



Predicting earnings management: A nonlinear approach



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ABSTRACT

This study compares conventional linear and nonlinear accrual models to evaluate their ability to predict earnings management when applied to firm experiencing different performance levels. Linear models, which ignore the nonlinear relation between performance and accruals, result in measurement errors and, in turn, biased inferences. Using financial restatement as a proxy for earnings management, I show that a nonlinear expense-related model is best-specified and enhances the reliability of inferences in earnings management issues. The results echo the increasing cost- or expense-related earnings management after July 2002. When firms engage in downward earnings management after the passage of the SOX Act, the other models are also statistically reliable.

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1. Introduction

Accrual accounting, with all its strength and weaknesses, occupies the dominant position in external financial reporting and is, therefore, the primary means by which the capital market measures firm value. To reflect positively on economic activity during a given period, accrual accounting temporally disconnects the recognition of revenues and expenses from their associated cash flows. The result is earnings and balance sheet measures with prime roles in performance measurement, valuation, and contracting. However, the judgments required within accrual accounting offer managers opportunities to mislead stakeholders and alter contractual results to their benefit. Previous research has examined earnings management via consideration of specific accruals, total accruals, and the decomposition of total accruals to their abnormal and discretionary components. Normal accruals relate to changes in economic circumstances, such as changes in sales and fixed assets. Accruals other than normal accruals are perceived as discretionary. That is, discretionary accruals are considered those accruals that are prone to manipulation (Healy, 1985). The literature has widely investigated the association between discretionary accruals and earnings management.

Researchers have commonly employed the Jones (1991) model and the modified Jones model (Dechow, Sloan, & Sweeney, 1995) to estimate the discretionary component of accruals. Using simulation studies, Dechow et al. (1995) and Kothari, Leone, and Wasley (2005) show that these models often provide reasonable estimates for detecting earnings management. However, they point out that the models present problems for firms experiencing extreme levels of performance. Such problems may reflect measurement errors. Thus, to improve the estimation quality, accrual models must consider the context to which earnings management is hypothesized.

In addition to the measurement error inherent in discretionary accrual models (e.g., McNichols & Wilson, 1998), coefficient bias can also stem from using balance sheet data rather than cash flow statement data (Hribar & Collins, 2002). Thus, possible improvements to the Jones model and the modified Jones model include adding cash from operations, earnings, and return on assets (DeAngelo, DeAngelo, & Skinner, 1994; Jeter & Shivakumar, 1999; Kothari et al., 2005; Rees, Gill, & Gore, 1996), controlling for firm performance (Holthausen, Larcker, & Sloan, 1995; Kothari et al., 2005), and using cash flow statement data to check the robustness (Hribar & Collins, 2002).

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In addition, researchers have recently begun to question the assumption that the accrual-generating process in the existing empirical cross-sectional accrual models is inherently homogeneous. That is, cross-sectional accrual models such as the Jones model and the modified Jones model implicitly assume that firms within the same industry in a given year have a homogeneous accrual-generating process. [Dopuch, Seethamraju, Mashruwala, and Zach \(2007\)](#) argue that the assumption of a uniform accrual-generating process is violated in industries. Because the accrual-generating process affects the measurement of the accrual models' coefficients, whether a substantial variation exists in the estimated coefficients of each explanatory variable across the different levels in accrual models is important.

Because firms with extreme performance are more likely to engage in earnings management ([Guay, Kothari, & Watt, 1996](#)), the conventional linear accrual models that do not consider the asymmetric influences of performance variables may lead to biased inferences. Previous studies ([Ball & Shivakumar, 2006](#); [Kothari et al., 2005](#)) have attempted to solve the nonlinear relation between accruals and performance proxies. Kothari et al.'s performance-matched accrual model, which uses return on assets (ROA) as a proxy for performance, does not assume a linear relation between accruals and performance. Although Kothari et al.'s nonlinear model is less misspecified than the Jones model and the modified Jones model, the model still suffers overrejection or underrejection when adopting earnings-to-price ratio, firm size, and operating cash flow as the performance proxy. Moreover, by matching each firm-year observation with another firm in the same industry and year and then calculating the differences for the Jones and modified Jones discretionary accruals with the closest ROA, the model assumes that firms in the same industry with similar ROA have comparable discretionary accruals. