%	5.47%	5.68%	5.33%	5.70%	4.59%	2.92%	4.92%	3.42%	5.41%
	Debt and risk	14	10	7	4	7	8	5	8	4	6	73
	issues	4.90%	4.07%	2.73%	1.52%	3.11%	3.51%	2.29%	3.33%	2.19%	4.11%	3.18%
Managerial accounting	Bankruptcy	6	4	12	7	3	4	5	2	3	1	47
		2.10%	1.63%	4.69%	2.65%	1.33%	1.75%	2.29%	0.83%	1.64%	0.68%	2.05%
	International	8	5	8	10	5	9	10	9	7	5	76
		2.80%	2.03%	3.13%	3.79%	2.22%	3.95%	4.59%	3.75%	3.83%	3.42%	3.32%
	Performance	8	7	9	2	5	6	14	7	5	7	70
	measures	2.80%	2.85%	3.52%	0.76%	2.22%	2.63%	6.42%	2.92%	2.73%	4.79%	3.05%
	Executive	6	3	5	6	5	6	8	2	6	2	49
	compensation	2.10%	1.22%	1.95%	2.27%	2.22%	2.63%	3.67%	0.83%	3.28%	1.37%	2.14%
	Cost measures and	10	8	8	9	6	8	10	13	11	9	92
	systems	3.50%	3.25%	3.13%	3.41%	2.67%	3.51%	4.59%	5.42%	6.01%	6.16%	4.01%

Auditing	Budgeting	10	6	7	3	4	5	3	5	6	2	51
		3.50%	2.44%	2.73%	1.14%	1.78%	2.19%	1.38%	2.08%	3.28%	1.37%	2.23%
	Transfer prices	3	3	3	1	2	1	3	3	1		20
		1.05%	1.22%	1.17%	0.38%	0.89%	0.44%	1.38%	1.25%	0.55%	0.00%	0.87%
	Strategic issues		1	2	1	4	1	1	4	5	4	23
			0.41%	0.78%	0.38%	1.78%	0.44%	0.46%	1.67%	2.73%	2.74%	1.00%
	Management control systems	6	2	7	5	6	3	11	5	4	2	51
		2.10%	0.81%	2.73%	1.89%	2.67%	1.32%	5.05%	2.08%	2.19%	1.37%	2.23%
	Information systems	9	7	10	6	5	4	3	4	2	4	54
		3.15%	2.85%	3.91%	2.27%	2.22%	1.75%	1.38%	1.67%	1.09%	2.74%	2.36%
	Human information processing	8	4	7	5	6	5	7	7	3	1	53
		2.80%	1.63%	2.73%	1.89%	2.67%	2.19%	3.21%	2.92%	1.64%	0.68%	2.31%
	Behavioral	5	4	8	8	11	5	4	9	8	8	70
		1.75%	1.63%	3.13%	3.03%	4.89%	2.19%	1.83%	3.75%	4.37%	5.48%	3.05%
	Agency theory	6	7	3	12	6	6	2	2	1	2	47
		2.10%	2.85%	1.17%	4.55%	2.67%	2.63%	0.92%	0.83%	0.55%	1.37%	2.05%
	Plans and techniques	6	5	7	4	3	5	3	4	3		40
		2.10%	2.03%	2.73%	1.52%	1.33%	2.19%	1.38%	1.67%	1.64%	0.00%	1.75%
	Litigation risk and fraud	3	4	3	8	11	8	6	7	2	6	58
		1.05%	1.63%	1.17%	3.03%	4.89%	3.51%	2.75%	2.92%	1.09%	4.11%	2.53%
	Quality and customer relations	6	6	5	13	5	8	5	7	7	2	64
		2.10%	2.44%	1.95%	4.92%	2.22%	3.51%	2.29%	2.92%	3.83%	1.37%	2.79%
Auditing	Rules and reporting	5	8	5	5	4	4	1	5	2	1	40
		1.75%	3.25%	1.95%	1.89%	1.78%	1.75%	0.46%	2.08%	1.09%	0.68%	1.75%
	Auditor decisions	12	17	12	17	7	10	5	3	8	7	98
		4.20%	6.91%	4.69%	6.44%	3.11%	4.39%	2.29%	1.25%	4.37%	4.79%	4.28%

Table 2. (Continued)

Main Topic	Secondary Topic	Year										Total
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Taxation	Internal auditing	4 1.40%	6 2.44%	1 0.39%	1 0.38%	3 1.33%	3 1.32%	1 0.46%	2 0.83%	1 0.55%	3 2.05%	25 1.09%
	Economic effects	14 4.90%	8 3.25%	12 4.69%	12 4.55%	8 3.56%	8 3.51%	8 3.67%	7 2.92%	7 3.83%	6 4.11%	90 3.93%
	Personal judgments	3 1.05%	4 1.63%	5 1.95%	2 0.76%	3 1.33%	4 1.75%	9 0.00%	1 3.75%	1 0.55%	1 0.68%	32 1.40%
	Taxation systems	4 1.40%	5 2.03%	2 0.78%	9 3.41%	8 3.56%	3 1.32%	5 2.29%	2 0.83%	4 2.19%	1 0.68%	43 1.88%
	Compliance	1 0.35%	4 1.63%	5 1.95%	2 0.76%	4 1.78%	6 2.63%	2 0.92%	2 0.83%	1 0.55%	4 2.74%	31 1.35%
	Methods of instruction	3 1.05%	2 0.81%	0.00%	2 0.76%	6 2.67%	2 0.88%	1 0.46%	5 2.08%	0.00%	3 2.05%	24 1.05%
	Educative systems	2 0.70%	1 0.41%	3 1.17%	1 0.38%	1 0.44%	2 0.88%	2 0.00%	4 1.67%	2 1.09%	1 0.68%	17 0.74%
Education	Student affairs	3 1.05%	3 1.22%	6 2.34%	2 0.76%	2 0.89%	3 1.32%	1 0.00%	1 0.42%	2 1.09%	1 0.68%	23 1.00%
	Professional education	5 1.75%	2 0.81%	0.00%	2 0.76%	2 0.89%	1 0.44%	1 0.46%	1 0.42%	3 1.64%	4 2.74%	21 0.92%
	Budgeting and financing	3 1.05%	2 0.81%	1 0.39%	1 0.38%	2 0.89%	3 1.32%	2 0.92%	1 0.00%	1 0.55%	0.00%	15 0.65%
	Cost and managerial issues	4 1.40%	4 0.00%	4 1.56%	3 1.14%	2 0.00%	1 0.88%	1 0.46%	3 1.25%	1 0.00%	1 0.68%	18 0.79%
Government accounting	Auditing	1 0.41%	1 0.39%	1 0.38%	1 0.89%	2 0.44%	1 0.46%	1 0.46%	0.00%	0.00%	2 1.37%	9 0.39%

Others	Reporting	2		1	1		2	1	1			8
		0.70%	0.00%	0.39%	0.38%	0.00%	0.88%	0.46%	0.42%	0.00%	0.00%	0.35%
	Law and rules	2	4	1	3	2	1		3	3	1	20
		0.70%	1.63%	0.39%	1.14%	0.89%	0.44%	0.00%	1.25%	1.64%	0.68%	0.87%
	Critical perspective		1	1	2		3		3			10
		!	0.41%	0.39%	0.76%	0.00%	1.32%	0.00%	1.25%	0.00%	0.00%	0.44%
	Job and promotion in accounting	1	4	1	5	5	3	10	4	1		34
		0.35%	1.63%	0.39%	1.89%	2.22%	1.32%	4.59%	1.67%	0.55%	0.00%	1.48%
	History	4	8	1	2	7	2		4	2	2	32
		1.40%	3.25%	0.39%	0.76%	3.11%	0.88%	0.00%	1.67%	1.09%	1.37%	1.40%
	Corporate governance	2	2	1	7	5	2	2	7	2	2	32
		0.70%	0.81%	0.39%	2.65%	2.22%	0.88%	0.92%	2.92%	1.09%	1.37%	1.40%
	Ethics	2	4	1	6	2	1	4	3	4	1	28
		0.70%	1.63%	0.39%	2.27%	0.89%	0.44%	1.83%	1.25%	2.19%	0.68%	1.22%
	Total	286	246	256	264	225	228	218	240	183	146	2,292
		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 3. Method of Research by Year.

Method of Research	Year										Total
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Empirical public sources	160 55.94%	117 47.56%	138 53.91%	140 53.03%	110 48.89%	128 56.14%	112 51.38%	125 52.08%	104 56.83%	80 54.79%	1,214 52.97%
Empirical private sources	39 13.64%	35 14.23%	39 15.23%	41 15.53%	48 21.33%	30 13.16%	37 16.97%	33 13.75%	31 16.94%	23 15.75%	356 15.53%
Experimental	38 13.29%	45 18.29%	34 13.28%	35 13.26%	33 14.67%	36 15.79%	31 14.22%	35 14.58%	18 9.84%	21 14.38%	326 14.22%
Cases field studies	17 5.94%	15 6.10%	17 6.64%	12 4.55%	14 6.22%	13 5.70%	20 9.17%	19 7.92%	14 7.65%	13 8.90%	154 6.72%
Descriptive	9 3.15%	11 4.47%	12 4.69%	11 4.17%	7 3.11%	5 2.19%	3 1.38%	6 2.50%	4 2.19%	5 3.42%	73 3.18%
Theory and models	23 8.04%	23 9.35%	16 6.25%	25 9.47%	13 5.78%	16 7.02%	15 6.88%	22 9.17%	12 6.56%	4 2.74%	169 7.37%
Total	286 100.00%	246 100.00%	256 100.00%	264 100.00%	225 100.00%	228 100.00%	218 100.00%	240 100.00%	183 100.00%	146 100.00%	2,292 100.00%

Table 4. Main Topic by Method of Research.

Main Topic	Method of Research						Total
	Empirical – Public Sources	Empirical – Private Sources	Experimental	Cases – Field Studies	Descriptive	Theory and Models	
Financial accounting	826	14	16	5	22	17	900
% within main topic	91.78	1.56	1.78	0.56	2.44	1.89	100.00
% within method of research	68.04	3.93	4.91	3.25	30.14	10.06	39.27
Managerial accounting	109	133	137	96	9	96	580
% within main topic	18.79	22.93	23.62	16.55	1.55	16.55	100.00
% within method of research	8.98	37.36	42.02	62.34	12.33	56.80	25.31
Auditing	101	69	108	12	3	32	325
% within main topic	31.08	21.23	33.23	3.69	0.92	9.85	100.00
% within method of research	8.32	19.38	33.13	7.79	4.11	18.93	14.18
Taxation	117	22	38		4	15	196
% within main topic	59.69	11.22	19.39	0.00	2.04	7.65	100.00
% within method of research	9.64	6.18	11.66	0.00	5.48	8.88	8.55
Education	8	47	14	11	3	2	85
% within main topic	9.41	55.29	16.47	12.94	3.53	2.35	100.00
% within method of research	0.66	13.20	4.29	7.14	4.11	1.18	3.71
Government accounting	24	17	2	23	3	1	70
% within main topic	34.29	24.29	2.86	32.86	4.29	1.43	100.00
% within method of research	1.98	4.78	0.61	14.94	4.11	0.59	3.05
Other	29	54	11	7	29	6	136
% within main topic	21.32	39.71	8.09	5.15	21.32	4.41	100.00
% within method of research	2.39	15.17	3.37	4.55	39.73	3.55	5.93
Total	1,214	356	326	154	73	169	2,292
% within main topic	52.97	15.53	14.22	6.72	3.18	7.37	100.00
% within method of research	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Symmetric measures		Value	Asymp. Std. Error	Approx. T	Approx. Sig.		
Interval by interval	Pearson's r	0.245	0.019	12.078	0.000		
Ordinal by ordinal	Spearman correlation	0.446	0.018	23.860	0.000		
N of valid cases		2,292					

fewer dissertations from the U.S. utilizing other methodologies; such as case study, descriptive, theory, or other methods of research. These appear to be stronger in other areas, especially Europe.

An analysis of dissertations produced at specific universities focused on two factors. First was an examination of universities noted as the most “prestigious” (Brown, 1996). The second was an examination of universities that are the most prolific in terms of the number of dissertations produced from 1991 to 2000. Tables 6 and 7 examine both types of universities over the ten-year period. The

Table 5. Country of University by Year, Main Topic and Research Methodology.

	US	%	Canada	Others America	%	UK	Rest of Europe	%	China	%	Australia and NZ	%	South Africa	%	Total		
1991	256	89.51	9		9	3.15	5	15	20	6.99				1	0.35	286	
1992	229	93.09	3		3	1.22		10	10	4.07		2	0.81	2	0.81	246	
1993	238	92.97	3		3	1.17	1	7	8	3.13		4	1.56	3	1.17	256	
1994	246	93.18	5		5	1.89	2	8	10	3.79		3	1.14		0.00	264	
1995	200	88.89	8		8	3.56	1	6	7	3.11		9	4.00	1	0.44	225	
1996	199	87.28	12		12	5.26	2	4	6	2.63	1	0.44	9	3.95	1	0.44	228
1997	197	90.37	7		7	3.21	3	5	8	3.67	1	0.46	2	0.92	3	1.38	218
1998	205	85.42	8	2	10	4.17	6	11	17	7.08	2	0.83		6	2.50	240	
1999	153	83.61	10		10	5.46		10	10	5.46	3	1.64	3	1.64	4	2.19	183
2000	132	90.41	5		5	3.42	4	3	7	4.79		0.00	1	0.68	1	0.68	146
Total	2,055	89.66	70	1	72	3.14	24	79	103	4.49	7	0.31	33	1.44	22	0.96	2,292
Financial	823	91.44	29		29	3.22	9	25	34	3.78	2	0.22	5	0.56	7	0.78	900
Managerial	507	87.41	20	2	22	3.79	6	31	37	6.38	1	0.17	9	1.55	4	0.69	580
Auditing	294	90.46	9		9	2.77	1	7	8	2.46	4	1.23	6	1.85	4	1.23	325
Taxation	188	95.92	6		6	3.06		2	2	1.02		0.00		0.00		0.00	196
Education	79	92.94	2		2	2.35	1	1	2	2.35		0.00		0.00	2	2.35	85
Government	57	81.43	4		4	5.71	2	5	7	1.00		0.00	2	2.86		0.00	70
Others	107	78.68				0.00	5	8	13	9.56		0.00	11	8.09	5	3.68	136
Total	2,055	89.66	70	1	72	3.14	24	79	103	4.49	7	0.31	33	1.44	22	0.96	2,292
Empirical public	1,145	94.32	34		34	2.80	8	13	21	1.73	3	0.25	6	0.49	5	0.41	1,214
Empirical private	331	92.98	8		8	2.25	2	4	6	1.69	2	0.56	1	0.28	8	2.25	356
Experimental	306	93.87	8		8	2.45	1	4	5	1.53	2	0.61	5	1.53		0.00	326
Cases	115	74.68	7	1	8	5.19	4	18	22	14.29		0.00	8	5.19	1	0.65	154
Descriptive	31	42.47	2		2	2.74	6	20	26	35.62		0.00	10	13.70	4	5.48	73
Theories and models	127	75.15	11	1	12	7.10	3	20	23	13.61		0.00	3	1.78	4	2.37	169
Total	2,055	89.66	70	1	72	3.14	24	79	103	4.49	7	0.31	33	1.44	22	0.96	2,292

Table 6. Top (Prestigious) Universities by Year, Main Topic and Research Method.

	Rochester	Stanford	Carnegie Mellon	MIT	Chicago	Cornell	Berkeley	Case Western	University of Washington	Iowa	Purdue	Ohio State	North Western	Suny Buffalo	Total	% of Total
1991	1	1				2	4	2	2		1	4	2	2	21	8.64
1992	4		1		2	1	1		4		2	4	1		20	8.23
1993	1	5	1			1	1	1	1	4	2	3	1	2	23	9.47
1994		2	2		2	3	2		4	2	5	3	4	2	31	12.76
1995	2	2				1	2	1	3		1	4	4	3	23	9.47
1996	1	1	2		2		1	1	5	5	3	3	2	1	27	11.11
1997	3	4		1		3	2	1	3	1		4	2	2	26	10.70
1998	1	3	3	3	5	2	4	1	1	2	2	2	1	3	33	13.58
1999	2		1	2	3	1	1	1		2	1	2	2	7	25	10.29
2000		3			3	1		1	1	4				1	14	5.76
Total	15	21	10	6	17	15	18	9	24	20	17	29	19	23	243	10.60
Financial	10	12	3	5	13	9	14	7	13	10	11	10	14	11	142	58.44
Managerial	3	8	5		1	6	2	1	8	4	2	10	1	6	57	23.46
Auditing	1	1	1	1	1		2		1	2	2	7	2		21	8.64
Taxation					1			1	1	2	2		1		8	3.29
Education									1			1			2	0.82
Government										1				3	4	1.65
Others	1		1		1					1		1	1	3	9	3.70
Total	15	21	10	6	17	15	18	9	24	20	17	29	19	23	243	10.60
Empirical public	13	13	6	5	16	10	16	6	16	14	16	12	15	15	173	71.19
Empirical private	1	1			1	1			1	1		4	1	5	16	6.58
Experimental						3		1	5	3		5		1	18	7.41
Cases	1	2	1	1		1			1			2		1	10	4.12
Descriptive			1					2				1		1	5	2.06
Theories and models		5	2				2		1	2	1	5	3		21	8.64
Total	15	21	10	6	17	15	18	9	24	20	17	29	19	23	243	10.60

Table 7. Prolific Universities by Year, Main Topic and Research Method.

	Texas A&M	Texas Austin	University of Mississippi	Illinois Urbana	Kentucky	Michigan State	North Texas	Georgia	Penn State	NYU	Arizona State	Nova Southeast	Florida State	Nebraska	Total	% of Total
1991	7	8	4	5	10	2	3	3	6	6	4	4	4	6	72	13.31
1992	6	4	6	6	2	5	6	8	5	4	3	1	6	7	68	12.57
1993	9	3	5	6	4	7	6	5	4	5	6	2	5	3	70	12.94
1994	4	4	4	4	4	4	6	4	4	6	4		5		53	9.80
1995	2	5	5	4	5	2	1	5	3	3	2	4	2	1	44	8.13
1996	3	7	3	3	3	5	8	3	5	2	3	2	3	2	52	9.61
1997	6	7	2	5	3	3	3	2	1	7	4	4	4	6	56	10.35
1998	6	2	6	1	7	4	5	4	6		2	4		3	50	9.24
1999	8	2	3	1	1	5	1	3			3	3	1	3	34	6.28
2000	2	2	4	5	1	2			3	4	3	9	3	2	40	7.39
Total	53	44	42	40	40	39	39	37	37	37	34	33	33	33	541	23.60
Financial	24	23	4	20	13	18	12	12	15	17	8	12	22	14	214	39.56
Managerial	11	6	7	8	10	12	9	8	7	11	4	10	5	9	117	21.63
Auditing	11	6	7	7	4	4	6	9	6	1	6	2	4	5	78	14.42
Taxation	2	7	10	3	4	4	3	2	6		13	4	1	1	60	11.09
Education	2	2	6	1	2		2	4		3	2	2		1	27	4.99
Government	2			1	2			1	3	2	1			1	13	2.40
Others	1		8		5	1	7	1		3		3	1	2	32	5.91
Total	53	44	42	40	40	39	39	37	37	37	34	33	33	33	541	23.60
Empirical public	34	28	11	22	21	24	16	21	21	19	17	16	28	17	295	54.53
Empirical private	3	2	13	3	10	5	8	9	4	8	6	11	1	7	90	16.64
Experimental	7	10	11	9	9	6	4	3	4	2	9	2	2	8	86	15.90
Cases	5		2	1		2	5	1	6	1		3			26	4.81
Descriptive		1	3				6	1					1		12	2.22
Theories and models	4	3	2	5		2		2	2	7	2	1	1	1	32	5.91
Total	53	44	42	40	40	39	39	37	37	37	34	33	33	33	541	23.60

largest, Texas A&M University, produced 53 dissertations during that period, University of Texas at Austin, 44. The 14 most prolific universities produced a total of 539 dissertations during that period, almost a quarter of the total. The 14 universities considered the most prestigious produced 243 accounting dissertations over the period, approximately 11% of the total.¹

Additional analysis of dissertations by the most prolific and most prestigious universities by research topic and research methodology is also illustrated in [Tables 6 and 7](#). Almost 40% of dissertations produced at the most prolific universities are in the financial accounting area, with 22% in managerial accounting. Further, over 58% of dissertations produced by the universities described as most prestigious are in financial accounting,² 23% in managerial accounting, or a combined total of almost 82%.

