行政院國家科學委員會專題研究計畫 成果報告

沙氏法案實施後為何會發生大量的會計師解聘？股票市場是如何反應的？

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1. INTRODUCTION

The main purpose of this study is to examine whether the non-Big 4's audit quality increases after the passage of the Sarbanes-Oxley Act (hereafter called SOX).[1] This issue is important for two reasons. First, even though audit quality has received much attention in the auditing literature for many decades,[2] the adoption of the "Big 4 vs. non-Big 4" dichotomy has been extensively used to proxy for audit quality in many empirical auditing studies (e.g., Becker et al. 1998; Behn et al. 2008; Davidson and Neu 1993; DeAngelo 1981; Khurana and Raman 2004; Mansi et al. 2005; Palmrose 1988). The use of such a dichotomy not only overly simplifies the major dimensions of audit quality (Watkins et al. 2004), but also leads to a "research bias" in which the non-Big 4's audit quality is often overlooked because it is traditionally deemed low. This bias exists even if recent studies have suggested many other measures of audit quality, such as the magnitude of accounting accruals (e.g., Ashbaugh et al. 2003; Becker et al. 1998; Frankel et al. 2002), frequency of restatements (e.g., Kinney et al. 2004), perceived audit quality (e.g., Chaney and Philipich 2002; Khurana and Raman 2004), and industry expertise (e.g., Francis et al. 2005).[3]

Second, in response to a number of high-profile audit failures occurred in late 2001 and 2002, SOX was passed in July 2002 with an aim to restore investors' confidence toward the public accounting profession (Oxley 2007). One of the ultimate goals of SOX is to improve audit quality to prevent deceptive accounting practices and, therefore, improve the quality of corporate financial reporting. Because prior studies in audit quality have consistently documented that the Big 4 are associated with high audit quality (e.g., Becker et al. 1998; Craswell et al. 1995; Davidson and Neu 1993; DeFond and Jiambalvo 1991; Francis et al. 1999;

[1]Before 1989, there were Big 8 CPA firms (i.e., Authur Andersen, PriceWaterhouse, KPMG, Arthur Young, Coopers and Lybrand, Ernst & Whinney, Deloitte, Haskins & Sells, and Touche Ross). In 1989, the Big 8 reduced to Big 6 because Ernst & Whinney and Arthur Young were merged into the Ernst & Young, and Deloitte, Haskins & Sells and Touche Ross were merged into the Deloitte Touche Tohmatsu. In 1997, the Big 6 further reduced to the Big 5 due to the merger of PriceWaterhouse and Coopers & Lybrand (i.e., the PriceWaterhouseCoopers). In August 2002, because the Authur Andersen was adjudicated by a 5-year probation, the Big 5 reduced to Big 4. To facilitate our discussions, I use Big 4 to represent the Big N whenever it is applicable.

[2]See Watkins et al. (2004) for a comprehensive review of prior studies that examine the audit quality issues.

[3]Only few studies have examined auditing issues related to the non-Big 4. For example, Louis (2005) finds that, during mergers, the abnormal returns of acquirers audited by non-Big firms outperform those audited by the Big 4 firms. This result implies that non-Big 4 firms may have comparative advantages in assisting their clients in merger activities. In another study, Chang et al. (2008) examines market reaction to announcements of downgrade auditor changes. The empirical results show that market reacts favorably to downgrade auditor changes, given the successor auditors are industry exporters.

Palmrose 1986, 1988), the efficacy of SOX to increase audit quality shall be greater for non-Big 4 than for Big 4. Therefore, an examination of the change in non-Big 4's audit quality before and after SOX provides more prominent evidence about the regulatory consequence of SOX. Currently, such evidence is rare.[4]

To address the research issue, I first use measures developed in the earnings management literature to capture audit quality. I use earnings management measures to proxy for audit quality because prior studies have found that higher audit quality can effectively mitigate (or suppress) companies' earnings management (e.g., Ashbaugh et al. 2003; Becker et al. 1998; Frankel et al. 2002). Two measures are used: a traditional measure in which the performance-adjusted discretionary accruals are calculated using the modified Jones model (1995), and a "real" earnings management measure proposed by Roychowdhury (2006). The performance-adjusted discretionary accruals have been extensively used in the earnings management literature during the past few years (e.g., Cohen et al. 2008; Cahan and Zhang 2006; Ferguson et al. 2004; Francis et al. 2005;Ghosh and Moon 2003; Gul et al. 2003; Johnson et al. 2002; Kothari et al. 2005; Myers et al. 2003). However, many researchers have recently begun to argue that companies may employ some real activities (rather than discretionary accruals) to manipulate earnings numbers (Cohen et al. 2008; Roychowdhury 2006). To better understand the association between auditor changes and earnings management, this study contributes to the literature by considering both the discretionary accruals and real earnings management measure to test if companies have changed their methods of managing earnings before and after SOX.

I then evaluate whether there are significant differences in these measures before and after SOX when companies change their auditors. I choose auditor changes because previous research has shown that auditor

[4]Recent studies have examined the impacts of the potential benefits and costs brought by the SOX on companies' behavior and market performance. For example, Zhang (2007) investigates the economic consequences of the SOX by examining market reactions to related legislative events prior and subsequent to the passage of SOX. The empirical results report significantly negative cumulative abnormal returns around key SOX events (i.e., restriction of non-audit services and Section 404), suggesting that SOX imposes net costs on complying companies. In another study, Engel et al. (2007) uses a sample of going-private companies from 1998 to 2004 to test the hypothesis that companies go private in response to SOX only if the SOX-imposed costs to the companies exceed the SOX-induced benefits to shareholders, and this difference swamps the net benefit of being a public company prior to the passage of SOX. The empirical findings support the hypothesis and, thus, are consistent with the notion that SOX has affected firms' going-private decisions. Finally, DeFond et al. (2007) examines the influences of SOX on bondholders and finds that bond values decline around the announcement of events leading up to the passage of SOX. This result is consistent with bondholders expecting SOX to impose net costs on them. This study also documents that the decline in bond values is larger among bonds issued by companies that are likely to experience greater changes to their governance systems due to SOX and among bonds with higher default risk. This finding is consistent with bondholders expecting SOX to impose relatively larger net costs on companies that SOX is intended to benefit most.

changes may be initiated to manage earnings (e.g., Davidson et al. 2005; DeFond and Subramanyam 1998; Kim et al. 2003; Lu 2006). Arguably, if auditor changes are triggered for earnings management purpose, then given the effectiveness of SOX's provisions, taking as a package, in preventing deceptive accounting practices and the empirical finding that switching costs usually outweigh the agency benefits of changing auditors (Blouin et al. 2007), companies should have weak incentive to switch their auditors. However, Glass Lewis' research report indicates that more than 1,600 U.S. companies change their auditors in 2004, a 78% jump from 914 companies in 2003. More importantly, the total of 2,514 auditor changes during 2003 and 2004 represent more than one-fourth of the publicly listed companies in the U.S. (Williams 2005). Therefore, this high jump in auditor changes provides a fertile ground to explore the impacts of SOX on the association between auditor changes and earnings management.[5]

I focus on *auditor dismissals* (rather than resignations) for two reasons. First, because dismissals represent companies' voluntary switching of their auditors, the association between auditor changes and earnings management shall be stronger. Second, there are four distinct types of auditor dismissals occurred in practice: changes within Big4, changes within non-Big4, upgrade from non-Big4 to Big 4, and downgrade from Big4 to non-Big4. Therefore, I can evaluate the change in a non-Big 4's audit quality before and after SOX by examining whether there are significant differences in earnings management measures when this non-Big 4 becomes the successor auditor under the "downgrade" and "changes within non-Big 4" scenarios. The "downgrade" scenario is of particular importance to the regulators and policy makers not only because of the substantial increase of downward auditor dismissals in the post-SOX period, but also because of managers' weaker incentives to manage earnings due to the numerous provisions rules in SOX (Cohen et al. 2005; Lobo and Zhou 2006). These two counterbalancing forces make the association between auditor dismissals and earnings management not as predictable and straightforward as in prior studies that use samples from the pre-SOX period.

[5]Several recent working papers have examined the association between auditor changes and audit fees before and after the SOX (e.g., Griffin and Lont 2005; Ho and Wang 2006). To the best of our knowledge, our study is the first one that investigates the impact of SOX on the association between auditor changes and managers' earnings management behavior.

I use a comprehensive sample of 3,373 auditor dismissals between fiscal years 2001 and 2007, during which auditor dismissals occurred before and after SOX are both included. Descriptive statistics show that downgrade and changes within the non-Big 4 account for 31.38 and 46.30 percents of all auditor dismissals after SOX. In addition, auditor dismissal companies are smaller, less profitable, having more debts and higher growth opportunities, engaging in more merger and acquisition activity, and suffering lower operating cash flows than companies that do not dismiss auditors. Notably, auditor dismissals appear to be motivated by opinion shopping rather than audit fee reduction.

To control for potential self-selection bias of auditor dismissals, I adopt Heckman's (1979) two-stage estimation procedure. I begin the analyses by using a single dummy variable to proxy for the occurrence of auditor dismissals. The empirical results indicate that companies dismiss their auditors before SOX so that they can use both discretionary accruals and real earnings activities to manage earnings. Importantly, auditor dismissal companies appear to shift their earnings management method from traditional accruals in the pre-SOX period to real manipulation activities in the post-SOX period. I then decompose auditor dismissals into four categories (i.e., upgrade, downgrade, within Big 4, and within non-Big 4) to test whether non-Big 4's audit quality increase after SOX. The empirical results show that, for downgrade and changes within the non-Big 4, there is a significant association between auditor dismissals and earnings management only in the pre-SOX period. After the passage of SOX, however, non-Big 4 successor auditors show the greatest ability to mitigate companies' artificial and real earnings management. These conclusions remain valid when I focus on downgrade and changes within non-Big 4 samples separately.

The remainder of this paper proceeds as follows. Section 2 describes the sample selection procedures and research design. Section 3 reports the empirical results and discusses their implications. The paper concludes with a summary of findings in Section 4.

2. RESEARCH DESIGN

2.1 Measurements of Earnings Management:

2.1.1 Artificial earnings management activities – Discretionary accruals

I first use the traditional discretionary accruals to proxy for managers' earning management. In Cohen et al.'s (2008) term, this is called the *artificial earnings management activities*. The procedures for estimating the discretionary accruals are as follows. First, I follow Hribar and Collins (2002) by adopting the direct approach to compute the total accruals (*TACC*). That is, the total accruals equal income before extraordinary items (Compustat item #123) less operating cash flows adjusted for discontinued operations and extraordinary items (#308 − #124). Second, I estimate the modified Jones model (1995) on a cross-sectional basis for each Fama and French (1997) industry with 20 or more firms in year *t*:

$$TACC_{i,t} / A_{i,t-1} = \alpha_1 + \beta_1(\Delta SALES_{i,t} / A_{i,t-1} - \Delta REC_{i,t} / TA_{i,t-1}) + \beta_1(PPE_{i,t} / TA_{i,t-1}) + \varepsilon \,, \quad (1)$$

where

TACC = Operating income less operating cash flows;
ΔSALES = Change in sales from the previous year to the current year;
ΔREC = Change in accounts receivable from the beginning to the end of the year;
PPE = Year-end property, plant and equipment;
TA = Total Assets at the end of year *t-1*;
ε = the residual term.

Third, I compute the performance-adjusted discretionary accruals (denoted by *DA*) based on Cahan and Zhang (2006), an alternative approach to control for companies' performance effect. That is, for each Fama and French (1997), I divide the sample into deciles based on sample companies' return on assets (*ROA*). I then adjust each discretionary accrual estimated from Equation (1) by subtracting the median discretionary accruals for the firm's industry-ROA deciles. Note that, since income-increasing accruals are often used to inflate current earnings and income-decreasing accruals are often used to create cookie jar reserves for future earnings, the distortion in earnings resulting from inappropriate income-increasing and/or income-decreasing accruals is as important as the magnitude of accruals to regulators and investors (Frankel, et al. 2002; Myers et al. 2003). Therefore, I use income-increasing, income-decreasing, and the absolute value of *DA* to measure the individual and combined effects of managers' earnings management decisions.

2.1.2 Real Earnings Management Activities

Managers may have employed real activities to manipulate earnings numbers as well (Cohen et al. 2008; Roychowdhury 2006). Roychowdhury (2006) identifies three major real manipulation activities that are relatively free of the effects of pure accrual manipulation: (1) accelerate the timing of sales and/or generate additional unsustainable sales through increased price discounts or more lenient credit terms, (2) reduce discretionary expenditures to report higher margins, and (3) overproduce or increase production to report lower cost of goods sold. To detect these real earnings management activities, I use the proxy developed by Roychowdhury (2006), the abnormal production costs (denoted by *RPROD*), to measure real earnings management. To compute *RPROD*, I first estimate the following cross-sectional regressions for each Fama and French (1997) industry and year:

$$RPROD_{i,t} / A_{i,t-1} = \alpha_0 + \beta_1 (1/A_{i,t-1}) + \beta_2 (SALE_{i,t} / A_{i,t-1}) + \beta_3 (\Delta SALE_{i,t} / A_{i,t-1}) + \beta_4 (\Delta SALE_{i,t-1} / A_{i,t-1}) + \varepsilon_{i,t} \quad (2)$$

where *RPROD* denotes the production costs in year *t*, which is defined as the sum of the cost of goods sold and the change in inventories. The abnormal production costs are computed as the difference between the actual values and the normal levels predicted from equations (2). To facilitate the comparisons between *DA* and *RPROD*, I also examine the positive, negative, and absolute values of *RPROD* in the analyses.

2.2 Auditor Choice Model

Because an auditor change decision is usually endogenously determined by the managers (Kim et al. 2003; Cahan and Zhang 2006), I adopt Heckman's (1979) two-stage estimation procedure to control for the self-selection bias. In the first stage, I estimate the following probit model of voluntary auditor changes:

$$\begin{aligned} CHANGE_{i,t} = {} & \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 LOSS_{i,t} \\ & + \alpha_6 GC_{i,t} + \alpha_7 FEE_{i,t} + \alpha_8 INDSHARE_{i,t} + \alpha_9 M\&A_{i,t} + \varepsilon, \end{aligned} \quad (3)$$

where

CHANGE = 1 if a company changes its auditor in year *t* and 0 otherwise;
SIZE = Natural log of total assets at end of year *t*;
MB = Market value to book value of equity;
LEVERAGE = Total debt divided by total assets;

ROA = Return on assets, defined as net income before extraordinary items divided by total assets;

LOSS = 1 if operating income is less than 0 in year *t* and 0 otherwise;

GC = 1 if the company receives a going concern opinion in the preceding one year and 0 otherwise;

FEE = Audit fee divided by total fees

INDSHARE = Auditor's market share in the client's industry, based on the percentage of the square root of total assets that the auditor audits for all companies in the client's industry;

M&A = 1 if the company experiences a merger or acquisition in the preceding two years and 0 otherwise;

ε = the residual term.

In estimating Equation (3), the dependent variable, *CHANGE*, is a dummy variable which equals one if a company changes its auditor during the sample period and zero otherwise. The independent variables include major determinants of voluntary auditor changes documented in prior studies. For example, Francis and Wilson (1988) and Krishnan (1994) find that the costs of changing auditors are higher for larger-size companies. Therefore, they are less likely to dismiss their auditors. I measure a company's size by the natural log of its total assets (denoted by *SIZE*) and predict its coefficient to be negative. In addition, Woo and Koh (2001) reports evidence that growing companies are more likely to switch their auditors. Thus, I use the market-to-book ratio (denoted by *MB*) to control for companies' growth opportunity and predict the coefficient of *MB* to be positive.

Since the financial condition of a company usually affects the likelihood that it will change auditor (Krishnan and Stephens 1995), Ie include three measures to proxy for a company's financial condition: *ROA*, *LOSS*, and *LEVERAGE*. I predict that the coefficient of *ROA* (or *LOSS*) to be negative (or positive) because profitable (or unprofitable) companies are less (or more) likely to be financially-distressed. Similarly, I expect the coefficient of *LEVERAGE* to be negative because higher debt levels increase the possibility of financial difficulty.

Previous empirical evidence has shown that companies receiving qualified opinions are more likely to change their auditors (e.g., Chow and Rice 1982; Geiger et al. 1998). Hence, I include going concern opinion as an indicator variable (denoted by *CG*) and predict its coefficient to be positive. Moreover, companies may have incentives to switch their auditors to reduce audit fees (Schwartz and Menon 1985) because prior research indicates that audit fees tend to be lower in the year of an auditor change than in the prior year (Deis and Giroux 1996). This audit fee-reduction incentive could be even stronger after the SOX because Section 404 requires the auditors to attest on companies' internal controls over financial reporting during annual audits. As Clark (2005) points out that, on average, public companies have to pay Section 404-type fees to their auditors that are 50 to 100 percent as large as the regular audit fees. Therefore, I control for the possible effect of higher audit fees on companies' auditor change decision by including a fee ratio variable (denoted by *FEE*), which is measured by audit fee divided by total fees and predict that companies with higher audit fees in the prior year are more likely to switch their auditors to reduce their audit fee payments.

Auditing studies have documented that companies are less likely to dismiss their auditors who are industry experts or specialists (Williams 1988; Carcello and Neal 2003). I follow Carcello and Neal (2003) by using auditor's industry share (*INDSHARE*) as the proxy for industry specialization, which is measured by the percentage of the square root of total assets that the auditor audits for all companies in the client's industry. Finally, empirical evidence has reported that mergers and acquisitions usually lead to auditor changes (Landsman et al. 2005). Accordingly, I employ *M&A* as an indicator variable for merger and acquisition activities. Following Collins and Hribar (2002) and Myers et al. (2003), I use Compustat footnote code 1 to identify companies undergoing mergers and acquisitions in the preceding two years before auditor changes.

2.3 Earnings Management Models:

I estimate two earnings management models at the second stage to compare companies with and without auditor dismissals. I first use a single dummy variable *CHANGE* to test the "overall" association between auditor dismissals and earnings management (to be discussed in section 2.3.1). I then decompose the *CHANGE* variable into four categories (i.e., upgrade, downgrade, within Big 4, and within non-Big 4) to test whether the association between auditor changes and earnings management vary with the type of auditor switching (to be discussed in section 2.3.2).

2.3.1 Models to test the association between auditor changes and earnings management

In the following equation (4), the dependent variable is measured by *DA* or *RPROD*:

$$DA_{i,t} \text{ or } RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 OCF_{i,t} + \alpha_5 CHANGE_{i,t} + \alpha_6 SOX_{i,t}$$
$$+ \alpha_7 SOX_{i,t} \times CHANGE_{i,t} + \alpha_8 LEADER + \alpha_9 SHAREDECR_{i,t} + \alpha_{10} SHAREINCR_{i,t} \qquad (4)$$
$$+ \alpha_{11} Lambda_{i,t} + \varepsilon,$$

where

DA = Performance-adjusted discretionary accruals (measured in negative, positive, and absolute) from equation (1);

RPROD =Abnormal production costs from Equation (2);

SIZE = Natural log of total assets;

MB = Market value to book value of equity;

LEVERAGE = Total debt dividend by total assets;

OCF = Cash flows from operating activity deflated by beginning total assets*;*

CHANGE = 1 if a company changes audit firm in year *t* and 0 otherwise;

SOX= 1 for all firm-year observations in 2003 and latter and 0 for observations in 2002 and 2001;

SOX×*CHANGE* = 1 if a company changes audit firm in the post-SOX period and 0 otherwise;

LEADER = 1 if the successor (or incumbent) auditor's industry expertise falls into the classification presented in Hogan and Jeter (1999), and 0 otherwise;

SHAREDECR = 1 if the company has a decline of more than 10 percent of total outstanding shares during the year and 0 otherwise;

SHAREINCR = 1 if the company has a increase of more than 10 percent of total outstanding shares during the year and 0 otherwise;

Lambda = Inverse Mills ratio variable from the Equation (3) regression;

ε = the residual term.

To address the first research issue, I focus on *CHANGE* (which captures managers' earnings management behavior for companies changing their auditors in the pre-SOX periods) and the interaction term *SOX×CHANGE* (which captures managers' earnings management activities for companies changing their auditors in the post-SOX periods).

I also include several control variables that have been found in prior studies to have significant impacts on managers' earnings management decisions (DeFond and Jiambalvo 1994; Frankel et al. 2002; Matsumoto 2002). For example, I consider company size (denoted by *SIZE*), which is measured by the natural log of total assets, because larger companies generally face greater political costs and, therefore, have less flexibility and weaker incentives to overstate earnings (Watts and Zimmerman 1978). In addition, empirical evidence shows that managers use discretionary accruals to avoid the violation of debt convents (DeFond and Jiambalvo 1994; Dichev and Skinner 2002). Thus, I control for companies' financial leverage (denoted by *LEVERAGE*) and expect its coefficient to be positive. Also, companies with growth opportunity have stronger incentives to avoid negative earnings surprises (Matsumoto 2002) or to have more discretion in terms of accounting choices (Smith and Watts 1992). Similar to Frankel et al. (2002), I use the market-to-book ratio (denoted by *MB*) to control for firms' growth opportunity and expect a positive relation between *MB* and earnings management. Further, prior research has suggested that firms with strong operating cash flow (denoted by *OCF*) are less likely to employ discretionary accruals to boost earnings (Becker et al. 1998; DeFond and Park 1997). Hence, I include *OCF* to control for this effect and predict its coefficient to be negative.

To control for auditor's industry leadership, I follow Hogan and Jeter (1999) by using an indicator variable *LEADER*, which equals one if the successor auditor (or incumbent auditor for no-auditor change companies) industry expertise falls into the classification presented in Hogan and Jeter (1999), and zero otherwise. Additionally, Rangan (1998) and Teoh et al. (1998) show that managers have incentives to use income-increasing discretionary accruals before seasoned equity offers. To take this effect into consideration, I include an indicator variable *SHAREINCR* and predict that larger increases in outstanding shares are associated with larger and more positive discretionary accruals. Moreover, Becker et al. (1998) shows that managers have incentive to reduce earnings using income-decreasing accruals before share repurchases. Therefore, I also include an indicator variable *SHAREDECR* to control for larger decreases in outstanding shares. Finally, *Lambda* represents the inverse Mills ratios obtained from Equation (3).[6]

[6]In contrast to a more standard application of Heckman's (1979) two-stage procedure, I do not select in or out certain observations for

__2.3.2 Models to test the audit quality of non-Big 4__

To test whether non-Big 4's audit quality increases, I decompose *CHANGE* into four categories: companies that switch from a non-Big 4 auditor and a Big 4 auditor (denoted by *UP*), companies that switch from a Big 4 auditor and a non-Big 4 auditor (denoted by *DOWN*), companies that switch auditors within the Big 4 (denoted by *WINB4*), and companies that switch auditors within the non-Big 4 (denoted by *NWINB4*). I then estimate the following equation (5):

$$\begin{aligned} DA_{i,t} \text{ or } RPROD_{i,t} = \alpha_0 &+ \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 OCF_{i,t} + \alpha_5 UP_{i,t} + \alpha_6 DOWN_{i,t} \\ &+ \alpha_7 WINB4_{i,t} + \alpha_8 NWINB4_{i,t} + \alpha_9 SOX_{i,t} + \alpha_{10} SOX_{i,t} \times UP_{i,t} + \alpha_{11} SOX_{i,t} \times DOWN_{i,t} \\ &+ \alpha_{12} SOX \times WINB4_{i,t} + \alpha_{13} SOX_{i,t} \times NWINB4_{i,t} + \alpha_{14} LEADER + \alpha_{15} SHAREDECR_{i,t} \\ &+ \alpha_{16} SHAREINCR_{i,t} + \alpha_{17} Lambda_{i,t} + \varepsilon, \end{aligned} \tag{5}$$

where

UP = 1 if a company with a non-Big 4 auditor switched to Big 4 in year *t* and 0 otherwise;

DOWN = 1 if a company with a Big 4 auditor switched to a non-Big 4 in year *t* and 0 otherwise;

WINB4 = 1 if a company with a Big 4 auditor switched to a Big 4 in year *t* and 0 otherwise;

NWINB4 = 1 if a company with a non-Big 4 auditor switched to a non-Big 4 in year *t* and 0 otherwise.

SOX×*UP* = 1 if a company with a non-Big 4 auditor switched to Big 4 in the post-SOX period and 0 otherwise;

SOX×*DOWN* = 1 if a company with a Big 4 auditor switched to a non-Big 4 in the post-SOX period and 0 otherwise;

SOX×*WINB4* = 1 if a company with a Big 4 auditor switched to a Big 4 in the post-SOX period and 0 otherwise;

SOX×*NWINB4* = 1 if a company with a non-Big 4 auditor switched to a non-Big 4 in the post-SOX period and 0 otherwise.

All other variables are the same as those defined in equation (4).

2.4 Models to Test the Audit Quality in the "Downgrade" and "Changes within non-Big 4" Samples:

In the first stage, I estimate the following probit model of downgrade auditor changes:

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the second-stage regressions. I retain the entire sample for equation (3) and, as such, in essence treat the auditor change variable as endogenous. This specification is often referred to in the econometric literature as a "treatment effects" model (Green 2002, 787-789).

$$DOWN_{i,t} \;/\; NWINB4_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 LOSS_{i,t} + \alpha_7 GC_{i,t} + \alpha_8 FEE_{i,t} + \alpha_9 INDSHARE_{i,t} + \alpha_{10} M\&A_{i,t} + \varepsilon, \quad (6)$$

where *DOWN* (or *NWINB4*) equals one if an auditor change is classified as a downgrade change (or change within non-Big 4) and zero otherwise, and all other variables are the same as those defined in equations (4) and (5). I then include the *Lambda* estimated from equation (6) into the following equations (7) and (8):

$$DA_{i,t} \text{ or } RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 OCF_{i,t} + \alpha_5 DOWN_{i,t} + \alpha_6 SOX_{i,t} + \alpha_7 SOX_{i,t} \times DOWN_{i,t} + \alpha_8 LEADER + \alpha_9 SHAREDECR_{i,t} + \alpha_{10} SHAREINCR_{i,t} + \alpha_{11} Lambda_{i,t} + \varepsilon, \quad (7)$$

$$DA_{i,t} \text{ or } RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 OCF_{i,t} + \alpha_5 NWINB4_{i,t} + \alpha_6 SOX_{i,t} + \alpha_7 SOX_{i,t} \times NWINB4_{i,t} + \alpha_8 LEADER + \alpha_9 SHAREDECR_{i,t} + \alpha_{10} SHAREINCR_{i,t} + \alpha_{11} Lambda_{i,t} + \varepsilon, \quad (8)$$

where all variables are the same as those defined in equations (4), (5), and (6).

3. EMPIRICAL RESULTS

3.1 Data and Sample Selection:

Our sample consists of auditor dismissals during fiscal year 2001 to 2007 collected in the *Audit analytics* database. I first use the *Audit Analytics* to identify companies that change their auditors during the sample periods. I classify each auditor change based on the identity of the predecessor and successor auditors. Next, I exclude all auditor dismissal cases in which Arthur Andersen was the predecessor auditor from our 2002 sample because these companies were forced to change auditors due to Andersen’s 5-year probation (Blouin et al. 2005). I obtain all financial information for both types of companies from the COMPUSTAT annual industrial and research files between 2001 and 2007. Further, I exclude financial institutions (SIC codes 6000-6999) because of its unique operating environment and differences in accounting classifications that make inferences difficult in subsequent analyses. I also restrict the sample to companies whose fiscal year ends on December 31 to make sample companies as homogenous as possible. The final sample consists of 3,373 auditor dismissals. Finally, to control for outlier problem, I follow Kothari et al. (2005) and Cahan and Zhang

(2006) by winsorizing observations that fall in the top and bottom 1 percent of the empirical distribution for both the dependent and independent variables.[7] Table 1 reports the sample selection procedures.

[Insert Table 1 here]

Panel A of Table 2 shows the distribution of auditor dismissals by years and by types of change. While SOX does not impose mandatory CPA firm rotation, Table 1 indicates that the frequency of voluntary auditor dismissals increase substantially from 374 and 351 in 2001 and 2002, respectively, to 411 and 630 in 2003 and 2004, respectively. Auditor dismissals decrease gradually to 587, 545, and 475 in 2005, 2006, and 2007, respectively. Notably, the highest frequency of auditor dismissals occurred in 2004 (i.e., 18.68% of 3,373), which is the year right after the GAO (2003) report.

[Insert Table 2 here]

Panel A also indicates that downgrade auditor changes account for the highest portion (i.e., 38.06 percent) of all 3,373 auditor dismissals occurred during the sample periods, followed by auditor changes within the non-Big 4 (i.e., 36.19 percent). Upgrade auditor changes comprise only 5.97 percent in the sample. If we focus on the post-SOX periods (i.e., 2003~2007), Panel B of Table 2 reports that the frequency of downgrade auditor changes decreases to 31.38 percent while the frequency of auditor changes within the non-Big 4 increases to 46.30 percent. Overall, Table 2 documents that almost one-third of the auditor dismissals involve downgrade auditor changes in the post-SOX period.

3.2 Descriptive Statistics and Univariate Tests:

Table 3 presents the descriptive statistics of the sample, partitioned by companies without auditor changes (N = 44,941) and companies with auditor changes (N = 3,373). Several findings are worth noting. First, the means (medians) of the performance-adjusted discretionary accruals (*DA*) are 0.000 (0.000) for auditor-change companies and –0.025 (–0.032) for no-auditor change companies, respectively. The differences are significant at the 0.01 level based on the *t* tests and Mann-Whitney *z* tests. Similarly, the means (medians) of *RPROD* are

[7] I also trim the observations that fall in the top and bottom 1 percent of the empirical distribution. The OLS results remain unchanged. Therefore, the empirical findings are not sensitive to the way I handle the outliers.

–0.233 (–0.210) for auditor-change companies and –0.126 (–0.029) for no-auditor change companies, respectively. The differences are also significant at the 0.01 level based on the *t* tests and Mann-Whitney *z* tests. These results imply that companies with auditor changes have significantly larger discretionary accruals and bigger abnormal production costs than companies without auditor changes, suggesting that companies involving auditor dismissals are more likely to engage in earnings management.

[Insert Table 3 here]

Second, I find evidence that auditor dismissal companies are smaller (*SIZE*), having more debts (*LEVERAGE*) and higher growth opportunities (*MB*), engaging in more merger and acquisition activity (*M&A*), and suffering lower operating cash flows (*OCF*) and more operating losses (*LOSS*) than control sample that do not dismiss auditors. These findings indicate that auditor dismissal companies are in significantly worse financial conditions than no-auditor dismissal companies. I also find that auditor dismissal companies have higher audit fees to total fees ratio (*FEE*) and are more likely to have received a going concern opinion from their predecessor auditors (*GC*), implying that auditor dismissals appear to be motivated by opinion shopping (Chow and Rice 1982 and Geiger et al. 1998) rather than audit fee reduction. Finally, auditor dismissal companies have larger decrease and increase in outstanding shares (*SHAREDECR* and *SHAREINCR*), suggesting that these companies are more likely to use income-increasing and income-decreasing accruals before seasoned equity offerings and share repurchase, respectively. Interestingly, while companies with and without auditor dismissals appear to hire incumbent auditors that are industry experts (*INDSHARE*), auditor dismissal companies are more willing to hire industry experts as their successor auditors (*LEADER*).

3.3 Multivariate Analysis of Auditor Changes:[8]

The first column of Table 4 reports the results of the first-stage auditor change model. This column indicates that companies having certain characteristics, as have been documented in Table 3, are more likely to dismissal their incumbent auditors. Notably, the significance of the coefficient of *GC* supports my conjecture that auditor dismissals are motivated by opinion shopping.

[8] All *t*-statistics reported in this section are corrected for heterosckedasticity (White 1980).

[Insert Table 4 here]

The second column of Table 4 reports the results of the second-stage model using traditional discretionary accruals as the measure of earnings management. The coefficients of *CHANGE* are significantly positive for absolute *DA* (coefficient 0.045, $t = 4.68$, two-tailed $p < 0.000$) and positive *DA* (coefficient 0.184, $t = 6.36$, two-tailed $p < 0.000$), and significantly negative for negative *DA* (coefficient –0.029, $t = –4.25$, two-tailed $p < 0.000$). That is, in the pre-SOX period, auditor dismissal companies have significantly more income-increasing and income-decreasing discretionary accruals than companies that do not dismiss their auditors. This finding implies that, taken as a whole, auditor dismissal companies change their auditors before SOX to engage in earnings management. In contrast, the coefficients of *SOX×CHANGE* are only marginally significant for three *DA* measures.[9] More importantly, the signs of these coefficients reverse. Two possible SOX effects drive this result: a *direct effect* in which SOX, taking as a package, mitigates auditor dismissal companies' earnings management, and an *indirect effect* in which successor auditors suppress auditor dismissal companies' earnings management due to SOX. As shown in the second column of Table 4, the signs and significance of the three coefficients of *SOX* support the direct effect. To examine whether the indirect effect also exists, a partition of auditor dismissal types is necessary. I will address this issue in the next section.

The third column of Table 4 reports the results of the second-stage model using abnormal production costs as the measure of earnings management. The coefficients of *CHANGE* are significant for positive *RPROD* (coefficient 0.288, $t = 11.27$, two-tailed $p < 0.000$) and negative *RPROD* (coefficient –0.077, $t = –2.93$, two-tailed $p < 0.000$), indicating that companies dismiss their auditors before SOX so that they can use both discretionary accruals and real earnings activities to manage earnings. Note that the coefficients of *SOX* are significant for positive *RPROD* (coefficient 0.031, $t = 3.99$, two-tailed $p < 0.000$) and negative *RPROD* (coefficient –0.032, $t = –4.16$, two-tailed $p < 0.000$), implying that SOX, taking as a package, is not effective in mitigating auditor dismissal companies' use of real earnings activities to distort earnings. This finding, together with the existence of SOX's direct effect reported in the second column, suggests that auditor dismissal

[9] The coefficient of *SOX×CHANGE* for negative *DA* (i.e., 0.010, $t = 1.33$) is significant at the one-tailed 0.10 level ($p < 0.092$).

companies appear to shift their earnings management method from traditional accounting accruals in the pre-SOX period to real manipulation activities in the post-SOX period. This is consistent with recent trend that companies' top management has become more conservative by reducing artificial earnings management to avoid penalty and fine generating from the CEO/CFO certification requirement in SOX Section 302 (Lobo and Zhou 2006). Real earnings management activities are more prevalent because they are generally more difficult to detect and, therefore, expose the managers to lesser liabilities (Cohen et al. 2005).

Since SOX is ineffective in mitigating real manipulation activities, the significantly negative coefficient of *SOX×CHANGE* (i.e., –0.076, $t = -2.78$, two-tailed $p < 0.000$) manifests the existence of SOX's indirect effect. Again, I will address this issue in the next section. Finally, the coefficients of *Lambda* are all significant at the 1% significance level (except for the absolute *DA*), indicating that I have successfully controlled for the self-selection bias.

3.4 Auditor Change Types and Earnings Management:

Table 4 shows that companies dismiss their auditors before SOX to engaging in earnings management using both discretionary accruals and abnormal production costs. A follow-up question would be: which type of successor auditors "connive" such earnings management behavior? Also, the existence and extent of SOX's indirect effect on audit quality deserve further exploration. In this section, I decompose the *CHANGE* variable into four category dummies (i.e., upgrade, downgrade, within Big 4, and within non-Big 4) to examine whether the association between auditor dismissals and earnings management vary with types of auditor switching.

The first three column of Table 5 reports that, before SOX, the Big 4 effectively suppress companies' artificial earnings management in auditor dismissals involving upgrade (coefficient of *UP* for negative *DA* is 0.053, $t = 2.52$, two-tailed $p < 0.012$) and changes within Big 4 (coefficient of *WINB4* for positive *DA* is –0.115, $t = -2.13$, two-tailed $p < 0.033$). Also, the last column of Table 5 shows that the Big 4 successfully mitigate companies' negative real earnings management for upgrade auditor dismissals (coefficient 0.223, $t = 4.31$, two-tailed $p < 0.000$). Different from the Big 4's results, the signs and significance of the coefficients of *NWINB4* indicate that auditor dismissals involving changes within the non-Big 4 have significantly higher levels of discretionary accruals and abnormal production costs than non-auditor dismissal companies in the pre-SOX period. These imply that it is those auditor dismissals involving changes within non-Big 4 that are associated with earnings management, leading to the significance of *CHANGE* in Table 4. Given audit quality can be captured by measures of earnings management (Ashbaugh et al. 2003; Becker et al. 1998; Frankel et al. 2002), these results suggest that, before SOX, audit quality of the non-Big 4 is significantly lower than that of the Big 4. This finding is consistent with the well-documented empirical research that uses the Big N vs. non-Big N dichotomy to proxy for audit quality (e.g., DeAngelo 1981; Mansi et al. 2005; Palmrose 1988).

[Insert Table 5 here]

Contrary to the pre-SOX finding, the signs of the coefficients of *SOX×NWINB4* reverse and are significant for absolute (coefficient –0.057, t = –3.37, two-tailed $p < 0.000$), positive (coefficient –0.305, t = –6.92, two-tailed $p < 0.000$), and negative *DA* (coefficient 0.062, t = 4.74, two-tailed $p < 0.000$). The same results can be found for positive (coefficient –0.415, t = –10.01, two-tailed $p < 0.000$) and negative *RPROD* (coefficient 0.059, t = 6.66, two-tailed $p < 0.000$). Comparing these results with the coefficients of *NWINB4* across two earnings management measures indicates that it is those auditor dismissals involving changes within non-Big 4 that drive the strongest indirect effect of SOX, leading to significant coefficients of *SOX×CHANGE* in Table 4.

Two findings related to the *RPROD* measures are worth noting. First, only for negative *RPROD* that the coefficients of *UP* (i.e., 0.223, t = 4.31, two-tailed $p < 0.000$), *WINB4* (i.e., –0.388, t = –8.89, two-tailed $p < 0.000$), and *SOX×WINB4* (i.e., 0.139, t = 2.88, two-tailed $p < 0.000$) are significant. These results imply that the Big 4 are able to detect and suppress companies' negative abnormal production costs when there are upgrade and within-Big 4 auditor changes in the pre-SOX and post-SOX periods, respectively. Second, for positive *RPROD*, the coefficients of *DOWN* (i.e., 0.0.097, t = 2.05, two-tailed $p < 0.041$) and *SOX×DOWN* (i.e., 0.124, t = 2.42, two-tailed $p < 0.016$) are both positive and significant. These results suggest that the non-Big 4 appear to allow companies' positive abnormal production costs when there are downgrade auditor changes before and after SOX.

Taken together, the empirical results reported in Table 5 show that there is a significant association between auditor dismissals and earnings management only for companies that change their auditors within the non-Big 4 in the pre-SOX period. After the passage of SOX, however, non-Big 4 successor auditors show the greatest ability to mitigate companies' artificial and real earnings management when these companies dismiss their non-Big 4 predecessor auditors. These findings have not been documented in prior literature in auditor changes and earnings management.

3.5 "Downgrade" and "Within Non-Big 4" Auditor Changes and Earnings Management:

Table 2 reveals that there are surprisingly large numbers of auditor dismissals involving downgrade (account for 31.38%) and within non-Big 4 (account for 46.30%) in the post-SOX periods. To further explore whether these prevailing "downgrade" and "within non-Big 4" auditor dismissals are driven for earnings management purpose, I compare the "downgrade" / "within non-Big 4" group with the other three groups using the same statistical analysis procedures used in previous sections.

3.5.1 "Downgrade" auditor changes and earnings management

The first column of Table 6 presents the results of first-stage probit regression, showing that downgrade change companies have higher profitability (*ROA* and *LOSS*) and less merger and acquisition activities (*M&A*), and are more likely to dismiss auditors for audit fee reduction (*FEE*) rather than opinion shopping.

[Insert Table 6 here]

The second column of Table 6 indicates that the coefficients of *DOWN* are significantly positive for positive *DA* (i.e., 0.180, $t = 1.34$, one-tailed $p < 0.090$) and significantly negative for negative *DA* (i.e., –0.039, $t = -1.80$, two-tailed $p < 0.072$), indicating that downgrade auditor change companies have significantly higher (lower) level of income-increasing (income-decreasing) DA than other three types of auditor change companies in the pre-SOX period. The third column of Table 6 also shows that the coefficient of *DOWN* is significantly positive for positive *RPROD* (i.e., 0.316, $t = 2.37$, two-tailed $p < 0.018$). These results imply that downgrade auditor changes are associated with earnings management before SOX.

In contrast, the signs of the coefficients of *SOX×DOWN* reverse and are significant for absolute (coefficient –0.052, $t = -1.44$, one-tailed $p < 0.075$), positive (coefficient –0.164, $t = -1.34$, one-tailed $p <$

0.090), and negative *DA* (coefficient 0.029, $t = 1.51$, one-tailed $p < 0.066$). The same results can be found for positive (coefficient –0.231, $t = –1.89$, two-tailed $p < 0.059$) and negative *RPROD* (coefficient 0.274, $t = 3.23$, two-tailed $p < 0.000$). These results suggest that non-Big 4 successor auditors are able to suppress artificial and real earnings manipulations done by companies that dismiss their Big 4 predecessor auditors.

Two possibilities may explain the above findings. First, the non-Big 4 are concerned that a "downgrade" auditor change may attract market participants' attention on it and, therefore, react more conservatively. Second, the passage of SOX motivates the non-Big 4 to improve their audit quality to a higher level. Since Table 5 has shown that auditor changes within non-Big 4 drive the strongest indirect effect of SOX, it appears that the second possibility is more feasible to explain downgrade auditor changes.

3.5.2 "Within non-Big 4" auditor changes and earnings management

The first column of Table 7 indicates that companies that change their auditors within non-Big 4 are smaller in size (*SIZE*), having more debts (*LEVERAGE*), less profitable (*ROA* and *LOSS*), and are more likely to dismiss auditors for opinion shopping (*GC*).

[Insert Table 7 here]

Similar to the results documented in Table 5, Tables 7 shows that the signs and significance of the coefficients of *NWINB4* support my previous finding that auditor dismissals involving changes within non-Big 4 are associated with earnings management in the pre-SOX period. Conversely, SOX's provisions induce the non-Big 4 to improve their audit quality, leading to significant reductions in artificial and real earnings management in the post-SOX period.

3.6 Sensitivity Analyses: (results are not tabulated)

3.6.1 Alternative measure of discretionary accruals

To ensure that the empirical results are not sensitive to the choice of discretionary accruals measures, I also calculate performance-adjusted discretionary accruals based on two-digit SIC codes, years, and lagged ROA. Moreover, I estimate performance-adjusted discretionary accruals by including current and lagged ROA in the modified Jones model. The empirical results remain the same under these alternative procedures.

3.6.2 Alternative definitions of the SOX period

The statistical tests conducts in the preceding sections assume that financial statements of firms with fiscal years ending in or after 2003 are subject to the jurisdiction of SOX. To examine the sensitivity of the results to this assumption, I exclude year 2003 and redo all the analyses. The empirical results are relatively insensitive to this alternative classification.

3.6.3 Matched-pairs analyses

I compare the relation between auditor changes and earnings management using another set of control firms. As an additional analysis, each auditor change company is matched with a non-change company based on year, industry, and size. The matched firms are chosen from the COMPUSTAT in the same year and two-digit SIC as the auditor change companies. In addition, each non-change company is within 30 percent of the total assets amount for corresponding auditor change companies[10]. For matched-pairs sample, I also conduct level and changes analysis after controlling self-selection bias. The results of these analyses are similar to those reported earlier.

4. SUMMARY AND CONCLUSIONS

Professional institutions and the public press have reported a dramatically higher increase of auditor changes in the post-SOX periods than in the pre-SOX periods (Jean 2004; Williams 2005; Yoon 2004). However, few attempts have been made to explore the possible reasons underlying this increase. Following the framework of earnings management literature, I focus on auditor dismissals and posit that the non-Big 4's audit quality has increased after SOX.

A comprehensive sample of 3,373 auditor dismissals between fiscal years 2001 and 2007 is collected and analyzed. Descriptive statistics show that downgrade and changes within the non-Big 4 account for 31.38 and 46.30 percents of all auditor dismissals after SOX. Auditor dismissal companies are generally smaller, less profitable, having more debts and higher growth opportunities, engaging in more merger and acquisition activity, and suffering lower operating cash flows than companies that do not dismiss auditors. To control for

[10]There is no difference in the mean size between auditor change firms (measured by total assets) and non-change firms, suggesting that I have successfully matched on firm size. To conduct a model that is consistent with the model in the full sample analyses, I include firm size as a control variable in the matched sample analyses. If I exclude the firm size from matched sample analysis, I obtain the similar results.

potential self-selection bias resulting from auditor dismissals, I adopt Heckman's (1979) two-stage estimation procedure. Two important findings are documented. First, companies dismiss their auditors before SOX so that they can use both discretionary accruals and real earnings activities to manage earnings. More importantly, auditor dismissal companies appear to shift their earnings management method from traditional accruals in the pre-SOX period to real manipulation activities in the post-SOX period. Second, after decomposing auditor dismissals into four categories, the empirical results show that, for downgrade and changes within the non-Big 4, earning management occurs only in the pre-SOX period. After SOX, non-Big 4 successor auditors show the greatest ability to mitigate companies' artificial and real earnings management. These conclusions remain valid when downgrade and changes within non-Big 4 samples are examined separately.

Some features of the study point to several directions for future research and caveats. First, further work is warranted on testing how the capital market interprets the dramatic increase of downward auditor changes in the post-SOX periods. To the extent that the capital participants can really "monitor" these downgrade auditor change companies, companies' opportunistic behavior shall be mitigated. Second, reasons other than earnings management may also explain the remarkable increase of auditor changes in the post-SOX periods. An understanding of these other reasons may provide the regulators with insights into the effectiveness of SOX in improving audit quality. Finally, I focus on auditor dismissals. Therefore, the empirical results could not be applied to explain the huge increase in auditor resignations brought by the Big 4 vs. non-Big 4 auditors. Since SOX has changed the legal environment imposed on the auditing profession, more studies are needed to further investigate resignation decisions made by CPA firms with differential audit quality in the post-SOX periods.

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TABLE 1
Sample Selection Procedure

All auditor dismissals during fiscal year 2001 to 2007 are collected from the *Audit analytics* database	9,791
Less: All auditor dismissal cases involving Arthur Andersen	(2,377)
Less: Financial institutions (SIC codes 6000-6999)	(2,169)
Less: Observations missing in the Compustat	(1,872)
Final sample	3,373

TABLE 2
Frequencies of Auditor Changes in the Sample (N = 3,373) – By Year and Auditor Change Types

Sample Year	Upgrade to Big 4[a]	Downgrade to non-Big 4	Switch within Big 4	Switch within non-Big 4	Total Number of Auditor Changes	Percentage of Auditor Changes in the Sample
Panel A: Full Auditor Change Sample (Years 2001 ~ 2007)						
2001	34	88	141	111	374	11.09%
2002	30	84	68	169	351	10.41%
2003	24	113	77	197	411	12.18%
2004	24	239	96	271	630	18.68%
2005	18	219	98	252	587	17.40%
2006	28	154	127	236	545	16.16%
2007	36	106	63	270	475	14.08%
Total Number of Auditor Changes	194	1,003	670	1,506	3,373	
Percentage of Auditor Changes in the Sample	5.97%	38.06%	19.78%	36.19%		
Panel B: Auditor Change Sample in the Post-SOX period (Years 2003 ~ 2007)						
Total Number of Auditor Changes	130	831	461	1,226		
Percentage of Auditor Changes in the Sample	4.91%	31.38%	17.41%	46.30%		

[a]Big 4 CPA firms include Deloitte Touche, Ernst Young, KPMG, and PricewaterhouseCoopers. All other CPA firms are classified as non-Big 4.