Results of analysis of research methodologies employed at the two types of universities isolated in this study yield similar findings ([Tables 6 and 7](#)). Approximately 55% of accounting dissertations out of prolific universities employed empirical research methodology using publicly available databases, whereas 71% of those from prestigious universities used this method of research.³

CONCLUSIONS

The accounting profession and accounting education have faced many challenges over the past decade or more, as identified by various commissions, and “white papers” (e.g. [AICPA, 2000](#); [Albrecht & Sack, 2000](#); [IMA, 1994, 1999](#)). A significant decline in the number of doctoral candidates in accounting also is observed. With the changes taking place in the profession, a call has been made for increased relevance of scholarly research in the field (e.g. [Lee & Williams, 1999](#)).

This study analyzes accounting doctoral dissertations produced during the period of 1991 through 2000. We believe that doctoral dissertations are an indication of the types of research that will be conducted by those entering accounting academia. Dissertations are categorized based on research topic and subtopic, research methodology, and country and university of origin. Data are collected from the *ProQuest – Dissertations Abstracts* database.

Results indicate that the number of dissertations produced from 1991 to 2000 has declined by one half. The proportion of dissertations on various topics and using specific methodologies has not changed during the period. The majority of dissertations are in the area of financial accounting and utilize empirical research methodologies employing publicly available databases. In those universities considered the most prestigious, a much larger proportion of dissertations is in that area. The United States is by far the leading producer of doctoral dissertations,

followed by Europe and Australia. The most prolific 14 United States universities produce almost a quarter of all the accounting doctoral dissertations.

Some limitations in this study must be noted. First, we did not create a separate category for dissertations in the “behavioral accounting” area. Many dissertations, especially in the areas of audit and taxation, would fit into this category. Although the distinguishing finding of this study is the predominance of financial accounting using empirical research with publicly available databases, identifying behavioral topics or methodologies may have slightly altered our findings. Second, in the process of culling dissertations that are identified as “accounting,” there may have been some overlap in other areas, especially finance and other economics areas. Further analysis of “secondary” topic areas is not presented in this paper.

The findings of this research concur with prior research on journal article publication trends and implications (e.g. [Beaver, 1996](#); [Brown, 1996](#); [Lee & Williams, 1999](#)). It appears that the strong predominance of financial accounting research utilizing public databases is consistent with what the recognized “top tier” accounting research journals are publishing. In order for young researchers (doctoral candidates) to establish themselves in academia, it is safer to pursue research streams in areas in which there is a higher likelihood of acceptance for publication in recognized journals. Especially in the United States and in those universities considered the most prestigious, a risk-averse approach is to pursue this type of research. Notably in other parts of the academic world – Europe, Australia, and other places – research in other topic areas employing other methodologies appears to be acceptable, perhaps encouraged.

An area for further research would be to examine the amount of outside support provided to both doctoral students (in the form of scholarships and research grants) and doctoral committee members (in the form of research support and chairs). It is possible that support by the global accounting firms and other institutions have an influence on the types of research that is encouraged and conducted. This may be more pronounced in the larger and more prestigious universities.

Perhaps more encouragement to explore other research areas is called for in light of declining enrollments in doctoral programs and a perceived crisis in accounting education ([Albrecht & Sack, 2000](#)). Further, recent private sector and government calls for changes in the accounting and auditing function and structure may serve as an impetus for academia to address this.

NOTES

1. It should be noted that our analysis of dissertations each year and by each school does not exactly correspond to the numbers presented in a table by [Hasselback \(2002\)](#); however our aggregate totals for the ten-year period do match his.

2. Note that out of all dissertations, 39% covered this topic.
3. Note that out of all dissertations, 53% used this methodology.

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THE ECONOMIC VALUE ADDED (EVA): AN ANALYSIS OF MARKET REACTION

Bartolomé Deyá Tortella and Sandro Brusco

ABSTRACT

The Economic Value Added (EVA^{®1}) is a widely adopted technique for the measurement of value creation. Using different event study methodologies we test the market reaction to the introduction of EVA. Additionally, we analyze the long-run evolution before and after EVA adoption of profitability, investment and cash flow variables. We first show that the introduction of EVA does not generate significant abnormal returns, either positive or negative. Next, we show that firms adopt EVA after a long period of bad performance, and performance indicators improve only in the long run. With respect to the firm investment activity variables, the adoption of EVA provides incentives for the managers to increase firm investment activity, and this appears to be linked to higher levels of debt. Finally, we observe that EVA adoption affects positively and significantly cash flow measures.

INTRODUCTION

The Economic Value Added is a technique for the measurement of value creation developed by the Stern Stewart and Company consultant group (Stern, 1985; Stern et al., 1995; Stewart, 1991). Basically, the technique provides a way to compute the economic value created by the firm over a period of time, the key

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variable which should guide managerial decision making (Bromwich & Walker, 1998; Chen & Dodd, 1997).

The Economic Value Added of a firm can be defined as the change in the NOPAT (Net Operating Profit after Taxes) minus the change in the Cost of the Capital used to generate this NOPAT (Rappaport, 1986, 1998).

The interaction of two important trends can explain the development and diffusion of EVA. First, during the 1980s it became clear that traditional accounting methods often generated very unsatisfactory measures of firm performance (Kaplan, 1983, 1984). Traditional accounting methods are often influenced by the subjective opinion of the accountant (e.g. FIFO vs. LIFO, depreciation methodology), and this appears to be especially important in the analysis of profitability. As a consequence, managers can easily manipulate accounting performance measures (Dyl, 1989; Gomez-Mejia & Balkin, 1992; Hunt, 1985; Jensen & Murphy, 1990; Verrecchia, 1986).

Second, during the 1980s American firms experienced tough competition from Japanese firms (Kaplan, 1983) and, at the same time, financial markets internationalized and experienced a huge expansion. This higher exposure to the challenges and opportunities of international competition increased the need for better performance measures.

The EVA technique was developed by Stern Stewart and Company in order to satisfy this need, and it has been widely adopted in the 90s. Important firms like Coca Cola, DuPont, Eli Lilly, Polaroid, Pharmacia (former Monsanto), and Whirlpool have been among the adopters. EVA has received much attention both in academic and practitioner publications (see Biddle et al., 1997; Brickley et al., 1997). The measurement of value creation according to EVA has been used as a guide for investment decisions. Furthermore, following standard agency-theoretic considerations, EVA measures have frequently been used in the determination of managerial compensation.

Despite all the positive rhetoric surrounding EVA, and all the positive aspects emphasized by Stern Stewart and Co. and others (O'Byrne, 1997; Stewart, 1991, 1994; Tully, 1993, 1994, 1998, 1999; Walbert, 1994; see also www.sternstewart.com), there are several studies questioning its efficiency (Biddle et al., 1997; Chen & Dodd, 2001; Fernandez, 2001; Haspeslagh et al., 2001; Wallace, 1997). For example, studies analyzing EVA information content (Biddle et al., 1997; Chen & Dodd, 2001; Clinton & Chen, 1998), and its correlation with Market Value Added (Fernandez, 2001; Riceman et al., 2000; Walbert, 1994) have obtained mixed results.

These studies do not analyze the stock market reaction when firms adopt EVA, or how key firm variables evolve. If EVA improves managerial decisions we should expect a positive market reaction after the adoption. On the other

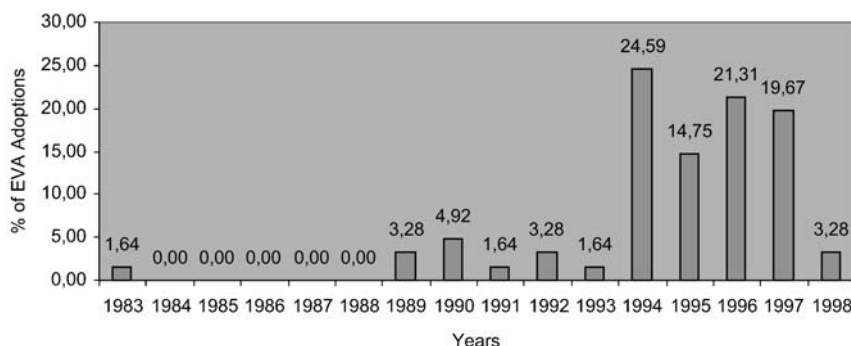


Fig. 1. EVA Adoption Timing.

hand, a lack of reaction would imply that the markets do not consider the adoption of EVA a significant improvement. In order to test these hypotheses, we perform an event study methodology (MacKinlay, 1997; McWilliams & Siegel, 1997), using a sample of firms that adopted EVA technique during the 1980s and 1990s.

In order to obtain robust results, we use different methodologies and test statistics. We find that on average a firm does not experience significant abnormal reactions, either positive or negative, before or after EVA adoption. The result appears to be in conflict with Stern Stewart and Company communications and other studies (O'Byrne, 1997; Walbert, 1994), observing that companies that apply the EVA technique have subsequently obtained high returns. This is probably due to the fact that the explosion of the EVA technique occurred in the mid-1990s (see Fig. 1), a period characterized by a strong stock market.