TABLE 3
Descriptive Statistics for the Full Sample (Sample Period 2001 ~ 2007)

Variable[a]	No-Auditor Change Companies (N = 44,941) Mean	Median	Std. Dev.	Auditor Change Companies (N = 3,373) Mean	Median	Std. Dev.	Differences: Parametric *t* tests[b]	Mann-Whitney *z* tests[b]
DA	-0.025	-0.016	0.231	0.000	-0.025	0.413	-5.730***	5.446***
RPROD	-0.126	-0.034	0.593	-0.233	-0.055	1.012	9.486***	10.951***
SIZE	5.570	5.715	2.756	3.730	3.391	2.408	37.493***	37.423***
LEVERAGE	0.419	0.200	0.749	1.059	0.306	1.393	-44.326***	-18.724***
MB	9.387	5.043	9.443	11.487	7.435	10.677	-12.353***	-8.692***
OCF	-0.232	0.030	1.366	-0.702	-0.013	1.927	18.864***	18.484***
LEADER	0.285	0.000	0.452	0.476	0.000	0.500	-23.540***	-23.408***
INDSHARE	0.003	0.004	0.009	0.003	0.004	0.009	-0.139	0.027
LOSS	0.380	0.000	0.485	0.596	1.000	0.491	-24.932***	-24.776***
SHAREDECR	0.113	0.000	0.316	0.099	0.000	0.299	2.343**	2.343**
SHAREINCR	0.237	0.000	0.425	0.301	0.000	0.459	-8.412***	-8.406***
ROA	-0.175	0.013	1.835	0.197	0.009	3.429	-10.547***	-0.130
M&A	0.006	0.000	0.075	0.030	0 .000	0.171	-14.251***	-16.121***
FEE	0.825	0.165	12.517	0.866	0.779	14.403	-23.241***	-24.667***
GC	0.001	0.000	0.033	0.099	0.000	0.299	-10.29***	-12.26***

[a]The definitions of the variables reported in this table are: *DA*= performance adjusted discretionary accruals; *RPROD*=abnormal production costs; *SIZE* = Natural log of total assets at end of year *t*; *LEVERAGE* = Total debt divided by total assets; *MB* = Market value to book value of equity; *ROA* = Return on assets, defined as net income before extraordinary items divided by total assets; *LOSS* = 1 if operating income is less than 0 in year t, and 0 otherwise; *GC* = 1 if a firm received a going concern opinion, and 0 otherwise in year *t-1*; *FEE* = the ratio of audit fees divided by the total fees in year *t-1*; *INDSHARE* = The percentage of the square root of total assets that the auditor audits for all companies in the client's industry; *M&A* = 1 if the firm experiences a merger or acquisition in the preceding two years, and 0 otherwise; *OCF* = Cash flows from operating activity deflated by beginning total assets; *LEADER* = 1if the successor auditor (or incumbent auditor for no-auditor change companies) industry expertise falls into the classification presented in Hogan and Jeter (1999), and zero otherwise; *SHAREDECR* = 1 if a company has a decline of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *SHAREINCR* = 1 if a company has a increase of more than 10 percent of total outstanding shares during the year, and 0 otherwise.
[b]Asterisks *, **, and *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

TABLE 4
Two-stage Regression Results for Full Sample - Using One Auditor Change Dummy[a]

Stage 1 Model: $CHANGE_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 LOSS_{i,t} + \alpha_6 GC_{i,t} + \alpha_7 FEE_{i,t} + \alpha_8 INDSHARE_{i,t} + \alpha_9 M\&A_{i,t} + \varepsilon$ (3)

Stage 2 Model: $DA_{i,t}/RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 CFO_{i,t} + \alpha_5 CHANGE_{i,t} + \alpha_6 SOX_{i,t} + \alpha_7 SOX_{i,t} \times CHANGE_{i,t} + \alpha_8 LEADER + \alpha_9 SHAREDECR_{i,t} + \alpha_{10} SHAREINCR_{i,t} + \alpha_{11} Lambda_{i,t} + \varepsilon$ (4)

	First-Stage		Second-Stage (two earnings management measures: *DA* and *RPROD*)											
	Probit Model		Absolute DA		Positive DA		Negative DA		Absolute RPROD		Positive RPROD		Negative RPROD	
Variable[b]	Coeff.	*z*-stat.[c]	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.
INTERCEPT	-1.295	-43.03***	-0.090	-6.8***	0.238	7.80***	-0.115	-14.26***	-0.007	-0.28	0.070	2.88***	-0.026	-0.84
SIZE	-0.101	-23.51***	-0.002	-1.90*	-0.012	-14.15***	0.017	29.81***	0.063	33.38***	-0.033	-17.98***	0.079	34.49***
MB	0.005	5.17***	0.001	6.10***	-0.001	-5.82***	0.001	18.84***	0.003	11.37***	-0.001	-3.84***	0.003	9.88***
LEVERAGE	0.218	24.29***	-0.007	-3.57***	0.075	17.24***	-0.044	-38.09***	-0.154	-41.07***	0.044	11.01***	-0.182	-41.23***
ROA	0.009	0.53												
LOSS	0.077	3.48***												
GC	3.062	28.26***												
FEE	-0.007	-1.82*												
INDSHARE	-0.112	-0.11												
M&A	0.742	9.59***												
OCF			0.001	9.62***	0.000	3.97***	0.002	12.44***	0.003	4.85***	-0.002	-1.14	0.001	3.70***
CHANGE			0.045	4.68***	0.184	6.36***	-0.029	-4.25***	0.010	0.49	0.288	11.27***	-0.077	-2.93***
SOX			0.071	24.33***	-0.098	-9.85***	0.081	40.50***	0.002	0.40	0.031	3.99***	-0.032	-4.16***
SOX×CHANGE			-0.020	-1.86*	-0.056	-1.76*	0.010	1.33	-0.005	-0.22	-0.076	-2.78***	0.010	0.35
LEADER			-0.024	-7.67***	-0.040	-4.61***	0.004	1.87*	0.045	6.26***	-0.006	-0.90	0.059	6.62***
SHAREDECR			0.023	8.29***	-0.039	-3.41***	0.048	16.97***	-0.013	-1.50	0.064	6.85***	-0.061	-5.65***
SHAREINCR			0.027	6.94***	0.068	9.08***	-0.010	-5.41***	-0.079	-12.33***	0.073	12.52***	-0.141	-17.99***
Lambda			0.007	0.97	-0.091	-6.78***	-0.061	-13.64***	-0.200	-13.88***	0.067	5.14***	-0.232	-13.07***
Pseudo/Adj. R^2	0.1613		0.017		0.117		0.153		0.086		0.157		0.128	
F-statistic	3887***		79.12***		98.78***		357.40***		267.15***		133.41***		338.96***	
N	48,314		48,314		11,893		34,001		48,314		9.991		37,848	

[a]Outliers are winsorized using the 1% and 99% percentiles.

[b]The definitions of the variables reported in this table are: *DA*= performance adjusted discretionary accruals; *RPROD*=abnormal production costs; *SIZE* = Natural log of total assets at end of year *t*; *MB* = Market value to book value of equity; *LEVERAGE* = Total debt divided by total assets; *ROA* = Return on assets, defined as net income before extraordinary items divided by total assets; *LOSS* = 1 if operating income is less than 0 in year t, and 0 otherwise; *GC* = 1 if a firm received a going concern opinion, and 0 otherwise in year *t-1*; *FEE* = the ratio of audit fees divided by the total fees in year *t-1*; *INDSHARE* = The percentage of the square root of total assets that the auditor audits for all companies in the client's industry; *M&A* = 1 if the firm experiences a merger or acquisition in the preceding two years, and 0 otherwise; *OCF* = Cash flows from operating activity deflated by beginning total assets*; CHANGE* = 1 if a company changes audit firm in year *t*, and 0 otherwise; *SOX*= 1 for all firm-year observations in 2003 and latter and 0 for observations in 2002 and 2001; *SOX*×*CHANGE* = 1 if a company changes audit firm in the post-SOX period and 0 otherwise; *LEADER* = 1if the successor auditor (or incumbent auditor for no-auditor change companies) industry expertise falls into the classification presented in Hogan and Jeter (1999), and zero otherwise; *SHAREDECR* = 1 if the firm has a decline of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *SHAREINCR* = 1 if the firm has a increase of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *Lambda* = inverse Mills ratio.

[c]Asterisks *, **, and *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

TABLE 5
Second-stage Regression Results for Full Sample - Using Four Auditor Change Dummies[a]

$$DA_{i,t} \text{ or } RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 CFO_{i,t} + \alpha_5 UP_{i,t} + \alpha_6 DOWN_{i,t} + \alpha_7 WINB4_{i,t} + \alpha_8 NWINB4_{i,t} + \alpha_9 SOX_{i,t} + \alpha_{10} SOX_{i,t} * UP_{i,t} + \alpha_{11} SOX_{i,t} * DOWN_{i,t} + \alpha_{12} SOX * WINB4_{i,t} + \alpha_{13} SOX_{i,t} * NWINB4_{i,t} + \alpha_{14} SHAREDECR_{i,t} + \alpha_{15} SHAREINCR_{i,t} + \alpha_{16} Lambda_{i,t} + \varepsilon \quad (5)$$

	Absolute DA		Positive DA		Negative DA		Absolute RPROD		Positive RPROD		Negative RPROD	
Variable[b]	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.
INTERCEPT	-0.084	-6.38***	0.362	10.40***	-0.204	-21.42***	-0.234	-7.66***	0.095	3.54***	0.062	25.61***
SIZE	-0.001	-0.91	-0.022	-10.00***	0.012	19.10***	0.048	24.17***	-0.028	-15.84***	0.004	11.17***
MB	0.001	6.14***	-0.002	-6.74***	0.002	20.93***	0.004	12.97***	-0.001	-3.72***	-0.168	-31.46***
LEVERAGE	-0.008	-4.09***	0.066	12.96***	-0.038	-27.32***	-0.139	-31.35***	0.042	9.92***	0.001	4.18***
OCF	0.001	9.47***	0.001	3.25***	0.003	12.76***	0.001	5.09***	-0.002	-0.63	0.132	1.56
UP	0.028	0.90	-0.106	-1.00	0.053	2.52**	0.116	1.61	-0.045	-0.60	0.223	4.31***
DOWN	0.010	0.53	0.023	0.36	0.020	1.52	0.223	5.00***	0.097	2.05**	0.058	1.26
WINB4	-0.014	-0.79	-0.115	-2.13**	0.008	0.66	0.058	1.45	-0.051	-1.03	-0.388	-8.89***
NWINB4	0.118	7.73***	0.447	10.96***	-0.092	-7.80***	-0.115	-3.22***	0.712	18.25***	-0.033	-4.17***
SOX	0.070	24.21***	-0.101	-10.15***	0.081	40.19***	0.003	0.39	0.030	3.92***	-0.095	-0.89
SOX×UP	0.044	1.16	0.151	1.30	-0.026	-0.94	-0.058	-0.66	0.015	0.18	-0.057	-1.01
SOX×DOWN	-0.027	-1.29	0.065	0.91	-0.016	-1.11	-0.048	-0.99	0.124	2.42**	0.006	0.11
SOX×WINB4	0.010	0.49	0.139	2.17**	-0.001	-0.07	-0.004	-0.08	0.047	0.83	0.139	2.88***
SOX×NWINB4	-0.057	-3.37***	-0.305	-6.92***	0.062	4.74***	0.048	1.24	-0.415	-10.01***	0.059	6.66***
LEADER	-0.024	-7.65***	-0.040	-4.66***	0.004	1.95**	0.046	6.29***	-0.006	-0.88	-0.063	-5.77***
SHAREDECR	0.022	7.75***	-0.038	-3.37***	0.047	16.63***	-0.014	-1.56	0.067	7.23***	-0.137	-17.51***
SHAREINCR	0.027	6.80***	0.067	8.90***	-0.011	-5.24***	-0.077	-11.99***	0.072	12.42***	-0.083	-4.00***
Lambda	0.003	0.38	-0.006	-7.33***	-0.006	-1.10	-0.057	-3.43***	0.044	3.12***	-0.255	-6.76***
Adj. R^2	0.019		0.122		0.151		0.008		0.183		0.131	
F statistics	7.71***		6.50***		58.78***		44.66***		5.30***		57.07***	
N	48,314		11,893		34,000		48,314		9,991		37,848	

[a]Outliers are winsorized using the 1% and 99% percentiles.

[b]The definitions of the variables reported in this table are: *DA*= performance adjusted discretionary accruals; *RPROD*=abnormal production costs; *SIZE* = Natural log of total assets at end of year *t*; *MB* = Market value to book value of equity; *LEVERAGE* = Total debt divided by total assets; *OCF* = Cash flows from operating activity deflated by beginning total assets*; UP* = 1 if a company with a non-Big 4 auditor switched to Big 4 in year *t*, and 0 otherwise; *DOWN* = 1 if a company with a Big 4 auditor switched to a non-Big 4 in year *t*, and 0 otherwise; *WINB4* = 1 if a company with a Big 4 auditor switched to a Big 4 in year *t*, and 0 otherwise; *NWINB4* = 1 if a company with a non-Big 4 auditor switched to a non-Big 4 in year *t*, and 0 otherwise; *SOX*= 1 for all firm-year observations in 2003 and latter and 0 for observations in 2002 and 2001; *LEADER* = 1if the successor auditor (or incumbent auditor for no-auditor change companies) industry expertise falls into the classification presented in Hogan and Jeter (1999), and zero otherwise; *SHAREDECR* = 1 if a company has a decline of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *SHAREINCR* = 1 if a company has a increase of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *Lambda* = inverse Mills ratio.

[c]Asterisks *, **, and *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

TABLE 6
Two-stage Regression Results for "Downgrade" Sample - Using Four Auditor Change Dummies[a]

Stage 1 Model: $$DOWN_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 LOSS_{i,t} + \alpha_6 GC_{i,t} + \alpha_7 FEE_{i,t} + \alpha_8 INDSHARE_{i,t} + \alpha_9 M\&A_{i,t} + \varepsilon \quad (6)$$

Stage 2 Model: $$DA_{i,t}/RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 CFO_{i,t} + \alpha_5 DOWN_{i,t} + \alpha_6 SOX_{i,t} + \alpha_7 SOX_{i,t} \times DOWN_{i,t} + \alpha_8 LEADER + \alpha_9 SHAREDECR_{i,t} + \alpha_{10} SHAREINCR_{i,t} + \alpha_{11} Lambda_{i,t} + \varepsilon \quad (7)$$

	First-Stage		Second-Stage (two earnings management measures: *DA* and *RPROD*)											
	Probit Model		Absolute DA		Positive DA		Negative DA		Absolute RPROD		Positive RPROD		Negative RPROD	
Variable[b]	Coeff.	*z*-stat.[c]	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.
INTERCEPT	-1.295	-43.03***	0.015	0.44	0.445	4.34***	-0.140	-7.15***	0.162	2.2**	1.211	3.31***	0.068	0.82
SIZE	0.014	1.18	-0.005	-1.2	-0.033	-3.07***	0.011	4.88***	0.032	3.82***	-0.108	-7.64***	0.061	6.62***
MB	0.002	1.10	0.002	2.78***	0.003	1.21	0.000	0.86*	-0.002	-1.18	0.001	0.48	-0.006	-3.36***
LEVERAGE	0.000	-0.01	-0.008	-1.28	0.022	1.22	-0.007	-1.82	0.007	0.48	0.020	0.99	0.016	1.05
ROA	0.028	2.88***												
LOSS	-0.128	-2.37***												
GC	0.002	0.03												
FEE	-0.039	-3.63***												
INDSHARE	0.015	0.01												
M&A	-0.305	-2.04**												
OCF			0.008	1.58	-0.035	-2.25**	0.024	7.52***	0.052	4.56***	0.002	0.10	0.044	3.35***
DOWN			-0.019	-0.48	0.180	1.34$^{\#}$	-0.039	-1.80*	-0.055	-0.64	0.316	2.37**	-0.075	-0.80
SOX			0.076	3.56***	-0.125	-2.09**	0.106	8.50***	-0.024	-0.53	-0.041	-0.58	-0.091	-1.76*
SOX×DOWN			-0.052	-1.44$^{\#}$	-0.164	-1.34$^{\#}$	0.029	1.51$^{\#}$	0.174	2.25**	-0.231	-1.89*	0.274	3.23***
LEADER			-0.015	-0.85	-0.044	-0.89	0.001	0.14	0.033	0.89	-0.035	-0.72	0.063	1.48
SHAREDECR			0.090	3.26***	0.159	2.28**	0.060	3.72***	-0.148	-2.53**	0.091	1.16	-0.319	-4.70***
SHAREINCR			0.048	2.69***	0.203	4.14***	-0.036	-3.53***	-0.020	-0.53	0.273	5.10***	-0.158	-3.61***
Lambda			-0.052	-3.81***	-0.010	-0.24	-0.077	-9.23***	-0.369	-12.73***	-0.477	-1.62	-0.429	-13.31***
Pseudo/Adj. R^2	0.031		0.021		0.068		0.209		0.121		0.135		0.128	
F-statistic	6.56***		7.14***		6.82***		56.13***		42.09***		10.54***		56.74***	
N	3,373		3,373		1,078		2,295		3,373		843		2,530	

[a]Outliers are winsorized using the 1% and 99% percentiles.

[b]The definitions of the variables reported in this table are: *DA*= performance adjusted discretionary accruals; *RPROD*=abnormal production costs; *SIZE* = Natural log of total assets at end of year *t*; *MB* = Market value to book value of equity; *LEVERAGE* = Total debt divided by total assets; *ROA* = Return on assets, defined as net income before extraordinary items divided by total assets; *LOSS* = 1 if operating income is less than 0 in year t, and 0 otherwise; *GC* = 1 if a firm received a going concern opinion in year *t-1*, and 0 otherwise; *FEE* = the ratio of audit fees divided by the total fees in year *t-1*; *INDSHARE* = The percentage of the square root of total assets that the auditor audits for all companies in the client's industry; *M&A* = 1 if the firm experiences a merger or acquisition in the preceding two years, and 0 otherwise; *OCF* = Cash flows from operating activity deflated by beginning total assets*; DOWN* = 1 if a company changes audit firm downward from a Big 4 to a non-Big 4 auditor in year *t*, and 0 otherwise; *SOX*= 1 for all firm-year observations in 2003 and latter and 0 for observations in 2002 and 2001; *SOX×DOWN* = 1 if a company changes audit firm downward from a Big 4 to a non-Big 4 auditor in the post-SOX period, and 0 otherwise; *LEADER* = 1if the successor auditor (or incumbent auditor for no-auditor change companies) industry expertise falls into the classification presented in Hogan and Jeter (1999), and zero otherwise; *SHAREDECR* = 1 if the firm has a decline of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *SHAREINCR* = 1 if the firm has a increase of more than 10 percent of total outstanding shares during the year, and 0 otherwise.

[c]Asterisks *, **, and *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively; pound key # denotes the 0.10 one-tailed significance level.

TABLE 7
Two-stage Regression Results for "Within Non-Big 4" Sample - Using Four Auditor Change Dummies[a]

Stage 1 Model: $$NWINB4_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 LOSS_{i,t} + \alpha_6 GC_{i,t} + \alpha_7 FEE_{i,t} + \alpha_8 INDSHARE_{i,t} + \alpha_9 M\&A_{i,t} + \varepsilon \quad (6)$$

Stage 2 Model: $$DA_{i,t}/RPROD_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 LEVERAGE_{i,t} + \alpha_4 CFO_{i,t} + \alpha_5 NWINB4_{i,t} + \alpha_6 SOX_{i,t} + \alpha_7 SOX_{i,t} \times NWINB4_{i,t} + \alpha_8 LEADER + \alpha_9 SHAREDECR_{i,t} + \alpha_{10} SHAREINCR_{i,t} + \alpha_{11} Lambda_{i,t} + \varepsilon \quad (8)$$

	First-Stage		Second-Stage											
	Probit Model		Absolute DA		Positive DA		Negative DA		Absolute RPROD		Positive RPROD		Negative RPROD	
Variable[b]	Coeff.	*z*-stat.[c]	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.	Coeff.	*t*-stat.
INTERCEPT	1.254	14.65***	0.140	4.74***	0.142	1.41	-0.190	-10.00***	-0.073	-0.95	0.342	3.27***	-0.038	-0.45
SIZE	-0.416	-24.94***	-0.016	-0.88	-0.071	-1.31	0.022	1.80*	-0.043	-0.92	-0.251	-3.42***	-0.021	-0.40
MB	0.000	-0.15	0.011	1.88*	0.031	1.74*	-0.008	-2.15*	-0.013	-0.89	0.024	1.26	-0.001	-0.06
LEVERAGE	0.059	2.34**	0.001	0.85	0.002	0.86	0.001	1.44	0.002	0.91	0.003	1.36	-0.003	-1.65*
ROA	-0.036	-3.03***												
LOSS	-0.103	-1.74*												
GC	0.169	2.01**												
FEE	0.216	2.31**												
INDSHARE	-0.366	-0.13												
M&A	0.106	0.69												
OCF			-0.016	-4.13***	-0.007	-0.64	0.040	14.47***	0.126	12.79***	0.024	1.27	0.138	12.21***
NWINB4			0.192	6.58***	0.524	5.40***	-0.078	-3.98***	-0.195	-2.56***	0.539	4.86***	-0.481	-5.59***
SOX			-0.026	-1.23*	0.092	1.15	0.067	5.00***	-0.051	-0.91	0.218	2.62***	-0.113	-1.85*
SOX× NWINB4			-0.124	-3.95***	-0.456	-4.41***	0.087	4.09***	0.059	0.72	-0.489	-4.16***	0.162	1.74*
LEADER			-0.001	-0.10	-0.027	-0.57	0.000	-0.03	0.018	0.46	-0.049	-1.04	0.036	0.77
SHAREDECR			0.020	0.82	0.176	2.51*	0.064	3.83***	-0.149	-2.37**	0.086	1.13	-0.319	-4.35***
SHAREINCR			0.089	5.61***	0.204	4.23***	-0.039	-3.75***	-0.046	-1.12	0.230	4.42***	-0.177	-3.76***
Lambda			0.025	0.44	0.172	0.99	-0.040	-1.02	0.208	1.37	0.575	2.36**	0.159	0.94
Pseudo/Adj. R^2	0.298		0.076		0.093		0.210		0.100		0.166		0.177	
F-statistic	1352.06***		25.93***		9.20***		56.70***		34.50***		13.19***		50.78***	
N	3,373		3,373		1,078		2,295		3,373		843		2,530	

[a]Outliers are winsorized using the 1% and 99% percentiles.

[b]The definitions of the variables reported in this table are: *DA*= performance adjusted discretionary accruals; *RPROD*=abnormal production costs; *SIZE* = Natural log of total assets at end of year *t*; *MB* = Market value to book value of equity; *LEVERAGE* = Total debt divided by total assets; *ROA* = Return on assets, defined as net income before extraordinary items divided by total assets; *LOSS* = 1 if operating income is less than 0 in year t, and 0 otherwise; *GC* = 1 if a firm received a going concern opinion in year *t-1*, and 0 otherwise; *FEE* = the ratio of audit fees divided by the total fees in year *t-1*; *INDSHARE* = The percentage of the square root of total assets that the auditor audits for all companies in the client's industry; *M&A* = 1 if the firm experiences a merger or acquisition in the preceding two years, and 0 otherwise; *OCF* = Cash flows from operating activity deflated by beginning total assets*; DOWN* = 1 if a company changes audit firm downward from a Big 4 to a non-Big 4 auditor in year *t*, and 0 otherwise; *SOX*= 1 for all firm-year observations in 2003 and latter and 0 for observations in 2002 and 2001; *SOX×DOWN* = 1 if a company changes audit firm downward from a Big 4 to a non-Big 4 auditor in the post-SOX period, and 0 otherwise; *LEADER* = 1if the successor auditor (or incumbent auditor for no-auditor change companies) industry expertise falls into the classification presented in Hogan and Jeter (1999), and zero otherwise; *SHAREDECR* = 1 if the firm has a decline of more than 10 percent of total outstanding shares during the year, and 0 otherwise; *SHAREINCR* = 1 if the firm has a increase of more than 10 percent of total outstanding shares during the year, and 0 otherwise.

[c]Asterisks *, **, and *** indicate two-tailed significance at the 0.10, 0.05, and 0.01 levels, respectively.

The Pricing of Intellectual Capital in the IT Industry*

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The Pricing of Intellectual Capital in the IT Industry

Abstract

This study adopts Ohlson's (1995) valuation model to examine the value relevance of intellectual capital (IC) disclosed by Taiwan's information technology (IT) companies. Drawn on prior studies, we focus on four types of IC: human, innovation, process, and relational. Using the mandated disclosure of intellectual capital information and considering intertemporal and firm-specific variations in rates of return on equity, the empirical results show several important findings. First, Taiwan's IT companies are more likely to focus on human capital by paying more bonuses to their employees. Second, due to an increase in sales over years, Taiwan's IT companies having high abnormal accounting rate of returns do not exhibit mean-reverting on their accounting rate of returns. Third, intellectual capital is value relevant to IT companies' business valuation because the significance of abnormal earnings vanishes when IC variables are considered. Finally, we provide some preliminary evidence showing that the use of a constant discount rate (which leads to significant abnormal earnings and high adjusted R^2 documented in the literature) could be inappropriate for value relevance research using the Ohlson model.

Keywords: Information technology, Intellectual capital, Human capital, Innovation capital, Process capital, Relational capital, Rate of return on equity.

Data Availability: The data used in this paper are available from a database established in Taiwan.

1. INTRODUCTION

The central purpose of accounting is to prepare financial statements that provide information to external users for optimal capital allocations. However, three problems impede the usefulness of accounting information to achieve such goal: the first one is the *measurement* problem, in which reported numbers could be irrelevant to the decision makers due to certain measurement rules (e.g., historical cost); the second one is the *recognition* problem, in which important unquantifiable economic events are not recognized and recorded (e.g., customer satisfaction) due to the monetary unit assumption; the last one is the *disclosure* problem, in which managers' are unwilling to voluntarily disclose private information (e.g., human resources) whose disclosure is not required by the GAAP but is useful in valuing firms' future prospects. Driven by these three problems, recent accounting studies have explored the changing role accounting plays to the economy and found that the value relevance of accounting information has declined over time (e.g., Brown et al. 1999; Dontoh et al. 2004; Ely and Waymire 1999; Lev and Zarowin 1999). In light of this finding, a follow-up examination of what other information is important and whether the stock market is able to react to such information is necessary in determining new regulations and accounting rules.

This study investigates the empirical questions of whether and how, from 2003 through 2006, Taiwan's stock market prices intellectual capital developed by the information technology (IT) industry.[1] We focus on intellectual capital for two reasons. First, neither the U.S. nor the international GAAP provides clear rules for recognizing and disclosing intellectual capital. Therefore, intellectual capital is subjected to the three accounting problem mentioned above. Because the majority of the intellectual capital is not fully recorded and reported in the financial statements, future earnings are likely to exceed normal return on book value of equity (Kohlbeck and Warfield 2007). In other words, the omission or incomplete disclosure of intellectual capital could be one reason of the diminishing value relevance of accounting information. Second, recent studies have shown that intangible assets are significantly associated with future earnings (e.g., Aboody and Lev 1998; Lev and Sougiannis 1996) and analysts' earnings forecasts (e.g., Barron et al. 2002; García-Meca

[1]Intellectual capital generally refers to *knowledge-based* assets such as the possession of certain domain knowledge, applied experience, organizational technology, customer relationships, and professional skills that can be put in use to create wealth and competitive edge in the market (Edvinsson and Malone 1997; Stewart 1997). Some researchers use "intangible assets" to describe intellectual capital and use these two terms interchangeably because they define intellectual capital as those intangible assets that have not been recorded and reported in the financial statements (e.g., Amir and Lev 1996; Ittner et al. 1997; Lev 2001). We take Edvinsson and Malone's (1997) and Stewart's (1997) definition and argue that intellectual capital encompasses intangibles assets (which, following the GAAP, are defined as non-financial fixed assets that do not have physical substance but are identifiable and controlled by an entity through custody and legal rights).

and Martínez 2007). Thus, intellectual capital may explain the increasing disparity between firms' market values and book values (Edvinsson and Malone1997; Power 2001; Stewart 1997).

We focus on the IT industry because, unlike traditional industries, IT companies exploit technologies through continuous R&D activities to gain unique competence for the delivery of new products, services, and solutions with enhanced value to customers. Since design, process, and technological innovations are critical to IT companies' survival and success in the marketplace, intellectual capital should be more influential to their future performance than traditional industries.

We examine Taiwan's stock market because all listed companies are required by the *Regulations Governing Information to be Published in Annual Reports of Public Companies* to disclose extra information related to their intellectual capital in the financial statements.[2] This rule provides us with two contributions to the intellectual capital literature.[3] First, a large body of research has examined the association between intangible assets and firms' performance (e.g., Aboody and Lev 1998; Ittner and Larcker 1998; Lev and Sougiannis 1996), and analysts' forecast properties (e.g., Barron et al. 2002; García-Meca and Martínez 2007). No studies have explicitly examined the value relevance of intellectual capital (which is broader than intangible assets) in investors' business valuation. Taiwan's disclosure rule gives rise to a unique data set that allows us to examine whether and how the stock market prices different types of intellectual capital simultaneously. We regard this as our major contribution because the focus on intellectual capital as the prime source of competitiveness in the knowledge-based economy has been emphasized by the accounting academics for many years (e.g., Goodwin and Ahmed 2006; Lev and Zarowin 1999).

Second, this study provides empirical evidence from a capital market that differs significantly from those of the U.S. and Europe. We believe that the ongoing development of international aspects of intellectual capital may benefit from evidence obtained from diverse economic environments. This study aims, therefore, at enlarging the understanding of the association between stock prices and intellectual capital in an international context. In light of the increasing spread of globalization and the importance of Taiwan in the emerging markets of the Asia-Pacific region (see section 2), such an understanding is

[2]This rule was first passed in 1988 to ensure that an appropriate amount of information be disclosed in the financial statements. After its initial enactment, this rule has been modified eight times to include additional disclosures such as compensations to top management and board members, ownership of top ten major shareholders, key financial ratios and their trends, and policies and procedures of corporate governance and risk management. Due to these revisions, public companies are also obliged to disclose information related to their R&D expenditures, technologies and products successfully developed, number of employees and their years of service, average ages, and education levels.

[3]See Ashton (2005) for a comprehensive review of prior studies in intellectual capital.

important to both investors and academics all over the world.

Drawn on prior research, this study examines four types of intellectual capital: human capital, innovation capital, process capital, and relational capital, with each type captured by two proxies. Using Ohlson's (1995) valuation model and Dechow et al.'s (1999) framework, the empirical results reveal several important findings. First, Taiwan's IT companies are more likely to focus on human capital (mainly through bonus payments) than on the other three capital types. Second, due to the ability to maintain an increase in sales over years, there is a positive association between IT companies' abnormal accounting rates of return and the persistence of abnormal earnings. Third, intellectual capital is value-relevant to IT companies' business valuation, leading to insignificant abnormal earnings in the Ohlson model. Notably, Taiwan's stock market views higher royalty payments as signal of weaker innovation capability and reacts unfavorably. Finally, this study provides some evidence that the use of a constant discount rate could be inappropriate for value relevance research using the Ohlson model. Only when the intertemporal and firm-specific variations in rate of return on equity are considered that intellectual capital is value relevant.

The remainder of this paper is organized as follows. Section 2 provides a brief overview of Taiwan's current economic status. Section 3 describes the research design and data. Section 4 presents and discusses the empirical results. A summary and conclusion are provided in section 5.

2. TAIWAN'S CURRENT ECONOMIC STATUS

Taiwan is the world's 18th-largest trading nation with the fourth-largest foreign exchange reserves (which amounts to US$348.2 billion by the end of January 2010). In World Economic Forum's 2009-2010 *Global Competitiveness Index*, Taiwan is ranked 12th. Among the top 50 countries evaluated by the US-based Business Environment Risk Intelligence, Taiwan has the fifth-largest Profit Opportunity Recommendation score. Since January 2010, the weight of Taiwan's shares in the Morgan Stanley Capital International's (MSCI) *Asia APEX 50 Index* is 17.6 percent (next to South Korea and Hong Kong). By February 3, 2010, the *iShares S&P Asia 50 Index* and the *SPDR S&P Emerging Asia Pacific Index* hold 21.73 percent (next to South Korea) and 29.73 percent (next to China) of Taiwan's shares, respectively. The London-based Economist Intelligence Unit's business environment outlook for 2009-2013 places Taiwan third in Asia, next only to Singapore and Hong Kong. These statistics indicate that Taiwan plays an important role in Asia-Pacific's emerging markets.

Information technology is the most important industry in Taiwan not only because it accounts for more than 37.2 percent of Taiwan's 2008 GNP, but also because it has gained world-wide recognition for many years (Einhorn et al. 2005). Currently, Taiwan is the world's second-largest manufacturer of IT products. The IT industry is composed of several major areas such as semiconductor, computer peripheral equipment, optoelectronics, Internet communication, and electronic products. In 2009, more than ten IT products (e.g., motherboards, notebooks, LCD-LED monitors, chip foundry, semiconductor packaging and testing, mask ROMs, WLAN NIC, VoIP Routers) have the largest market share in the world. Notably, the motherboards and the notebooks gain global market shares of 97.2% and 92.8%, respectively. The outstanding performance and the prosperity of the IT industry have attracted institutional investors all over the world. By February 3, 2010, 73.54 percent and 75.51 percent of the Taiwanese companies included in the *iShares S&P Asia 50 Index* and the *MSCI Asia APEX 50 Index*, respectively, belong to the IT industry.

3. RESEARCH DESIGN

3.1 Model Specification:

We adopt Ohlson's (1995) valuation model because it theoretically shows that a firm's market value of equity at the end of year t (denoted by P_t) is determined by information reported in the balance sheet (i.e., the book value, denoted by BV_t) and the income statement (i.e., the abnormal earnings, denoted by X_t^a) together with "other" information (i.e., the difference between the conditional expectation of abnormal earnings for period t+1 based on all available information and the expectation of abnormal earnings based only on period t's abnormal earnings, denoted by v_t). Many studies have documented that Ohlson (1995) model has fairly high explanatory power (e.g., Barth et al. 1999; Bernard 1995; Dechow et al. 1999; Francis et al. 2000) and, therefore, could be appropriate for examining the association between intellectual capital and business valuation (e.g., Kohlbeck and Warfield 2007).