It has also been claimed that EVA helps to improve firm performance, operating profits, cash flow measures, the cost of capital, and the firm investment activity (Prober, 2000; Stewart, 1991). In order to check these claims we analyze the evolution, before and after EVA adoption, of three sets of firm variables. First, we look at performance indicators, both accounting based (Return on Assets), and market based (Annual Average Monthly Market Return). Second, we analyze variables measuring investment and financing activity (Price to Book ratio, Tobin-q ratio, Debt to Assets ratio, the R&D Expenses to Sales ratio, and the Total Assets item). Finally, since EVA increases the importance of cash flow versus other accounting variables, we also analyze the evolution of two cash flow variables (Cash Flow Margin and the EBITDA Margin), as well as the dividends per share. In this final study, we observe that EVA companies experience significant cash flow increments after the EVA adoption, but no significant increment in dividends per share.

We find some weak evidence that the improvement in cash flow is stronger when managerial compensation is linked to EVA, although the small size of our sample makes it difficult to provide robust conclusions.

The rest of the paper is organized as follows. We first describe the most important characteristics and properties of the EVA technique. Next we discuss the sample and the methodology used in the analysis. In the central part of the paper, we present the results obtained in the event study and in the company analysis profile before and after the EVA adoption. Finally we summarize and discuss the main findings.

THE ECONOMIC VALUE ADDED (EVA) TECHNIQUE

EVA can be defined as the firm operating profit after taxes (NOPAT), less the cost of capital (Rappaport, 1986, 1998). EVA proponents assume that any increment in the firm EVA increases the value of the firm (Chen & Dodd, 1997; Ray, 2001). From the operational point of view we have (Biddle et al., 1997; Fernandez, 2001; Rappaport, 1998):

$$\text{EVA} = \text{NOPAT} - (D + \text{Ebv}) \times \text{WACC}$$

where $\text{NOPAT} = \text{EBEI} + \text{ATIn}$ and the variables are defined as follows:

- NOPAT: Net Operating Profits After Taxes.
- D: Debt Book Value.
- Ebv: Equity Book Value.
- WACC: Weighted Average Cost of Capital.
- EBEI: Earnings Before Extraordinary Items.
- ATIn: After Taxes Cost of Interest Expense.

The change in EVA is therefore equal to

$$\Delta \text{EVA} = \Delta(\text{NOPAT} - (D + \text{Ebv}) \times \text{WACC})$$

The information needed to compute EVA is obtained mainly from accounting data. However, accounting information has to go through some adjustments. Some of these adjustments are to add back deferred tax reserves and bad debt reserves, goodwill amortization, and LIFO reserve increase (Prober, 2000; Rappaport, 1998). These adjustments are made to correct the “distortions” in accounting information, and in order to get a better approximation of firm cash flows (Stewart, 1994). Basically, the EVA methodology uses modifications of GAAP earnings in addition to a capital charge (Wallace, 1997).

In order to provide incentives for managers to use EVA in making investment decisions, some firms link part of the managerial compensation to some measure of EVA (Haspeslagh et al., 2001; Pettit & Ahmad, 2000; Riceman et al., 2000; Wallace, 1997). The introduction of EVA into managerial compensation usually occurs some time after the adoption of EVA. However, we observe that most firms do not introduce EVA in the compensation system (Ittner & Larcker, 1998).

Controversy in EVA Literature

The literature on EVA has produced mixed results. Some papers have found that EVA increases shareholders value (Pettit, 2000; Stern et al., 1995; Stewart, 1991, 1994; see also: www.sternstewart.com). In this line, we can also find studies that observe a positive and significant correlation between EVA and Market Value Added (Walbert, 1994), and shareholder returns (O'Byrne, 1997). The financial press has also devoted some attention to the positive properties of EVA (e.g. Davies, 1996; Tully, 1993, 1994, 1998, 1999; Walbert, 1993). However, as several authors point out (Chen & Dodd, 2001; Ray, 2001), in most of the cases these papers only expose anecdotal stories about the spectacular stock price evolution of EVA firms after the EVA adoption.

Other papers have put forward theoretical arguments and empirical evidence questioning the properties of EVA. The main issue is whether EVA is a really useful technique or it is only a management fashion that will fade away with time, as was the case with ABC (Carmona & Gutierrez, 2003) and TQM (Abrahamson & Fairchild, 1999). Brickley et al. (1997) classify EVA as a management fashion. O'Hanlon and Peasnell (1998) discuss the main characteristics of the EVA, but at the same time question its utility, and posit that we will have to wait some time to evaluate if EVA is a really useful technique.

Some empirical studies have questioned the efficiency of EVA. Fernandez (2001), using a representative sample of American and European firms based on data provided by Stern Stewart and Company, analyzes the correlation between the MVA (*Market Value Added*) and the EVA, NOPAT, and WACC. Fernandez observes a low (and sometimes negative) correlation between EVA and MVA, and concludes that NOPAT and WACC present higher levels of correlation with the increase in the MVA.² The results are in the line with those obtained by Biddle et al. (1997), and Riceman et al. (2000).

Motivated by the huge increase in the use of EVA, Biddle et al. (1997) analyze the EVA information content with respect to other accounting-based measures using data provided by Stern Stewart and Company. They find evidence that accounting earnings and operating cash flows are more closely associated to stock

market returns or firm values than EVA. In the same line, [Chen and Dodd \(2001\)](#) examine the information content (in terms of value-relevance) of operating income, residual income, and EVA. Using different statistical testing methodologies, they find that operating income and residual income present higher information content than the EVA measure. [Clinton and Chen \(1998\)](#) obtain similar results.

[Wallace \(1997\)](#) observes that firms adopting residual income compensation plans do not present statistically significant abnormal returns over the market portfolio. At the same time he observes that firms adopting such plans present highly significant increments in their residual income measures, a “*you get what you measure and reward*” kind of effect. Our paper is in the same line as Wallace’s study, but there are some important differences. First, Wallace analyzes all the firms that adopt residual income-based compensation plans, while we focus only on firms that apply the EVA technique. Second, Wallace uses monthly stock return data, while our event study uses daily stock return data. Finally, the time period of the study is different. Wallace only analyzes firms that adopt residual income-based compensation plans over the ten-year period ending fiscal year 1994. Our paper analyzes firms that adopt the EVA technique during the period 1982–1999.

We supplement the event study with an analysis of the evolution of three sets of variables: performance measures (ROA, and Annual Average Monthly Market Return), investment activity indicators (Price to Book ratio, Tobin-q ratio, Debt to Assets, R&D to Sales, and Total Assets), and cash flow measures (Cash Flow Margin, the EBITDA Margin and Dividends per Share). In order to obtain a long-term perspective we analyze how these three sets of variables evolve during the period starting from five years before and ending five years after the adoption.

SAMPLE AND METHODOLOGY

Sample

The list of EVA firms and their adoption day is obtained from Stern Stewart and Company marketing brochures. We began with an initial list of 66 events/firms, all the events being from different firms.

Starting from this initial firm list, we apply several filters. First, we require that firm information is available in the *Compustat Database* and *CRSP Database*. Second, we want to have a sufficiently long estimation period for the market model. The estimation period is the time between $(-330, -30)$, where moment 0 is the adoption day. We establish a minimum of 200 daily returns for the estimation period. As usual, any non-trading date is converted to the next trading day.

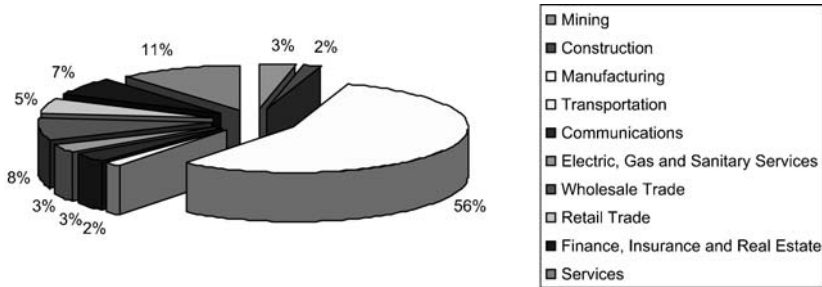


Fig. 2. Sector Distribution.

Applying both restrictions we end up with a sample of 61 firms for the company analysis and 55 firms/events for the event study (the list of firms is in the [Appendix](#)). Following the Standard Industrial Classification code, we analyze the sample sector distribution (see [Figs 2 and 3](#)). The sample includes firms from many sectors, with the manufacturing sector being the most important one. Inside manufacturing, we can observe that the electronic and computer sector presents the highest level of adoption.

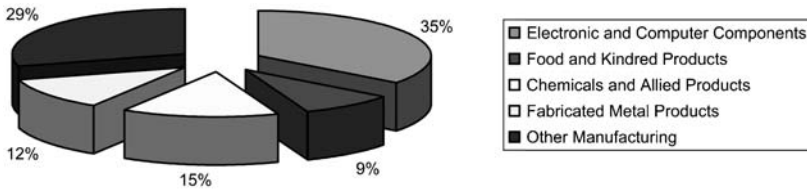


Fig. 3. Manufacturing Sector Distribution.

Event Study Methodology

As pointed out before, the estimation period is set between $(-330, -30)$ (where 0 is the EVA adoption day). The event window is set between day -30 to day $+100$. We compute the CAAR from a set of windows embedded in this event window. Specifically, we analyze the windows $(-30, 0)$, $(-20, 0)$, $(-10, 0)$, $(0, +20)$, $(0, +30)$, $(0, +50)$, $(0, +60)$, $(0, +90)$, $(0, +100)$.