We use the following model (1) to test the value relevance of various types of intellectual capital:

$$\begin{aligned} P_{i,t} = {} & \alpha_0 + \alpha_1 \cdot BV_{i,t} + \alpha_2 \cdot X_{i,t}^a + \alpha_3 \cdot V_{i,t}^f + \alpha_4 \cdot CT_{i,t} + \alpha_5 \cdot Y2004 + \alpha_6 \cdot FOREIGN_{i,t} + \alpha_7 \cdot MASTER_{i,t} \\ & + \alpha_8 \cdot BONUS_{i,t} + \alpha_9 \cdot RD_{i,t} + \alpha_{10} \cdot ROYALTY_{i,t} + \alpha_{11} \cdot ADMIN_{i,t} + \alpha_{12} \cdot CURRENT_{i,t} \\ & + \alpha_{13} \cdot PROMOTION_{i,t} + \alpha_{14} \cdot CREDIT_{i,t} + \varepsilon_{i,t} , \qquad (1) \end{aligned}$$

where

$P_{i,t}$ = stock price per share for firm i at the end of year t;

$BV_{i,t}$ = book value of equity per share for firm i at the end of year t;

$X^a_{i,t}$ = abnormal earnings per share of firm *i* for year *t*;

$V^f_{i,t}$ = year *t*'s consensus analyst forecast of firm *i*'s abnormal earnings for year *t*+1;

$CT_{i,t}$ = stockholders' tax deductible balance plus accrued tax payable per share for firm *i* at year *t*;

Y2004 = 1 for year 2004 and 0 otherwise;

FOREIGN = the foreign institutional investors' ownership percentage of firm *i* for year *t*;

$MASTER_{i,t}$ = the percentage of employees with graduate education for firm *i* at the end of year *t*;

$BONUS_{i,t}$ = bonus to pre-tax earnings ratio for firm *i* in year *t*;

$RD_{i,t}$ = R&D density (i.e., R&D expenses divided by net sales) for firm *i* in year *t*;

$ROYALTY_{i,t}$ = ratio of royalty payments to net sales for firm *i* in year *t*;

$ADMIN_{i,t}$ = ratio of administrative expenses to new sales for firm *i* in year *t*;

$TURNOVER_{i,t}$ = asset turnover (i.e., net sales divided by average total assets) for firm *i* in year *t*;

$PROMOTION_{i,t}$ = ratio of marketing expenses to net sales for firm *i* in year *t*;

$CREDIT_{i,t}$ = Taiwan Corporate Credit Risk Index (TCRI) basic rank for firm *i* in year *t*;

$\varepsilon_{i,t}$ = the residual term.

3.2 Definitions of Variables:

3.2.1 Book value (BV) and abnormal earnings (X^a)

Following Ohlson (1995), we measure $BV_{i,t}$ using firm *i*'s book value of equity at the end of year *t*. In addition, $X^a_{i,t}$ is computed using the following model (2):

$$X^a_{i,t} = X_{i,t} - r_{i,t} \cdot BV_{i,t-1}, \tag{2}$$

where

$X_{i,t}$ = firm *i*'s earnings before extraordinary items for year *t*;

$r_{i,t}$ = firm *i*'s rate of return on equity for year *t*;

$BV_{i,t-1}$= firm *i*'s book value of equity at the end of year *t*-1.

While prior studies assume a constant *r* of 12% (which is the U.S. long-term average rate of return) in estimating the abnormal earnings (e.g., Barth et al. 1999; Dechow et al. 1999), we compute $r_{i,t}$ using the geometric average of each firm's returns on equity (ROE) across three years before year *t*. Geometric average provides an unbiased estimate of $r_{i,t}$ because it considers both intertemporal and firm-specific variations in discount rates (Blume 1974), resulting in a more precise measurement of abnormal earnings.[4]

[4]According to Ku et al. (2006), the long-term average rate of return on equity exhibits high variation in Taiwan's IT industry. For

In Section 4.5, we will examine the impacts of using a constant r vs. geometric average $r_{i,t}$ on our regression results. Note that we choose a 3-year short window to avoid any mean-reverting problem that could happen to specific firms if we use longer windows (Bekaert and Hodrick 1992). Following prior studies, we predict $\alpha_1 > 0$ and $\alpha_2 > 0$ in model (1).

3.2.2 "Other" information

Analysts' forecasts of abnormal earnings ($V^f_{i,t}$)

Prior studies have shown that analysts' earnings forecasts constitute an important part of "other" information in the Ohlson model (e.g., Dechow et al. 1999; Ohlson and Zhang 1998). Following Dechow et al. (1999), we measure $V^f_{i,t}$ using the following Model (3):

$$V^f_{i,t} = \left(f_{i,t} - r_{i,t} \cdot BV_{i,t-1}\right) - \omega_{i,t} \cdot X^a_{i,t}, \tag{3}$$

where

$f_{i,t}$ = the first consensus earnings forecast per share of firm i for year t+1 measured in the year following the announcement of earnings for year t;

$\omega_{i,t}$ = the persistence of abnormal earnings per share for firm i at year t;

The definitions of other variables are the same as those defined in equation (2).

To calculate $\omega_{i,t}$, we first estimates the persistence parameters $\omega_0 \sim \omega_5$ determining the autoregressive properties of abnormal earnings in the following stochastic function:

$$X^a_{i,t} = \omega_0 + \omega_1 \cdot X^a_{i,t-1} + \omega_2 (X^a_{i,t-1} \cdot q1_{i,t-1}) + \omega_3 (X^a_{i,t-1} \cdot q2_{i,t-1}) + \omega_4 (X^a_{i,t-1} \cdot q3_{i,t-1}) + \omega_5 (X^a_{i,t-1} \cdot div_{i,t-1}) + \varepsilon_{i,t}, \tag{4}$$

where

$X^a_{i,t-1}$ = firm i's abnormal earnings per share for year t-1;

$q1_{i,t}$ = the absolute value of firm i's abnormal earnings at the end of year t divided by its book value of equity at the beginning of year t;

$q2_{i,t}$ = the absolute value of firm i's special accounting items (nonrecurring items) divided by its book value of equity at the beginning of year t;

$q3_{i,t}$ = the absolute value of firm i's accounting accruals divided by its total assets at the beginning of year t;

$div_{i,t}$ = firm i's dividends paid during year t divided by its earnings for year t.

example, this rate was 12.5% (ranging from -51.5% to 31%), 16% (ranging from -36.1% to 100%), 11.76% (ranging from -10.7% to 27.1%), and 12.43 (ranging from -51.6% to 31%) in 2002, 2003, 2004, and 2005, respectively. Therefore, the use of geometric averages to estimate the rate of return on equity, which has been used in prior accounting research (e.g., Abarbanell and Bushee 1997; Rajan et al. 2007), is deemed appropriate in our study.

Consistent with Dechow et al. (1999), we predict ω_2, ω_3, and ω_4 to be negative.[5] Contrary to prior studies, which have reported a negative association between firms' future growth opportunities and their cash dividend payout ratio (e.g., Anthony and Ramesh 1992), we predict $\omega_5 > 0$ because almost all Taiwan's IT companies pay more cash dividends as their EPS' are higher in response to shareholders' demand for earning cash dividends rather than gains from speculations.[6]

Once $\hat{\omega}_1$, $\hat{\omega}_2$, $\hat{\omega}_3$, $\hat{\omega}_4$, and $\hat{\omega}_5$ are estimated, the predicted value of each firm's conditional(denoted by $\omega_{i,t}^{c}$) can be determined by plugging these $\hat{\omega}$'s into the following Model (5)

$$\omega_{i,t}^{c} = \hat{\omega}_1 + \hat{\omega}_2 \cdot q1_{i,t} + \hat{\omega}_3 \cdot q2_{i,t} + \hat{\omega}_4 \cdot q3_{i,t} + \hat{\omega}_5 \cdot div_{i,t}\,. \tag{5}$$

We then calculate $V_{i,t}^{f}$ by applying this $\omega_{i,t}^{c}$ to equation (3) and predict $\alpha_3 > 0$ in model (1).

Shareholders' imputed credits (*$CT_{i,t}$*)

The full imputation credit prototype forms the core of Taiwan's integrated tax system adopted in 1998. Under this new system, individual shareholders are allowed a tax credit against their individual income tax for any dividend income tax paid at the corporate level. Dividends paid to corporate shareholders are exempt from corporate income tax, and the imputation credit will be passed on, in its entirety, to individual shareholders. It is this full imputation feature that changes the nature of corporate income tax from a pure operating expense to an asset (Yu et al. 2003). To accommodate this tax reform, Taiwan's GAAP mandate listed companies to disclose shareholders' taxable dividend balance (STDB) in the footnotes of the financial statements. Due to this Taiwan-specific feature, we consider $CT_{i,t}$ and predict $\alpha_4 > 0$ in model (1). Note that $CT_{i,t}$ is measured by adding accrued tax payables to the STDB because STDB denotes the actual amount of cash firm *i* has paid in year *t* but does not include the tax that firm *i* will pay in year *t*+1.

3.2.3 Other control variables

The presidential election year (*Y2004*)

As compared to 2003, 2005, and 2006, Taiwan's stock market suffered substantial fluctuation in 2004 due to the presidential election on March 20. Due to many provoking political actions and scandals in his

[5]Variable $q1$ measures the impact of abnormal accounting rate of return on the persistence of abnormal earnings. Since Dechow et al. (1999) and Freeman et al. (1982) have found that companies having extremely high or low accounting rate of returns exhibit stronger mean-reverting on their accounting rate of returns, we expect that the larger the $q1$, the weaker the persistence of abnormal earnings. In addition, variable $q2$ measures the effect of nonrecurring items on the persistence of abnormal earnings. Fairfield et al. (1996) shows that the persistence of nonrecurring items is generally decreasing. Variable $q3$ measures the influence of operating accruals on the persistence of abnormal earnings. According to Sloan (1996), companies having extremely high or low operating accruals usually suffer weaker persistence of accounting rate of returns.

[6]See Shefrin and Statman (1984) for behavioral explanations of why investors have strong preference for cash dividends.

Administration, former President Chen Shui-bian's opinion polls were far behind his competitor, Lien Chan. With the expectation that Lien Chan would win the election, the stock market soared in terms of trading amount and volume in early 2004. However, Chen was shot while campaigning on March 19, 2004, the day before polls opened on March 20. Using this as an allegation of assassination planned by China, Chen narrowly won the election. Lien Chan refused to concede and sued both for a recount and for a nullification of the outcome while supporters held a week-long riot in front of the Presidential House due to alleged election irregularities throughout the island. The stock market reacted to this unexpected event by a drop of more than 400 points in the week following the election. We adopt a dummy *Y2004* to control for the potential impact of this political event on the stock market and predict $a_5 < 0$ in model (1).

Foreign institutional investors' ownership percentage (*FOREIGN*)

Due to its high competitiveness and good financial performance, Taiwan's IT industry has long been the target to foreign institutional investors since early 1990s (Dean 2004). Because foreign institutional investors have better professional knowledge and are more capable of gathering and analyzing accounting information than domestic investors (Kim and Singal 1994), they usually take a leadership position in Taiwan's stock market, especially in the IT industry (You and Lai 1999). Taiwan Securities Exchange reports that foreign institutional investors hold 23.15% and 33.24% ownerships of Taiwan's electronics and semiconductor companies in 2003, respectively. These percentages jump to 30.72% and 42.78% in 2005, 32.90% and 46.66% in 2006, and drop slightly to 31.94% and 44.18% in 2007, respectively. Because companies whose ownerships are held by foreign institutional investors tend to be more financially transparent (Chen et al. 2005) and domestic investors often rely on foreign investors' strategy to guide their own investment decisions (Liu 2004), we predict $a_6 > 0$ in model (1).

3.2.4 Intellectual capital variables

Human capital

Human capital refers to the knowledge, skills, and competencies of people in an organization. Numerous studies have emphasized the importance of human as a key component of intellectual capital (e.g., Davis and Noland 2003; Lee and Witteloostuijn 1998; Ulrich 1998). We adopt *employees' educational background* (denoted by *EDU*) to proxy for human capital because educational background reflects employees' professional knowledge and learning potential to enhance problem-solving capability (Bröcheler et al. 2004; Lim and Dallimore 2004; Skaggs and Youndt 2004). We measure *EDU* by the percentage of total professional employees holding a graduate degree and predict $\alpha_7 > 0$ in model (1).

We also use the *bonus paid to the employees* (denoted by *BONUS*) as our second proxy because compensation is important in motivating capable employees to create firm value (Mavrinac and Siesfeld 1998; Wilson and Peel 1991). Bonus-sharing contracts lower the probability of strike (Brown et al. 1999), turnover (Wilson and Peel 1991), and improve productivity (Bhargava 1994). We measure *BONUS* by the total bonus paid to professional employees divided by the pre-tax earnings and predict $\alpha_8 > 0$ in model (1).

Innovation capital

Innovation capital is an organization's capability to use emerging technologies to innovate and develop new products, services, and solutions. Therefore, innovation is deemed the most vital intellectual capital to its survival and success. We choose two proxies to capture innovation capital: *R&D density* (denoted by *RD*) and *royalty ratio* (denoted by *ROYALTY*). These two proxies are selected mainly because most of Taiwan's IT companies obtain new technology either by their own R&D activities or by acquiring patents through royalty payments. Previous research has found that R&D expenditure plays a pivotal role to firms' innovation activities, giving rise to future growth opportunities (e.g., Bae and Kim 2003; Bhagat and Welch 1995). Also, spending on R&D is viewed as a form of investment in intangible assets with predictably positive effects on future cash flows (Chauvin and Hirschey 1993), leading to favorable market reactions (Sougiannis 1994). We measure *RD* and *ROYALTY* by the ratios of R&D expenses and total royalty payments to net sales, respectively, and predict $\alpha_9 > 0$ and $\alpha_{10} > 0$ in model (1).

Process capital

Process capital is the procedures, systems, and techniques an organization adopts to facilitate its operations. Since investors regard the quality of internal processes as an important business valuation factor (Mavrinac and Siesfeld 1998), firms should maintain smooth and flexible operation processes to achieve process quality. Our first proxy for process capital is the *administrative expense ratio* (denoted by *ADMIN*). This ratio has been widely used because more administrative expenses usually imply more resources invested in process management (Hurwitz et al. 2002; Stewart 1997). We measure *ADMIN* by the ratio of total administrative expenses to net sales and predict $\alpha_{11} > 0$ in model (1).

Prior studies have indicated that working capital turnover serves as a good measure of firms' operating efficiency because higher turnover may imply less overstocking of capital, higher inventory turnover, and shorter operating cycle (e.g., Knight 1999; Stewart 1997). On the other hand, since the IT industry requires high-technology investments in fixed assets with greater asset specificity (OECD 1996, 1999), production efficiency influences its global competiveness and future growth. Several recent studies have used fixed assets turnover to proxy for production efficiency and shown that IT companies with higher fixed asset turnover have better earnings performance (e.g., Mouritsen et al. 2001; Wang and Chang 2005). Because both operation and production efficiencies are vital to Taiwan's IT industry, we adopt the (*total*) *asset turnover* (denoted by *TURNOVER*) as our second proxy.[7] We measure *TURNOVER* by the ratio of net sales to average total assets and predict $\alpha_{12} > 0$ in model (1).

Relational (customer) capital

Relational capital is the value of an organization's relationships with its suppliers, customers, and other stakeholders (Johanson et al. 2001). The first proxy we choose is the *promotion (marketing) expense ratio* (denoted by *PROMOTION*). Prior studies have documented that advertising and promotion expenditures affect consumers' product image or brand image (e.g., Edvinsson and Malone 1997; Lim and Dallimore 2004; Stewart 1997) and, therefore, have positive effect on future earnings (e.g., Bublitz and Ettredge 1989; Cañibano et al. 2000; Chauvin and Hirschey 1993). We measure *PROMOTION* by the ratio of total marketing expenses to net sales and predict $\alpha_{13} > 0$ in model (1).

The second proxy we choose is the *credit risk rating* (denoted by *CREDIT*). Previous research has indicated that relational capital can be measured by an organization's capabilities and reputation in its surrounding community (e.g., Knight 1999). A major source of such information is independent ranking agencies in general (Mavrinac and Siesfeld 1998), and corporate credit ratings in particular (Lee and Guthrie 2010). To fulfill investors' needs, the *Taiwan Economic Journal* (TEJ) creates and releases the *Taiwan Corporate Credit Risk Index* (TCRI) for all listed companies in Taiwan. TCRI provides a comprehensive evaluation of each firm's profitability, security, operations, size, and business and environmental risks on a 10-point scale (ranging from 0 to 9), with larger points indicating higher risk. To create the TCRI, the TEJ first calculates a basic rank for each firm using ten financial statement ratios.[8] This basic rank is further

[7]The use of asset turnover was first proposed by the DuPont Analysis in the 1920s. Soliman (2008) empirically shows that the asset turnover is positively associated with future earnings, stock returns, and analyst forecast revisions.

[8]These ten financial statement ratios encompass four aspects: *profitability* (including return on net worth, operating revenue ratio,

refined by considering each firm's pressure index and TEJ's subjective adjustments due to companies' potential agency costs. While the pressure index and subjective adjustments are not publicly available, the formula of computing and converting the financial statement ratios into basic rank are well-documented by numerous TEJ publications and its website. More importantly, the basic rank accounts for 85% of the weights in determining the TCRI. We thus measure *CREDIT* by the basic TCRI ranks and predict $\alpha_{14} < 0$ in model (1). Arguably, this portion of the TCRI is public information to the stock market.