According to the traditional market model, we can represent the stock return of the firm j in day t as:

$$r_{j,t} = \alpha + \beta \cdot r_{m,t} + \varepsilon_{j,t}$$

Thus, we can define the abnormal return of j -firm ($AR_{j,t}$), as:

$$AR_{j,t} = r_{j,t} - \hat{\alpha} - \hat{\beta} \cdot r_{m,t}$$

where $(\hat{\alpha}, \hat{\beta})$ are the parameters estimated during the estimation period. The Average Abnormal Return of period t (AAR_t), is defined as:

$$AAR_t = \frac{\sum_{j=1}^J AR_{j,t}}{J}$$

Finally, the Cumulative Average Abnormal Return in the window (T_1, T_2) ($CAAR_{T_1, T_2}$), is:

$$CAAR_{T_1, T_2} = \frac{\sum_{j=1}^J \sum_{t=T_1}^{T_2} AR_{j,t}}{J}$$

In order to obtain robust results, we apply different methodologies and test statistics (MacKinlay, 1997; McWilliams & Siegel, 1997). We develop the traditional Event Study Methodology and compute the traditional t -statistics for each daily return AAR_t , and for each $CAAR_{T_1, T_2}$. Additionally, we also apply the Standardized Abnormal Return method, and compute the z -statistic proposed by Patell (1976). This method is based on the concept of standardized abnormal return that can be defined as:

$$SAR_{j,t} = \frac{AR_{j,t}}{S_{AR_{j,t}}}$$

where $(S_{AR_{j,t}})$ is the maximum likelihood estimate of the variance of $AR_{j,t}$. Under a set of conditions (see Patell, 1976), the test statistic for the hypothesis ($CAAR_{T_1, T_2} = 0$), follows (under the null hypothesis) a standard normal distribution.

The traditional event study t -statistic uses the standard error from the time series standard deviation of estimation period. Following Pilotte (1992), we apply the cross-sectional method, consisting in computing the t -statistic using for each event date the cross-sectional (across securities) standard deviation.

Finally, we also compute the standardized cross-sectional test proposed by Mikkelsen and Partch (1988). This test corrects the test of Patell (1976), and adjusts the CAAR for the possible serial correlation of the abnormal returns of each stock. As Cowan (1993) points out, serial correlation may be an important factor for long windows (e.g. windows of 100 days' length). These statistics also follows a standard normal distribution.

The daily returns needed for the event study are obtained from *CRSP Database*. The value weighted and the equally weighted index used in the event study are the *NYSE-AMEX-Nasdaq* indices provided by *CRSP Database* using all stocks.

We also performed the study using the *SandP500* and *Composite* market indexes, obtaining identical results.

Company Analysis Methodology

EVA proponents claim that EVA helps to improve firm performance, operating profits, cash flow measures, the cost of capital and the firm investment activity (Prober, 2000; Stewart, 1991). In order to test these claims, and also in order to analyze how the EVA company profiles evolve, we use annual data to capture the long-term firm evolution around the adoption date. The data are obtained from the *Compustat Database*. We analyze the cross time evolution of three sets of key firm variables in the period from five years before to five years after the adoption. First, we analyze profitability measures such as the Return on Assets, and the Annual Average Monthly Market Return. ROA is obtained directly from Compustat Database, and is the standard measure used in the literature to capture the firm's performance evolution. Additionally, in order to analyze both accounting-based and market-based performance measures, we also consider the Annual Average Monthly Market Return.

The second set of measures analyzed in this section is related to the firm investment activity. We analyze the Price to Book ratio and the Tobin-q ratio (using the approximation proposed by Chung & Pruitt, 1994). Both measures are used in the literature as proxies for the firm investment opportunities set (Fenn & Liang, 2001; Martin, 1996; Wright et al., 1996). We also use the Debt to Assets ratio, to analyze how the investment activity is financed. We also broke down the ratio Debt to Assets into Long and Short Term Debt to Assets ratios. The R&D to Sales ratio is frequently used in the literature to measure directly the firm investment activity. In order to analyze the impact of EVA on company size before and after the adoption, we also analyze the time evolution of the Total Assets item.

Lastly, we take a look at cash flow measures. We analyze the Cash Flow Margin (Income Before Extraordinary Items plus Depreciation and Amortization, scaled by Sales) and the EBITDA Margin (Earnings Before Interest, Taxes and Depreciation, scaled by Sales), since some studies use this variable as a proxy for the free cash flow (Fenn & Liang, 2001). We also consider the evolution of the Dividends per Share, a measure of how much cash is given back to shareholders.

RESULTS

Abnormal Market Returns Around the EVA Adoption

As discussed before, in order to obtain robust conclusions we apply different event studies methodologies and test statistics. In Table 1, we develop the traditional

Table 1. Daily Abnormal Returns.

Day	AAR (%)	Pos:Neg	<i>t</i> -Stat (1)	<i>z</i> -Stat (2)	CS- <i>t</i> -Stat (3)	Gen. Sign <i>z</i> (4)
-30	-0.04	24:31	-0.160	-0.139	-0.191	-0.540
-29	0.02	25:30	0.080	-0.089	0.069	-0.270
-28	0.31	29:26	1.270	0.735	1.401	0.810
-27	-0.26	22:33	-1.060	-0.611	-1.318	-1.081
-26	0.29	27:28	1.190	1.201	1.162	0.270
-25	-0.01	22:33	-0.040	-0.317	-0.037	-1.081
-24	0.36	28:27	1.480	1.519	1.835 ^{\$}	0.540
-23	-0.15	19:36	-0.620	-0.352	-0.680	-1.891 ^{\$}
-22	0.11	30:25	0.450	-0.230	0.412	1.080
-21	0.31	29:26	1.270	0.887	1.287	0.810
-20	0.27	30:25	1.110	1.667 ^{\$}	1.241	1.080
-19	0.08	22:33	0.330	-0.332	0.267	-1.081
-18	-0.16	19:36	-0.660	-0.993	-0.803	-1.891 ^{\$}
-17	-0.24	20:35	-0.970	-1.221	-0.870	-1.621
-16	0.10	30:25	0.410	0.239	0.435	1.080
-15	0.29	28:27	1.190	0.950	0.919	0.540
-14	-0.08	26:29	-0.330	-0.243	-0.431	0.000
-13	0.19	29:26	0.780	1.145	0.795	0.810
-12	-0.28	25:30	-1.150	-0.942	-0.969	-0.270
-11	0.24	33:22	0.990	1.259	0.883	1.890 ^{\$}
-10	0.20	32:23	0.820	1.331	0.781	1.620
-9	-0.53	23:32	-2.180*	-1.646 ^{\$}	-1.808 ^{\$}	-0.811
-8	0.26	34:21	1.070	1.539	1.113	2.160*
-7	0.07	30:25	0.290	-0.022	0.303	1.080
-6	0.18	32:23	0.740	1.025	0.718	1.620
-5	0.32	31:24	1.310	1.476	1.475	1.350
-4	0.46	35:20	1.890 ^{\$}	1.976*	2.026*	2.431*
-3	-0.21	23:32	-0.860	-0.704	-0.994	-0.811
-2	0.36	31:24	1.480	1.069	1.391	1.350
-1	-0.26	19:36	-1.070	-1.220	-1.124	-1.891 ^{\$}
+0	0.10	27:28	0.400	0.492	0.441	0.270
+1	0.27	27:28	1.100	0.624	1.109	0.270
+2	-0.47	22:33	-1.910 ^{\$}	-1.378	-1.703 ^{\$}	-1.081
+3	0.21	27:28	0.860	0.391	0.597	0.270
+4	0.01	27:28	0.040	0.038	0.054	0.270
+5	0.07	26:29	0.290	0.315	0.318	0.000
+6	0.52	30:25	2.110*	2.130*	2.609**	1.080
+7	-0.17	21:34	-0.680	-0.685	-0.972	-1.351
+8	-0.39	18:37	-1.600	-1.696 ^{\$}	-2.344*	-2.161*
+9	0.11	28:27	0.450	0.452	0.546	0.540
+10	0.29	28:27	1.200	1.121	1.105	0.540
+11	-0.03	23:32	-0.130	-0.327	-0.105	-0.811
+12	0.13	24:31	0.540	0.684	0.440	-0.540

Table 1. (Continued)

Day	AAR (%)	Pos:Neg	<i>t</i> -Stat (1)	<i>z</i> -Stat (2)	CS- <i>t</i> -Stat (3)	Gen. Sign <i>z</i> (4)
+13	-0.33	17:38	-1.350	-1.563	-1.370	-2.431*
+14	-0.35	24:31	-1.420	-1.417	-1.232	-0.540
+15	-0.23	29:26	-0.920	-0.515	-1.009	0.810
+16	-0.07	24:31	-0.280	-0.582	-0.288	-0.540
+17	0.01	27:28	0.060	0.053	0.067	0.270
+18	0.04	25:30	0.170	0.214	0.221	-0.270
+19	-0.09	25:30	-0.390	-0.436	-0.453	-0.270
+20	-0.09	24:31	-0.380	-0.544	-0.338	-0.540
+21	0.67	30:25	2.760**	2.472*	2.349*	1.080
+22	0.05	32:23	0.210	0.355	0.207	1.620
+23	0.15	24:31	0.620	0.008	0.494	-0.540
+24	-0.16	25:30	-0.660	-0.393	-0.613	-0.270
+25	-0.15	22:33	-0.620	-0.905	-0.623	-1.081
+26	-0.07	31:24	-0.280	0.112	-0.373	1.350
+27	-0.12	23:32	-0.510	-0.733	-0.361	-0.811
+28	0.05	28:27	0.200	-0.131	0.235	0.540
+29	0.09	31:24	0.370	0.737	0.485	1.350
+30	0.26	36:19	1.070	1.419	1.079	2.701**

Note: Equally Weighted Index.

§ significant at 10%, * significant at 5%, and ** significant at 1%.

event study methodology, computing the *t*-statistics (column 1), both for the daily and cumulative average abnormal returns (AAR and CAAR, respectively). Additionally, we develop the Standardized Residual Methodology proposed by Patell (1976). This methodology uses the *z*-statistic instead of the traditional *t*-statistic to test the null hypothesis that daily and cumulative average abnormal returns are equal to zero (column 2).

Following Pilotte (1992), we compute the *t*-statistic using the cross-sectional methodology (CS-*t*-statistic), using the cross-sectional standard deviation (column 3). We also compute the Generalized Sign *z*-statistic for the proportion of positive and negative abnormal returns (column 4).

We consider both an Equally Weighted (EW) index and a Value Weighted (VW) index for market return. The results are presented in Tables 1 and 3 (using EW index), and 2 and 4 (using VW index), for daily and cumulative abnormal returns, respectively.

According to Tables 1 and 2 there is no significant market reaction before or after EVA adoption. This result is obtained looking at the traditional *t*-statistic (column 1), the *z*-statistic (column 2), the cross-sectional *t*-statistic (column 3), and the Generalized Sign test (column 4). Before the adoption we observe a

Table 2. Daily Abnormal Returns.