4. EMPIRICAL RESULTS

4.1 Data and Sample Selection

The empirical data are collected from the TEJ database for the period from 2003 to 2006. Our preliminary sample consists of 1,228 firm-year observations. After subtracting observations with missing data and outliers,[9] we obtain 1,053 observations for estimating the persistence of abnormal earnings and 756 observations for estimating the Ohlson model. Table 1 demonstrates the sample selection process.

[Insert Table 1 here]

4.2 Sample Distribution, Descriptive Statistics, and Correlations

Table 2 indicates that the numbers of firm-year observations are roughly the same across the period 2003~2006. However, there are considerable variations among sub-industries within the IT industry. For example, as shown on the last column of Table 2, 21.96% of the companies are manufacturers of electronic parts / components, followed by computer peripheral equipment (18.12%), optoelectronic (16.67%), and semiconductor (16.53%). Only 8.73%, 6.22%, and 1.19% of the companies belong to Internet communication, electronic product distribution, and information service, respectively. Finally, some of the largest companies are classified as "Others" because of their high diversification (e.g., Foxconn Technology Group, the world largest provider of CEM, EMS, ODM and CMMS).[10]

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and return on total assets, with a weight of 1/9 assigned to each ratio), *liquidity and solvency* (including quick ratio, interest payment ratio, and loan dependence, with a weight of 1/9 assigned to each ratio), *business activity* (including average collection period for receivables and average inventory selling days, with a weight of 1/18 assigned to each ratio), and *size* (including total revenue and total assets, with a weight of 1/9 assigned to each ratio).

[9]To control for outliers, we trim observations that fall outside the upper and lower 1% of the empirical distributions for both the dependent and independent variables.

[10]Contract electronic manufacturers (CEM) are companies that offer contracts for electronic assembly for other original equipment manufacturers (OEM). Generally, a CEM does not post its brand name on any product, and both the design and the brand name belongs to the OEM. In contrast, electronics manufacturing service (EMS) providers are companies that design, test, manufacture, distribute, and provide repair services for electronic components and assemblies for OEM. Original design manufacturers (ODM) are companies that manufacture products which ultimately will be branded by another company for sale. ODM companies allow the brand firm to produce without having to engage in the organization or running of a factory. Finally, component module move service (CMMS) providers are companies offering joint development manufacturing (JDVM) and joint design manufacturing

[Insert Table 2 here]

Table 3 summarizes the definitions of all variables. Table 4 presents the descriptive statistics of these variables. All monetary amounts are measured by New Taiwan (NT) dollars (with an exchange rate around US$1 = NT$32). As reported in Table 4, the year-end stock price has a mean value of NT$27.421, ranging from NT$7.00 to NT$146.42. In addition, the average book value per share and abnormal earnings per share are NT$17.867 and NT$0.179, respectively. The mean value of analysts' forecasts is NT$0.881. Notably, the foreign institutional investors' ownership percentages display considerable dispersion, with a minimum of zero to a maximum of 73.1%. Our Ohlson model estimations thus control for the possible effect of foreign institution ownership on the value relevance of intellectual capital.

[Insert Tables 3 and 4 here]

Table 4 also shows substantial variations between and within four types of intellectual capital. For example, the mean values of *EDU* and *BONUS* are 0.115 (ranging from 0 to 0.679) and 0.150 (ranging from 0 to 0.769), respectively, indicating that Taiwan IT companies' human capital is more likely to be driven by paying more bonuses to their employees. In contrast, the mean values of *RD* and *ROYALTY* are 0.037 (ranging from 0 to 0.195) and 0.002 (ranging from 0 to 0.115), respectively, implying that sample firms tend to develop innovation capital mainly through their own research activities rather than acquiring patents from outside parties. The mean values of *ADMIN* and *TURNOVER* are 0.029 (ranging from 0 to 0.126) and 0.010 (ranging from 0.002 to 0.037), respectively, suggesting that Taiwan's IT companies invest more administrative expenses to manage their process capital. Finally, the mean values of *PROMOTION* and *CREDIT* are 0.039 (ranging from zero to 0.211) and 3.413 (with Q2 = 2, median = 3, and Q3 = 4), respectively, indicating that most of these IT companies have fairly good credit ratings based on which they build up their relational capital. To the extent that the above eight variables capture the capacity of their corresponding intellectual capital dimensions, Table 4 implies that Taiwan's IT companies have a propensity to focus more on the human capital than on the other three capital types.

Table 5 reports the Pearson and Spearman correlations for the variables. Consistent with Dechow et al. (1999) and Yu et al. (2003), Table 5 demonstrates that firms' stock prices are positively correlated with their book values (BV), abnormal earnings (X^a), analysts' forecasts (V^f), and shareholders' deductible tax amount

(JDSM). Since a CMMS takes the advantages of CEM and ODM, it can effectively reduce its production costs and speedup the production process. The CMMS model was initially developed and adopted by Foxconn since 1998.

(*CT*). Also, stock prices are significantly correlated with most of the intellectual capital variables (e.g., *EDU*, *BONUS*, *ADMIN*, *TURNOVER*, *PROMOTION*, *and CREDIT*) in the predicted directions, suggesting that investors seem to be able to detect and incorporate this intellectual capital information into their business valuation process. Two things are worth noting. First, many of the correlation coefficients are significant among independent variables. Therefore, multicollinearity may adversely affect our statistical testing power. We will use the variance inflation factor (VIF) to test if our empirical results are subjected to this multicollinearity problem. Second, untabulated statistics indicate that the Pearson and Spearman correlation coefficients between the basic ranks (which is labeled *CREDIT* in Table 5) and TEJ's TCRI are 0.7274 and 0.7494, respectively. Both coefficients are significant at the 1% significance level. Therefore, our use of the basic ranks provides an appropriate proxy for firms' real TCRI.

[Insert Table 5 here]

4.3 Determinants of the Persistence of Abnormal Earnings

Table 6 presents the empirical result for the determinants of the persistence of abnormal earnings, with all parameter estimates significant at the two-tailed 1% level. Except for ω_2, persistence is hypothesized to decrease when earnings contain more transitory accounting items, which are measured by the empirical constructs *q2* and *q3*. The significance of ω_3 and ω_4 indicates that the less the nonrecurring items and accounting accruals, the more the abnormal earnings in the next period. In contrast, the significance of ω_5 implies that an increase in cash dividend would result in an increase in next period's abnormal earnings.

[Insert Table 6 here]

The significantly positive coefficient ω_2, which is inconsistent with our prediction, suggests that Taiwan's IT companies having high abnormal accounting rate of returns do not exhibit mean-reverting on their accounting rate of returns. In fact, these companies enjoy an even higher increase in their abnormal earnings mainly due to a substantial increase in sales growth. For example, Foxconn Technology Group's net sales increase by 28.7%, 59.7% and 34.7% in 2004, 2005, and 2006, respectively. Likewise, Quanta Computer's (the world's largest notebook ODM / OEM company) operating sales increase by 11.0%, 24.2% and 14.5% in the same period. Surprisingly, the ASUSTek Computer (the world's largest motherboard manufacturer who introduced the *EeePC* in 2007) has a more than 20-fold increase in sales from 4.9% in 2004 to 130.3% in 2005 and 114.8% in 2006. These and many other IT companies have some important characteristics in common. First, they successfully establish their brand names by continuously designing high-end electronic products that lead the global market. Second, they develop more efficient manufacturing processes to cut down the costs, reduce the defective rate, shorten the production cycle, and adapt to technological changes faster. Finally, they maintain a close networked relation with their global vendors and customers. Because of these salient features, together with the government's long-term financial supports, Taiwan's IT companies are able to sustain a considerable sales increase in consecutive years, leading to a positive association between their abnormal accounting rates of return and the persistence of abnormal earnings. Our study thus contributes to the literature by providing empirical evidence against prior studies' finding that companies having extreme accounting rate of returns exhibit stronger mean-reverting on their accounting rate of returns (e.g., Dechow et al. 1999; Freeman et al. 1982).

4.4 Value Relevance of Intellectual Capital

We first run Model (1) without considering the intellectual capital variables. As depicted in the first and second columns of Table 7, all the independent variables are significant in their predicted directions (two-tailed $p < 0.01$). A fairly high adjusted R^2 of 0.5273 implies that the Ohlson model is appropriate for Taiwan's stock market ($F = 141.55$, $p < 0.000$).

[Insert Table 7 here]

After taking intellectual capital variables into account, the third and fourth columns of Table 7 indicate several major findings. First, except for *ROYALTY* and *TURNOVER* (which are significant at the one-tailed 10% level), all other intellectual capital variables are significant at least at the two-tailed 5% level. This result, together with a 0.1008 (0.6281 – 0.5273) increase in adjusted R^2, suggests that the public disclosure of these eight intellectual capital variables is relevant to market participants in determining stock prices. In this regard, we provide empirical evidence showing that Taiwan's stock market is able to incorporate IT companies' various types of intellectual capital into the determination of equity values simultaneously.

Second, the relatively weaker significance of the innovation capital may arise from IT companies' unwillingness to disclose more innovation-related information that could be beneficial to their potential competitors (García-Meca and Martínez 2007; Marston 1996). Another possible reason is that market participants place less emphasis on IT companies' innovation activities because the outcomes of these activities are usually uncertain and unpredictable (Barker 1999; García-Meca and Martínez 2007).

Third, the coefficients of *ROYALTY* (i.e., a_{10}) and *PROMOTION* (i.e., a_{13}) are significant but not in the predicted direction. A significantly negative a_{10} may capture the stock market's view that higher royalty payment ratio signals weaker R&D ability. To maintain leadership in the highly competitive global IT market, patents and copyrights developed by the companies are deemed crucial for their long-term survival. In contrast, the significantly negative coefficient a_{13} may reflect the fact that, since many of the buyers of Taiwan's IT (especially semiconductor and electronic components) companies are manufacturers rather than individual customers, advertising expenses may create little value to the relational capital but simply increase marketing expenses. This finding provides management implication that advertisement would not be a value-creation vehicle to the IT companies.

Finally, Table 7 shows that abnormal earnings X^a becomes insignificant when all intellectual capital variables are included in Model (1). Because X^a captures the "unexpected" part of the realized earnings, the vanishing of its significance suggests that intellectual capital accounts for a large portion of the unexpected earnings. This finding contributes to the literature by emphasizing the importance of considering intellectual capital when one uses the Ohlson model to examine value relevance and business valuation issues. Note that the VIFs of all independent variables reported in Table 7 are smaller than 2.27, implying that our empirical results are not subjected to multicollinearity (Kleinbaum et al. 1997).

4.5 Is the Use of a Constant Discount Rate Appropriate?

We argue that the use of a constant discount rate *r* could be theoretically and empirically inappropriate because it explicitly assumes that all firms have the same rate of return on equity across multiple periods, resulting in biased estimation of abnormal earnings. To elaborate this issue, we run Model (1) using a constant *r* manipulated at five levels: 10%, 11%, 12%, 13%, and 14%. Table 8 displays that, across these five *r* levels, the coefficient of abnormal earnings X^a is significant at two-tailed 1% level while the coefficients of *ROYALTY* (an innovation capital) and *TURNOVER* (a process capital) become insignificant. These results contrast with Table 7, which shows that the explanatory power of abnormal earnings has been replaced by intellectual capital.

[Insert Table 8 here]

A comparison of Tables 7 and 8 reveals two empirical implications. First, the use of constant *r*'s seems to mask, dilute, or even distort the value relevance of intellectual capital during the business valuation process. A notable example is *CREDIT*, whose coefficient remains significant (two-tailed $p < 0.01$) but change from negative to positive. Because higher TCRI rank represents higher credit risk, a positive coefficient of *CREDIT* is inconsistent with recent empirical finding that downgrade credit rating is associated with decreases in stock prices (e.g., Parnes 2008). Second, we conjecture that the significance of the abnormal earnings and the fairly high adjusted R^2 (which increases by almost 8% in Table 8) documented in prior studies using the Ohlson model could be the result of assuming a constant r corss-sectionally and intertemporally. In light of these, a suggested refinement of future studies would be the use of different rates of return on equity that accommodate variations across firms and years.

4.6 Robustness Tests:

4.6.1 Use April-end stock prices

Since the intellectual capital information will not be publicly available until the release of the annual reports (whose official deadline for all Taiwanese listed companies is April 30), we also use firm *i*'s stock prices at the end of April in year t+1 as the dependent variable. The empirical results are similar to those reported in Table 7. Therefore, our empirical findings do not change under different stock price time frames.

4.6.2 Use the last consensus earnings forecast per share

Barron et al. (2002) finds that analyst consensus is lower for high-tech manufacturing companies due to their high uncertainty in future earnings associated with intangible assets. Because prior studies have documented that individual analysts' forecasts will be more accurate as firms' earnings announcements approach (e.g., Francis and Philbrick 1993; Lim 2001; O'Brien, 1988), it is possible that the level of analyst consensus will be higher for forecasts made near the year-end than those made early in the year. We thus measure V^f by the last consensus earnings forecast per share at the end of year t to re-estimate model (1). The empirical results are similar to those reported in Table 7.

4.6.3 Alternative measure of shareholders' imputed credits

Because Taiwan's GAAP requires that companies disclose shareholders' taxable dividend balances in the footnotes, market participants may interpret these numbers mechanically without taking into account the accrued tax payables to be paid in the next year. To test whether the results reported in Table 7 are subjected to market participants' "functional fixation," we exclude accrued tax payables from *CT* and re-estimate model (1). Our conclusions remain the same under this alternative *CT* measure.

4.6.4 Eliminate Y2004

Because Taiwan's 2004 Presidential Election is a political event that has never occurred before in Taiwan's history, the above analyses may be subjected to the uniqueness of this non-economic event, leading to weak generalization of our empirical results. We eliminate *Y2004* and re-estimate model (1). The results obtained in Table 7 remain unchanged.

5. CONCLUDING REMARKS

5.1 Summary and Conclusions:

This study employs the Ohlson (1995) model to examine whether Taiwan's stock market is able to incorporate and react to various types of intellectual capital accumulated in the IT industry. Using the mandated disclosure of intellectual capital and considering intertemporal and firm-specific variations in rates of return on equity, the empirical results show several important findings. First, Taiwan's IT companies create and accumulate different types of intellectual capital in different ways. Specifically, they are more likely to focus on human capital by paying more bonuses to their employees. In addition, these companies appear to develop innovation (relational) capital through their own R&D activities (maintaining good credit ratings). Second, due to the ability to maintain an increase in sales over years, Taiwan's IT companies having high abnormal accounting rate of returns do not exhibit mean-reverting on their accounting rate of returns. Third, intellectual capital is value relevant to IT companies' business valuation. More importantly, intellectual capital captures a large portion of the unexpected earnings. Notably, Taiwan's stock market appears to view higher royalty payments as signal of weaker innovation ability and reacts unfavorably. Finally, we provide a preliminary test and find that the use of a constant discount rate could be inappropriate for value relevance research using the Ohlson model.

From the management's perspective, accumulation and improvement on intellectual capital shall definitely enhance firm value. However, management should prioritize its scarce resources to different types of intellectual capital to maximize firm's long-term competitiveness in the global market. Our study provides empirical evidence that may help the management identify the priority of intellectual capital so that appropriate resources planning can be done in an efficient way. To increase human capital, for example, management should dedicate more resources to educational training and design effective compensation contracts that link bonus to performance. To accumulate innovation capital, management should support

R&D activities instead of relying on know-how acquired from outside parties. To build up process and relational capital, management should improve asset turnover and pay more attention to criteria that determine companies' credit ratings.

5.2 What Do We Learn from This Study?

This study has two important implications. First, the significance of all the intellectual capital variables and the insignificance of abnormal earnings suggest that intellectual capital plays an imperative role in IT companies' valuation process. Since prior studies have generally overlooked the value relevance of intellectual capital, our study provides a first step to show that various aspects of intellectual capital should be considered in future business valuation studies.

Second, recent regulations of compulsorily disclosing certain information have received much attention by the accounting academic (e.g., Bushee et al. 2004; Linsmeier et al. 2002). We base our study on a set of Taiwan's publicly available information related to intellectual capital and find that the stock market is able to incorporate different types of intellectual capital simultaneously in determining firms' equity values. This finding accentuates the necessity of mandated disclosure of such information by regulators and policy-makers in other countries. Although the significance of intellectual capital is based on data from Taiwan, we believe that the results should be applicable to more mature and larger size stock markets such as the North America and Europe. Since intellectual capital has received much attention by the academics and practice as a vital means of competing with others in the global markets, institutional and individual investors who plan to trade securities from foreign firms in these countries should take the disclosure of intellectual capital into consideration in formulating their business valuation models.

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TABLE 1
Sample Selection Procedure

Sample of listed firms from information electronics industry[a]	1,228
Observations with missing data	(93)
Subtotal	1,135
Observations with outlier data[b]	(82)
First-stage Sample (used to estimate the abnormal earnings persistence ω^c)	1,053
Observations without variables used in Ohlson model	(125)
Subtotal	928
Observations with outlier data	(172)
Final (second-stage) Sample (used in the Ohlson model)	756

[a]The sample contains firm-year observations from 2003 to 2006.
[b]To control for outliers, we trim observations that fall outside the upper and lower 1% of the empirical distributions for both the dependent and independent variables.