Day	AAR (%)	Pos:Neg	<i>t</i> -Stat (1)	<i>z</i> -Stat (2)	CS- <i>t</i> -Stat (3)	Gen. Sign <i>z</i> (4)
-30	-0.03	24:31	-0.120	-0.049	-0.140	-0.550
-29	-0.04	24:31	-0.170	-0.229	-0.185	-0.550
-28	0.25	27:28	1.040	0.336	1.106	0.260
-27	-0.35	20:35	-1.450	-0.994	-1.769 ^{\$}	-1.630
-26	0.34	31:24	1.410	1.460	1.327	1.340
-25	0.01	20:35	0.040	-0.265	0.031	-1.630
-24	0.28	30:25	1.160	1.112	1.427	1.070
-23	-0.07	21:34	-0.290	0.025	-0.322	-1.360
-22	0.14	29:26	0.580	0.009	0.547	0.800
-21	0.36	33:22	1.500	1.185	1.518	1.881 ^{\$}
-20	0.27	21:24	1.120	1.758 ^{\$}	1.262	1.340
-19	0.05	20:35	0.200	-0.451	0.164	-1.630
-18	-0.15	20:35	-0.620	-0.913	-0.713	-1.630
-17	-0.18	22:33	-0.750	-0.938	-0.662	-1.090
-16	0.16	32:23	0.660	0.479	0.676	1.611
-15	0.26	27:28	1.080	0.763	0.803	0.260
-14	-0.14	26:29	-0.580	-0.452	-0.718	-0.010
-13	0.10	28:27	0.410	0.807	0.431	0.530
-12	-0.37	23:32	-1.540	-1.289	-1.264	-0.820
-11	0.23	32:23	0.960	1.200	0.819	1.611
-10	0.13	31:24	0.540	0.971	0.552	1.340
-9	-0.57	23:32	-2.370*	-1.819 ^{\$}	-1.975*	-0.820
-8	0.21	34:21	0.870	1.359	0.889	2.151*
-7	0.11	29:26	0.460	0.022	0.472	0.800
-6	0.24	31:24	0.990	1.270	0.956	1.340
-5	0.32	31:24	1.330	1.547	1.423	1.340
-4	0.48	36:19	1.990*	2.009*	2.113*	2.691**
-3	-0.28	24:31	-1.160	-1.008	-1.417	-0.550
-2	0.32	33:22	1.330	0.851	1.300	1.881 ^{\$}
-1	0.09	24:31	0.370	0.182	0.380	-0.550
+0	0.02	24:31	0.100	0.085	0.118	-0.550
+1	0.27	26:29	1.100	0.544	1.107	-0.010
+2	-0.47	23:32	-1.940 ^{\$}	-1.513	-1.721 ^{\$}	-0.820
+3	0.28	29:26	1.170	0.700	0.829	0.800
+4	-0.02	28:27	-0.070	-0.128	-0.077	0.530
+5	0.00	27:28	0.020	0.043	0.021	0.260
+6	0.49	34:21	1.990*	2.066*	2.541*	2.151*
+7	-0.12	20:35	-0.480	-0.586	-0.726	-1.630
+8	-0.36	18:37	-1.500	-1.667 ^{\$}	-2.255*	-2.170*
+9	0.06	28:27	0.250	0.260	0.317	0.530
+10	0.25	27:28	1.030	0.958	0.991	0.260
+11	-0.06	22:33	-0.230	-0.430	-0.194	-1.090
+12	0.13	27:28	0.520	0.659	0.423	0.260

Table 2. (Continued)

Day	AAR (%)	Pos:Neg	<i>t</i> -Stat (1)	<i>z</i> -Stat (2)	CS- <i>t</i> -Stat (3)	Gen. Sign <i>z</i> (4)
+13	-0.31	15:40	-1.270	-1.468	-1.245	-2.981**
+14	-0.36	24:31	-1.480	-1.483	-1.317	-0.550
+15	-0.27	23:32	-1.100	-0.661	-1.208	-0.820
+16	-0.13	22:33	-0.520	-0.820	-0.514	-1.090
+17	0.09	26:29	0.360	0.340	0.420	-0.010
+18	-0.03	25:30	-0.110	0.067	-0.138	-0.280
+19	-0.25	25:30	-1.040	-1.185	-1.181	-0.280
+20	-0.06	27:28	-0.240	-0.405	-0.229	0.260
+21	0.69	32:23	2.820**	2.561*	2.369*	1.611
+22	0.04	32:23	0.180	0.243	0.176	1.611
+23	0.13	24:31	0.550	-0.118	0.430	-0.550
+24	-0.19	26:29	-0.790	-0.486	-0.746	-0.010
+25	-0.17	20:35	-0.710	-1.008	-0.708	-1.630
+26	-0.05	28:27	-0.210	0.121	-0.290	0.530
+27	-0.14	23:32	-0.580	-0.812	-0.422	-0.820
+28	0.08	27:28	0.330	-0.035	0.373	0.260
+29	0.02	26:29	0.080	0.388	0.107	-0.010
+30	0.15	33:22	0.620	1.005	0.644	1.881 [§]

Note: Value Weighted Index.

[§] significant at 10%, * significant at 5%, and ** significant at 1%.

positive significant abnormal return for the day -4, and a negative significant abnormal return for the day -9. The rest of abnormal returns before adoption are not significant, but we observe 19 positive daily abnormal returns and 11 negative abnormal returns.

For the period after the EVA adoption we observe positive significant abnormal returns for the day 6 and 21. Days 2 and 8 present significant negative abnormal returns. The rest of daily abnormal returns after the adoption are not significant, with a fair number of them being negative (14 daily negative abnormal returns and 16 positive). The results are consistent for both the Equally Weighted Index (Table 1), and the Value Weighted Index (Table 2).

We also compute the CAAR of a set of windows before and after the EVA adoption in Table 3 (using EW index), and Table 4 (using VW index).

In the windows beginning right after the adoption day, we do not observe any significant positive CAAR. Some negative CAAR, although not significant, is also observed.

Looking at the windows ending at the adoption date, we can observe some significant positive CAAR (see columns 3 and 4), although the effects appear to be weak.

Table 3. Cumulative Abnormal Returns.

Window	CAAR (%)	Pos:Neg	<i>t</i> -Stat (1)	<i>z</i> -Stat (2)	CS- <i>t</i> -Stat (3)	Gen. Sign <i>z</i> (4)
(−30, 0)	2.29	30:25	1.69 ^{\$}	1.69 ^{\$}	1.74 ^{\$}	1.08
(−20, 0)	1.36	36:19	1.22	1.49	1.36	2.70**
(−10, 0)	0.95	34:21	1.18	1.60	1.44	2.16*
(0, +20)	−0.44	23:32	−0.40	−0.58	−0.42	−0.81
(0, +30)	0.31	29:26	0.23	0.05	0.26	0.81
(0, +50)	2.08	29:26	1.20	1.30	1.29	0.81
(0, +60)	1.81	26:29	0.95	1.18	1.14	0.00
(0, +90)	2.20	30:25	0.95	1.20	0.99	1.08
(0, +100)	1.39	32:23	0.57	0.92	0.58	1.62

Note: Equally Weighted Index.

^{\$} significant at 10%, * significant at 5%, and ** significant at 1%.

As noted above, we use the [Mikkelson and Partch \(1988\)](#) methodology to correct cumulative abnormal returns for stock serial dependence. This only affects the CAAR *z*-statistics. The results are shown in [Table 5](#) (using EW index), and [Table 6](#) (using VW index).

When the computation of CAAR is adjusted for serial dependence, all the values turn out not to be significantly different from zero. Thus, we conclude that the weak positive effects found in the previous analysis do not appear to be very robust.

To sum up, from the different event studies, we find that there is no significant market reaction to EVA adoption. There are some weakly positive abnormal returns before adoption, but these results are not robust. The same results are obtained using the S&P500 or Composite as market indexes.

Table 4. Cumulative Abnormal Returns.

Window	CAAR (%)	Pos:Neg	<i>t</i> -Stat (1)	<i>z</i> -Stat (2)	CS- <i>t</i> -Stat (3)	Gen. Sign <i>z</i> (4)
(−30, 0)	2.18	29:26	1.61	1.62	1.79 ^{\$}	0.80
(−20, 0)	1.30	33:22	1.17	1.40	1.33	1.88 ^{\$}
(−10, 0)	1.06	36:19	1.32	1.64 ^{\$}	1.77 ^{\$}	2.69**
(0, +20)	−0.83	24:31	−0.75	−1.01	−0.78	−0.55
(0, +30)	−0.28	22:33	−0.21	−0.50	−0.23	−1.09
(0, +50)	1.37	28:27	0.79	0.76	0.82	0.53
(0, +60)	0.66	25:30	0.35	0.42	0.39	−0.28
(0, +90)	0.48	27:28	0.21	0.32	0.21	0.26
(0, +100)	−0.99	29:26	−0.41	−0.20	−0.41	0.80

Note: Value Weighted Index.

^{\$} significant at 10%, and ** significant at 1%.

Table 5. Cumulative Abnormal Returns Corrected by Serial Dependence.

Window	CAAR-EW (%)	CAAR-PW (%)	Median CAR (%)	SD-z	Pos:Neg	Gen. Sign z
(−30, 0)	2.29	2.02	0.44	1.62	30:25	1.08
(−20, 0)	1.36	1.46	1.78	1.45	36:19	2.70**
(−10, 0)	0.95	1.14	1.80	1.57	34:21	2.16*
(0, +20)	−0.44	−0.56	−0.56	−0.57	23:32	−0.81
(0, +30)	0.31	0.06	0.86	0.04	29:26	0.81
(0, +50)	2.08	1.99	0.73	1.19	29:26	0.81
(0, +60)	1.81	1.98	−0.84	1.06	26:29	0.00
(0, +90)	2.20	2.46	2.74	1.03	30:25	1.08
(0, +100)	1.39	1.99	2.96	0.78	32:23	1.62

Note: Equally Weighted Index.