TABLE 2
Sample Distribution by IT Sub-Industry and Year

Sub-Industry	2003	2004	2005	2006	Total by Sub-Industry
Semiconductor	30 (16.95%)	33 (16.92%)	30 (16.57%)	32 (15.76%)	125 (16.53%)
Computer and Peripheral Equipment	30 (16.95%)	38 (19.49%)	32 (17.68%)	37 (18.23%)	137 (18.12%)
Optoelectronic	30 (16.95%)	32 (16.41%)	29 (16.02%)	35 (17.24%)	126 (16.67%)
Communications and Internet	11 (6.21%)	17 (8.72%)	17 (9.39%)	21 (10.34%)	66 (8.73%)
Electronic Parts / Components	40 (22.60%)	45 (23.08%)	39 (21.55%)	42 (20.69%)	166 (21.96%)
Electronic Products Distribution	11 (6.21%)	11 (5.64%)	12 (6.63%)	13 (6.40%)	47 (6.22%)
Information Service	4 (2.26%)	1 (0.51%)	2 (1.11%)	2 (0.99%)	9 (1.19%)
Other Electronic	21 (11.87%)	18 (9.23%)	20 (11.05%)	21 (10.34%)	80 (10.58%)
Total	177 (23.41%)	195 (25.79%)	181 (23.94%)	203 (26.85%)	756 (100.00%)

TABLE 3
Definitions of Variables

Variables	Definitions
$P_{i,t}$	Stock price per share for firm *i* at the end of year *t*
$BV_{i,t}$	Book value of equity per share for firm *i* at the end of year *t*
$X^a_{i,t}$	Abnormal earnings per share of firm *i* for year *t*
$V^f_{i,t}$	Year *t* consensus analysts' forecast of firm *i*'s abnormal earnings for period *t*+1
Y2004	Equal 1 for year 2004 and 0 otherwise
$CT_{i,t}$	Stockholders' tax deductible balance plus accrued tax payable per share for firm *i* at year *t*
$EDU_{i,t}$	Percentage of employees with graduate educational background for firm *i* at the end of year *t*
$BONUS_{i,t}$	Bonus to pre-tax earnings ratio for firm *i* in year *t*
$RD_{i,t}$	R&D density (i.e., R&D expenses divided by net sales) for firm *i* in year *t*
$ROYALTY_{i,t}$	Ratio of royalty payments to net sales for firm *i* in year *t*
$ADMIN_{i,t}$	Ratio of administrative expenses to new sales for firm *i* in year *t*
$TURNOVER_{i,t}$	Total assets turnover (i.e., net sales divided by average total assets) for firm *i* in year *t*
$PROMOTION_{i,t}$	Ratio of marketing expenses to net sales for firm *i* in year *t*
$CREDIT_{i,t}$	Taiwan Corporate Credit Risk Index (TCRI) basic rank for firm *i* in year *t*

TABLE 4
Descriptive Statistics (n = 756)

Variables[a]	Mean	Std. Dev.	Min.	Q1	Median	Q3	Max.
P	27.421	19.457	7.000	14.315	21.280	34.090	146.420
BV	17.867	5.768	6.640	14.015	16.530	20.600	46.930
X^a	0.179	1.744	-5.810	-0.819	0.216	1.160	7.259
V^f	0.881	1.689	-3.898	-0.081	0.722	1.764	8.330
CT	0.444	0.485	0.000	0.101	0.277	0.597	2.739
FOREIGN	0.102	0.132	0.000	0.009	0.048	0.142	0.731
EDU	0.115	0.121	0.000	0.035	0.069	0.154	0.679
BONUS	0.150	0.134	0.000	0.054	0.119	0.211	0.769
RD	0.037	0.037	0.000	0.013	0.025	0.047	0.195
ROYALTY	0.002	0.011	0.000	0.000	0.000	0.000	0.115
ADMIN	0.029	0.021	0.000	0.015	0.025	0.039	0.126
TURNOVER	0.010	0.006	0.002	0.006	0.009	0.013	0.037
PROMOTION	0.039	0.032	0.000	0.019	0.032	0.049	0.211
CREDIT	3.413	1.735	1.000	2.000	3.000	4.000	9.000

[a]See Table 3 for the definitions of the variables.

TABLE 5
Correlation Coefficients (n = 756)[a]

Variables	*P*	*BV*	X^a	V^f	*CT*	*FOREIGN*	*EDU*	*BONUS*	*RD*	*ROYALTY*	*ADMIN*	*TURNOVER*	*PROMOTION*	*CREDIT*
P		0.656	0.181	0.221	0.363	0.403	0.327	0.496	0.030	-0.049	-0.140	0.142	-0.123	-0.537
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.408)	(0.177)	(0.000)	(0.000)	(0.001)	(0.000)
BV	0.635		0.123	0.101	0.513	0.287	0.064	0.289	-0.253	-0.044	-0.271	0.163	-0.062	-0.503
	(0.000)		(0.001)	(0.005)	(0.000)	(0.000)	(0.080)	(0.000)	(0.000)	(0.226)	(0.000)	(0.000)	(0.087)	(0.000)
X^a	0.222	0.125		0.456	0.026	0.038	-0.040	0.163	-0.065	-0.038	-0.066	0.047	-0.103	-0.398
	(0.000)	(0.001)		(0.000)	(0.475)	(0.294)	(0.267)	(0.000)	(0.076)	(0.297)	(0.068)	(0.201)	(0.005)	(0.000)
V^f	0.191	0.084	0.452		0.122	0.047	-0.022	0.178	-0.095	-0.027	-0.045	0.070	-0.077	-0.169
	(0.000)	(0.021)	(0.000)		(0.001)	(0.198)	(0.538)	(0.000)	(0.009)	(0.455)	(0.217)	(0.056)	(0.035)	(0.000)
CT	0.369	0.489	0.026	0.083		0.007	0.001	0.173	-0.261	-0.096	-0.196	0.340	0.032	-0.333
	(0.000)	(0.000)	(0.475)	(0.022)		(0.852)	(0.970)	(0.000)	(0.000)	(0.009)	(0.000)	(0.000)	(0.387)	(0.000)
FOREIGN	0.390	0.273	0.031	0.039	-0.029		0.269	0.183	0.016	0.035	-0.160	0.007	-0.079	-0.392
	(0.000)	(0.000)	(0.397)	(0.287)	(0.419)		(0.000)	(0.000)	(0.660)	(0.331)	(0.000)	(0.839)	(0.029)	(0.000)
EDU	0.267	0.025	-0.077	-0.044	-0.050	0.295		0.280	0.564	0.232	-0.098	0.127	0.004	-0.275
	(0.000)	(0.492)	(0.034)	(0.225)	(0.172)	(0.000)		(0.000)	(0.000)	(0.000)	(0.007)	(0.001)	(0.915)	(0.000)
BONUS	0.545	0.493	0.191	0.164	0.275	0.156	0.219		0.083	-0.094	-0.187	0.143	-0.142	-0.405
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.022)	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)
RD	-0.008	-0.277	-0.041	-0.056	-0.337	0.033	0.413	0.051		0.174	0.299	-0.304	0.156	0.071
	(0.826)	(0.000)	(0.261)	(0.125)	(0.000)	(0.364)	(0.000)	(0.164)		(0.000)	(0.000)	(0.000)	(0.000)	(0.052)
ROYALTY	0.018	-0.026	-0.032	-0.058	-0.156	0.153	0.170	-0.062	0.141		0.084	-0.124	0.305	0.030
	(0.630)	(0.469)	(0.379)	(0.108)	(0.000)	(0.000)	(0.000)	(0.091)	(0.000)		(0.020)	(0.001)	(0.000)	(0.407)
ADMIN	-0.189	-0.287	-0.030	-0.030	-0.246	-0.211	-0.200	-0.225	0.345	-0.081		-0.542	0.229	0.367
	(0.000)	(0.000)	(0.417)	(0.409)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.026)		(0.000)	(0.000)	(0.000)
TURNOVER	0.189	0.177	0.063	0.058	0.387	-0.017	0.207	0.269	-0.339	-0.013	-0.645		-0.178	-0.234
	(0.000)	(0.000)	(0.084)	(0.110)	(0.000)	(0.632)	(0.000)	(0.000)	(0.000)	(0.718)	(0.000)		(0.000)	(0.000)
PROMOTION	-0.135	-0.113	-0.123	-0.035	0.053	-0.120	-0.004	-0.165	0.224	0.031	0.219	-0.174		0.115
	(0.000)	(0.002)	(0.001)	(0.333)	(0.148)	(0.001)	(0.919)	(0.000)	(0.000)	(0.392)	(0.000)	(0.000)		(0.002)
CREDIT	-0.652	-0.549	-0.398	-0.141	-0.341	-0.420	-0.268	-0.470	0.086	-0.031	0.340	-0.246	0.209	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.018)	(0.402)	(0.000)	(0.000)	(0.000)	

[a]The Pearson (Spearman) correlation coefficients are reported in the upper right (lower left) part of the Table. See Table 3 for the definitions of the variables. Two-tailed *p* values are reported in parentheses.

TABLE 6
Determinants of the Persistence of Abnormal Earnings (n = 1,053)[a, b]

$$X^a_{i,t} = \omega_0 + \omega_1 \cdot X^a_{i,t-1} + \omega_2 (X^a_{i,t-1} \cdot q^1_{i,t-1}) + \omega_3 (X^a_{i,t-1} \cdot q^2_{i,t-1}) + \omega_4 (X^a_{i,t-1} \cdot q^3_{i,t-1}) + \omega_5 (X^a_{i,t-1} \cdot div_{i,t-1}) + \varepsilon_{i,t}$$

	ω_0	ω_1	ω_2	ω_3	ω_4	ω_5	*F* value	Adj. R^2
Predicted sign	?	?	–	–	–	+		
Coefficients	0.069	0.319	1.220	-1.519	-1.126	0.481	94.23***	0.307
t-statistics[c]	1.155	3.967***	8.011***	-3.800***	-3.762***	3.519***		

[a]The definitions of the variables reported in this table are: $X^a_{i,t}$ = firm *i*'s abnormal earnings per share for year t; $q^1_{i,t}$ = the absolute value of firm *i*'s abnormal earnings at the end of year *t* divided by its book value of equity at the beginning of year *t*; $q^2_{i,t}$ = the absolute value of firm *i*'s special accounting items (nonrecurring items) divided by its book value of equity at the beginning of year *t*; $q^3_{i,t}$= the absolute value of firm *i*'s accounting accruals divided by its total assets at the beginning of year *t*; $div_{i,t}$= firm *i*'s dividends paid during year *t* divided by its earnings for year *t*.
[b]To control for outliers, we trim observations that fall outside the upper and lower 1% of the empirical distributions for both the dependent and independent variables.
[c]Arterisks "***", "**", and "*" indicate two-tailed significance at the 0.01, 0.05, 0.10 levels, respectively.

TABLE 7
Empirical Results for Value Relevance of Intellectual Capital

$$P_{i,t} = \alpha_0 + \alpha_1 \cdot BV_{i,t} + \alpha_2 \cdot X^a_{i,t} + \alpha_3 \cdot V^f_{i,t} + \alpha_4 \cdot CT_{i,t} + \alpha_5 \cdot Y2004_{i,t} + \alpha_6 \cdot FOREIGN_{i,t} + \alpha_7 \cdot EDU_{i,t} + \alpha_8 \cdot BONUS_{i,t} + \alpha_9 \cdot RD_{i,t} + \alpha_{10} \cdot ROYALTY_{i,t} + \alpha_{11} \cdot ADMIN_{i,t} + \alpha_{12} \cdot TURNOVER_{i,t} + \alpha_{13} \cdot PROMOTION_{i,t} + \alpha_{14} \cdot CREDIT_{i,t} + \varepsilon_{i,t} \quad (1)$$

Variables	Predicted Sign	Model (1) without IC Variables		Model (1)	
		Coefficients	t statistics[b]	Coefficients	t statistics[b]
Intercept		-8.815	-5.149***	-10.220	-3.310***
BV	+	1.781	16.902***	1.584	15.166***
X^a	+	0.829	2.606***	0.207	0.652
V^f	+	1.005	2.993***	0.997	3.306***
CT	+	3.109	2.648***	2.496	2.162**
Y2004	−	-6.368	-5.570***	-5.597	-5.497***
FOREIGN	+	0.359	9.166***	0.238	6.276***
EDU	+			0.247	4.616***
BONUS	+			0.226	5.894***
RD	+			0.365	2.082**
ROYALTY	+			-0.663	-1.520#
ADMIN	+			1.283	4.824***
TURNOVER	+			1.435	1.554#
PROMOTION	+			-0.374	-2.520**
CREDIT	−			-1.442	-3.907***
n		757		756	
F value		141.55***		92.07***	
Adj. R^2		0.5273		0.6281	

[a]See Table 3 for the definitions of the variables.
[b]Arterisks ***, **, * indicate two-tailed significance at the 0.01, 0.05, 0.10 levels, respectively; pound key # indicates one-tailed significance at the 0.10 levels.

TABLE 8
Empirical Results for Value Relevance of Intellectual Capital – Using Constant Rates of Return

$$P_{i,t\_12} = \alpha_0 + \alpha_1 \cdot BV_{i,t} + \alpha_2 \cdot X^{a}_{i,t} + \alpha_3 \cdot V^{f}_{i,t} + \alpha_4 \cdot CT_{i,t} + \alpha_5 \cdot Y2004_{i,t} + \alpha_6 \cdot FOREIGN_{i,t} + \alpha_7 \cdot EDU_{i,t} + \alpha_8 \cdot BONUS_{i,t} + \alpha_9 \cdot RD_{i,t} + \alpha_{10} \cdot ROYALTY_{i,t} + \alpha_{11} \cdot ADMIN_{i,t} + \alpha_{12} \cdot TURNOVER_{i,t} + \alpha_{13} \cdot PROMOTION_{i,t} + \alpha_{14} \cdot CREDIT_{,t} + \varepsilon_{i,t} \quad (1)$$

Variables	Pred. Sign	r = 10%		r = 11%		r = 12%		r = 13%		r = 14%	
		Coefficients	t statistics[b]	Coefficients	t statistics	Coefficients	t statistics	Coefficients	t statistics	Coefficients	t statistics
Intercept		-12.081	-4.499***	-12.017	-4.477***	-10.671	-4.021***	-11.721	-4.404***	-11.660	-4.382***
BV	+	1.359	14.399***	1.393	14.827***	1.333	14.186***	1.434	15.462***	1.468	15.862***
X^a	+	3.623	12.040***	3.564	11.941***	3.116	10.634***	3.662	12.310***	3.604	12.212***
V^f	+	1.169	4.613***	1.203	4.714***	1.465	5.908***	1.140	4.290***	1.168	4.378***
CT	+	-1.043	-0.997	-1.025	-0.981	-0.464	-0.448	-1.136	-1.096	-1.112	-1.073
Y2004	−	-6.367	-7.067***	-6.303	-6.992***	-5.958	-6.686***	-6.209	-6.923***	-6.148	-6.849***
FOREIGN	+	0.298	8.781***	0.297	8.773***	0.309	9.270***	0.293	8.712***	0.293	8.704***
EDU	+	0.246	5.247***	0.246	5.250***	0.254	5.496***	0.256	5.497***	0.256	5.495***
BONUS	+	0.087	2.422**	0.087	2.430**	0.101	2.787***	0.092	2.591***	0.092	2.603***
RD	+	0.239	1.535#	0.241	1.552#	0.228	1.490#	0.203	1.312#	0.206	1.330#
ROYALTY	+	0.252	0.640	0.249	0.631	0.168	0.435	0.277	0.709	0.273	0.700
ADMIN	+	0.852	3.595***	0.849	3.583***	0.863	3.707***	0.856	3.645***	0.854	3.636***
TURNOVER	+	0.120	0.146	0.114	0.138	0.240	0.295	0.092	0.112	0.088	0.107
PROMOTION	+	-0.390	-2.970***	-0.388	-2.951***	-0.355	-2.739***	-0.365	-2.801***	-0.363	-2.786***
CREDIT	−	0.984	2.696***	0.972	2.665***	0.773	2.154**	1.022	2.828***	1.009	2.794***
n		754		754		753		753		753	
F value		128.20***		128.30***		124.92***		130.90***		130.90***	
Adj. R^2		0.7028		0.7030		0.6976		0.7075		0.7075	

[a]See Table 3 for the definitions of the variables.
[b]Arterisks ***, **, * indicate two-tailed significance at the 0.01, 0.05, 0.10 levels, respectively; pound key # indicates one-tailed significance at the 0.10 levels.