* significant at 5%, and ** significant at 1%.

Table 6. Cumulative Abnormal Return corrected by Serial Dependence.

Window	CAAR-VW (%)	CAAR-PW (%)	Median CAR (%)	SD-z	Pos:Neg	Gen. Sign z
(−30, 0)	2.18	1.90	1.07	1.55	29:26	0.80
(−20, 0)	1.30	1.35	1.40	1.36	33:22	1.88 [§]
(−10, 0)	1.06	1.15	1.22	1.62	36:19	2.69**
(0, +20)	−0.83	−0.98	−0.85	−1.00	24:31	−0.55
(0, +30)	−0.28	−0.58	−1.10	−0.50	22:33	−1.09
(0, +50)	1.37	1.15	0.34	0.70	28:27	0.53
(0, +60)	0.66	0.69	−1.94	0.38	25:30	−0.28
(0, +90)	0.48	0.64	−0.21	0.27	27:28	0.26
(0, +100)	−0.99	−0.42	0.85	−0.19	29:26	0.80

Note: Value Weighted Index.

[§] significant at 10%, and ** significant at 1%.

COMPANY PROFILE BEFORE AND AFTER THE EVA ADOPTION

Profitability Measures

We analyze the evolution of two measures, one accounting based (Return on Assets), and the other one market based (Annual Average Monthly Market Return) (Table 7).

Table 7. Profitability Measures.

	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ROA											
Average	6.439	5.266	4.742	3.913	4.419	5.339	5.544	5.172	4.139	4.464	7.946
Median	5.699	4.930	4.944	3.769	3.744	5.832	5.540	3.976	3.683	4.612	7.820
Std. Dev.	6.003	3.591	3.933	4.045	5.004	4.522	4.250	6.105	5.686	10.292	5.513
Annual average monthly return											
Average	2.018	1.074	0.704	0.878	1.848	1.837	1.716	1.064	0.927	0.540	1.853
Median	1.808	1.055	0.812	1.192	1.398	1.786	1.843	0.598	1.201	0.656	2.242
Std. Dev.	2.014	2.911	2.581	2.248	2.408	3.247	2.737	4.072	3.459	3.659	2.601

Both measures appear to be declining up to year -2, when they start improving until year zero. However, following the introduction no clear positive improving trend emerges. Only in year 5 after the adoption does the ROA appear to be clearly better than before the adoption. This is also true for the median monthly return, but not for the average. The good results of year 5 may not be representative. Many firms in our sample adopt EVA in 1994 and 1995, so that the fifth year coincides with a very strong market.

Investment Activity Measures

We now check whether the EVA introduction affects the company investment and financing activity. We analyze five measures: the Price to Book ratio, Tobin-q ratio, Debt to Assets, the R&D to Sales ratio, and the firm Total Assets. The Price to Book and the Tobin-q ratios are used in the literature as proxies of the firm investment opportunities set. Debt to assets ratio measures the firm leverage, and the R&D to sales ratio measures directly the R&D firm activity (Table 8).

The Price to Book and Tobin-q ratios show significant increases after the adoption of the EVA technique. This reveals that firms increase their investment activity, investing in new projects that expand the firm investment opportunity set. This fact is corroborated by the evolution of the R&D to sales ratio analyzed in the study. However, if we analyze the evolution of the Total Assets item, we observe that this increment in the firm investment activity is not followed by an increase in the firm size. Additionally, we can observe an increment in the Debt to Assets ratio. This can be interpreted in the sense that this increment in the firm investment activity after EVA adoption is usually financed through higher levels of debt. When we broke down debt into short-term and long-term, a slightly more pronounced role for long-term debt seems to emerge, although the patterns are not very clear.

Table 8. Investment Activity Measures.

	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Price to book											
Average	2.226	2.233	2.100	2.155	2.210	2.606	2.900	2.862	2.952	3.982	3.971
Median	1.784	1.930	1.916	1.870	2.308	2.266	2.325	2.385	2.265	2.948	2.797
Std. Dev.	1.150	1.427	1.100	1.245	1.891	2.600	3.310	3.130	7.328	4.138	3.597
Tobin-q ratio											
Average	1.035	0.982	0.903	0.939	1.022	1.227	1.329	1.315	1.538	1.495	1.661
Median	0.832	0.911	0.831	0.858	0.931	0.945	0.953	1.015	0.986	0.895	1.080
Std. Dev.	0.607	0.525	0.521	0.580	0.628	0.828	1.022	1.172	1.726	1.509	1.501
Debt to assets											
Average	24.574	25.106	25.817	24.269	26.371	27.308	27.009	27.421	27.035	28.037	26.807
Median	27.167	25.970	27.746	24.009	28.031	27.431	28.820	28.351	28.747	31.575	28.737
Std. Dev.	13.196	13.545	15.036	15.031	13.978	14.607	14.142	13.637	13.676	12.942	11.969
Long-term debt to assets											
Average	20.690	20.228	20.526	19.606	20.599	22.230	22.152	22.286	21.802	21.167	20.840
Median	22.154	20.859	21.349	19.859	20.667	21.905	21.987	22.186	23.272	23.451	20.782
Std. Dev.	13.923	14.002	15.118	15.050	13.231	14.613	13.731	12.825	13.339	11.349	11.383
Short term debt to assets											
Average	4.596	5.894	5.778	5.193	5.772	5.078	4.857	5.135	5.233	6.870	5.967
Median	3.306	3.921	4.746	4.685	3.802	3.185	3.677	3.911	3.020	4.680	3.502
Std. Dev.	4.559	5.328	5.523	5.187	7.537	5.360	5.140	5.279	5.052	6.161	5.950
R&D to sales											
Average	3.059	2.962	3.029	3.423	3.202	3.216	3.186	4.132	5.634	4.100	4.215
Median	1.963	1.739	1.329	1.356	1.385	1.718	1.597	1.469	1.759	1.723	1.720
Std. Dev.	3.395	3.319	3.490	4.238	4.000	4.041	3.989	5.947	11.405	5.343	5.492
Total assets (in millions of \$)											
Average	2329.6	2592.3	2739.0	2914.0	3314.8	3685.2	4244.9	4374.1	3891.6	3524.7	4057.8
Median	1252.0	1507.1	1787.9	1974.9	1992.8	2143.8	2164.2	2197.7	1930.0	1800.0	1881.6
Std. Dev.	2807.1	3182.5	3208.8	3315.4	4013.8	4529.4	5487.6	5320.4	4554.9	3999.5	4828.5

Table 9. Cash Flow Measures.

	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow margin											
Average	12.166	10.982	10.709	9.670	10.464	12.919	11.667	11.806	8.503	11.159	14.453
Median	9.154	8.739	8.020	8.625	9.544	9.948	10.420	10.779	9.010	11.455	13.280
Std. Dev.	10.081	7.892	7.440	6.444	7.167	14.112	9.182	11.783	14.547	9.434	8.093
Dividends per share											
Average	1.502	1.571	1.643	2.031	1.825	1.818	1.614	1.660	2.267	1.434	1.935
Median	0.460	0.501	0.492	0.460	0.430	0.345	0.354	0.337	0.320	0.306	0.511
Std. Dev.	2.957	3.194	3.482	4.307	4.114	3.913	3.555	3.675	5.849	3.088	3.592
EBIDTA margin											
Average	16.710	16.318	16.224	16.761	17.730	17.895	17.926	17.208	15.308	19.054	21.173
Median	15.024	13.787	12.727	14.484	15.281	16.887	16.499	16.552	15.852	17.926	18.299
Std. Dev.	11.336	11.307	11.387	11.543	11.990	9.755	9.351	10.092	20.824	9.827	12.002

Cash-Flow Measures

Given the emphasis put by EVA on cash flow, we thought it interesting to analyze the evolution of the Cash Flow Margin, the EBITDA Margin and Dividends per Share (Table 9).

We observe that the EVA adoption has generated significant important positive effects over Cash Flow measures. This stands in contrast with the lack of significant improvement in other performance measures, such as ROA. Dividends per Share also do not appear to be positively influenced by EVA. The median dividend is lower in all years following the adoption (except the fifth) than in the years preceding the adoption.

In order to provide incentives for managers, some firms that adopt EVA link part of managerial compensation to the firm economic value added. This in turn provides incentives for managers to improve cash flow measures. This behavior is very similar to the one observed with respect to accounting measures. Various empirical studies have documented that when managerial compensation is tied to firm accounting benefits, the main objective for managers becomes to increase such measures, sometimes manipulating them (Dyl, 1989; Gomez-Mejia & Balkin, 1992; Hunt, 1985; Jensen & Murphy, 1990; Verrecchia, 1986).

In order to test this hypothesis we analyze how the cash flow measures evolve around the year in which EVA is introduced in the executive compensation system. In order to determine when firms introduce the EVA methodology in their executive compensation system we use the *Edgar Online SEC Documents Database*. Through this database we analyze the 10-K files and proxy statements of each sample firm, to determine when (if at all) they introduce EVA measures in the executive compensation system. We observe that not all the sample firms

Table 10. Firms Introducing EVA in the Compensation System.

	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow margin											
Average	10.282	9.789	8.620	9.958	10.617	10.604	10.527	8.792	11.135	13.193	10.556
Median	8.322	7.543	7.027	9.117	8.631	9.014	9.499	7.327	11.720	10.596	8.812
Std. Dev.	7.651	6.728	5.644	6.299	8.904	6.650	7.025	7.616	10.437	7.376	8.096
EBIDTA margin											
Average	14.360	14.301	15.062	16.331	16.730	17.478	17.148	17.661	18.806	21.209	16.966
Median	13.435	11.498	11.627	13.778	13.674	15.073	15.680	15.986	17.194	17.835	14.335
Std. Dev.	8.278	8.485	9.891	10.210	10.286	9.969	9.873	10.690	10.222	12.248	9.548

introduce the EVA in the compensation system; when they do, it usually happens one or two years after the EVA adoption. From the original sample of 61 firms, 45 introduce EVA in the compensation system, while the remaining 16 firms only introduce the EVA as a measure for guiding investment. Thus, we divide the initial sample in two subgroups, the first with the 45 firms that introduce EVA in managerial compensation, and another one with the 16 firms that do not.

We compare the evolution of cash flow measures in the two groups. In the first group, year 0 denotes the moment when the firm introduces the EVA system in the compensation system. In the second group, we fix year 0 at the year in which the firm adopts EVA (Tables 10 and 11).

The evolution of the EBITDA Margin in the first group (firms that introduce EVA in the compensation system) appears to be better than the one in the second group. All the values of the median for the EBITDA margin in years from 0 to 5 are superior to the values obtained before adoption, and the same is true for the average. This does not happen for firms that do not introduce EVA in the managerial compensation. On the other hand, no clear difference in pattern between the two groups emerges when we analyze the Cash Flow Margin. We must also point out that the small size of the two sub-samples does not let us provide robust conclusions.

Table 11. Firms not Introducing EVA in the Compensation System.

	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash Flow margin											
Average	18.532	15.420	14.322	13.040	13.679	18.830	15.546	17.083	7.810	15.050	16.479
Median	13.784	10.157	8.572	10.887	11.671	13.842	11.632	12.745	13.408	13.031	14.566
Std. Dev.	13.617	11.026	8.991	7.894	8.421	24.003	13.931	19.905	27.188	7.926	7.772
EBIDTA margin											
Average	23.946	22.994	22.554	22.514	24.082	20.913	19.605	19.398	10.724	21.663	21.693
Median	18.296	15.922	15.978	17.714	19.661	18.933	18.350	19.069	19.449	19.256	19.363
Std. Dev.	16.467	17.585	16.588	14.936	15.118	8.178	7.476	10.429	38.761	9.461	12.025

DISCUSSION AND CONCLUSIONS

Discussion

Our event study shows that EVA adoption does not generate significant market abnormal returns, neither before nor after the adoption. We observe significant positive abnormal returns only in days -4 , 6 and 21 , and negative in days -9 , 2 and 8 .

In the case of CAAR, we observe that windows beginning right after the adoption day do not present significant CAAR. We observe some significant positive CAAR for windows ending at the adoption date. It is reasonable to expect that, if there is a positive effect, this should occur before the adoption date. In fact, it is likely that the information about EVA adoption become public in the market sometimes before the formal adoption, so any effect of this information should be incorporated into prices before date 0. At any rate, we remark that the effects that we find are very weak.

We observe that all the studies and test statistics generate similar results, both using an equally weighted and a value weighted market index, and conclude that the market does not appear to consider EVA adoption as likely to lead to a significant increase in the value of the firm.

Analyzing the evolution of company variables around adoption, we obtain several important conclusions. The analysis of profitability measures reveals that companies adopt the EVA technique after a long period of declining firm performance. After the adoption we can observe that these measures do not improve in the short run, but only (and sometimes not very significantly) in the long run. However, the good results of year 5 may not be representative; many firms in our sample adopt EVA in 1994 and 1995. Thus, years 4 and 5 correspond to 1999 and 2000, a period characterized by a strong economy, as well as a strong stock market. Therefore, at least part of the long-term improvement is probably due to the general economic situation rather than to EVA adoption.

The analysis of the investment activity measures indicates an increase in company investment activity after the EVA adoption. The Price to Book, R&D to Sales, and Tobin-q ratios show significant increases after the adoption of EVA. Analyzing the firm Total Assets we observe that the increment in the firm investment activity is not followed by an increase in the firm size. This can be interpreted in the sense that the EVA methodology provides incentives for managers to increment firm investment activity, not with the objective to increase firm size (which may generate inefficiencies), but in order to improve firm economic value and future perspectives.

In the case of R&D expenses to sales, some comments are in order. According to U.S. accounting rules (SFAS 2), R&D expenses are considered as expenses in

the fiscal year in which they are done and must appear in the P&L account. In contrast EVA considers R&D expenses as an asset acquisition (Stewart, 1991). Therefore, accounting NOPAT is adjusted adding back the R&D expense and deducting the amortization of the R&D asset (Stewart, 1991, pp. 28–30). This can explain why EVA firms experience an increase in the R&D to sales ratio after the EVA adoption.

We also observe a significant increment in the Debt to Assets ratio. This indicates that the increment in the firm investment activity observed after the EVA adoption is frequently financed through higher levels of debt. This can be explained by the fact that NOPAT (which is directly used to compute EVA) adds back the after tax effect of debt financing charges (interest expense) included in EBEI (Biddle et al., 1997). Thus some firms can have incentives to increase their debt ratio, since this will increase their NOPAT, and therefore their EVA. For example, M. A. Volkema, President and CEO of Herman Miller, Inc., states that (see www.sternstewart.com):

EVA analysis has enabled us to identify waste in both our costs and overuse of capital. (...) EVA analysis demonstrated that debt capital was cheaper than equity capital. Thus our Board set a new debt to capital ratio of 30% to 35% (...).

Finally, we also analyze how the cash flow measures evolve around adoption. In this final study we observed that EVA companies experience significant cash flow increments after the EVA adoption, while this does not happen when dividends per share are considered. This result may be influenced by the fact that many firms in our sample adopted EVA in the middle of the 90s, so that the long-run we analyze coincides with the end of 90s, a period characterized by a strong economy. Another possibility is that when managerial compensation is linked to EVA, the managers have strong incentives to increase the firm's cash flows, an important determinant of EVA. In order to test this hypothesis we divide the sample in two groups. The first group comprises those firms that introduce EVA in managerial compensation, and the other group by those firms that don't. As expected, the evolution of cash flow measures appear to be better in the first group, although the small size of the groups makes it difficult to provide robust conclusions. Comparing the evolution of the EBITDA Margin we observe that in the first group it appears to be better than in the second group, but no clear differences emerge between the two groups when we analyze the Cash Flow Margin.

CONCLUSIONS

This paper, using an event study methodology, has analyzed the market reaction to the adoption of the EVA technique. Using a sample of firms adopting EVA

during the period 1983–1998, we do not observe a significant market reaction to EVA adoption. This result appears to be in conflict with some other studies (i.e. O’Byrne, 1997; Walbert, 1994), that observe that EVA companies have high levels of stock market returns. This difference is probably due to the fact that the explosion of the EVA technique occurs in the middle and the second part of the 90s, coinciding with a strong stock market. Probably, the positive stock market evolution observed in these studies can be attributed to the stock market tendency and not to the EVA properties. Our paper focuses on abnormal returns, and we do not observe the positive market response observed by those studies.

Our results are in the line of Chen and Dodd (2001) and Biddle et al. (1997). Both papers observe that the market price evolution may rely more on audited accounting earnings than on the non-audited EVA.

Additionally, we also analyze how the company profile evolves around the EVA adoption. The main objectives of this second exercise is to analyze the long-term firm evolution, and to check whether EVA helps to improve operating profits, the cost of capital and the investment activity (Prober, 2000; Stewart, 1991). We analyze three sets of firm variables: firm performance variables, investment variables, and cash flow variables. In the first set, we observe that firms usually adopt EVA after a long period of bad performance. After the adoption, performance measures appear to improve only in the long run, a result probably influenced by the favorable evolution of the general economic situation. Analyzing firm investment variables, we observe that EVA adoption increases firm investment activity. We also observe increases in the debt ratios.

Finally, since EVA focuses on firm cash flow, we also analyze the evolution of company cash flow variables. We observe a positive impact on the Cash Flow Margin and the EBITDA after the adoption. This may be due to the fact that managerial compensation depends positively on these variables; to check this hypothesis we analyze separately the evolution of cash flow variables for firms that introduce EVA in managerial compensation and firms that do not. The evolution of the EBITDA margin is more favorable in firms introducing EVA in the compensation system. However, the small size of our sample does not let us provide robust conclusions.

NOTES

1. The abbreviation EVA is a trademark of Stern Stewart & Company.
2. MVA is defined as the Equity’s Market Value less the Equity’s Book Value.

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APPENDIX

Sample Firm List

ACXIOM CORP	GC COMPANIES INC
ADAPTIVE BROADBAND CORP	GEORGIA-PACIFIC GROUP
ADC TELECOMMUNICATIONS INC	GRAINGER (W W) INC
ALEXANDER and BALDWIN INC	GUIDANT CORP ^a
ALLTRISTA CORP ^a	HERSHEY FOODS CORP
ARMSTRONG HOLDINGS INC	INTL MULTIFOODS CORP
BALL CORP	JONSON OUTDOORS INC – CL A
BARD (C.R.) INC	KANSAS CITY POWER and LIGHT
BAUSCH and LOMB INC	LILLY (ELI) and CO
BECTON DICKINSON and CO	MANITOWOC CO
BEST BUY CO INC	MATERIAL SCIENCES CORP
BOISE CASCADE CORP	MIDAMERICAN ENERGY HOLDINGS
BOWATER INC	MILLENNIUM CHEMICALS INC ^a
BRIGGS and STRATTON	MILLER (HERMAN) INC
CDI CORP	MONTANA POWER CO
CENTURA BANKS INC	NOBLE DRILLING CORP
COCA-COLA CO	OLIN CORP
COLUMBUS MCKINNON CORP	PENNEY (J C) CO
COX COMMUNICATIONS – CL A	PERKINELMER INC
CRANE CO	PHARMACIA CORP
DONNELLEY (R R) and SONS CO	PMI GROUP INC ^a
DUN and BRADSTREET CORP ^a	POLAROID CORP
EQUIFAX INC	PULTE HOMES INC
FEDERAL-MOGUL CORP	QUAKER OATS CO
FLEMING COMPANIES INC	

APPENDIX *(Continued)*

RYDER SYSTEM INC	TUPPERWARE CORP ^a
SILICON VY BANCSHARES	VULCAN MATERIALS CO
SPRINT FON GROUP	WEBSTER FINL CORP
SPX CORP	WATERBURY
STANDARD MOTOR PRODS	WELLMAN INC
TENET HEALTHCARE CORP	WHIRLPOOL CORP
TOYS R US INC	

^aNot included in the event study (not enough data for the estimation period).

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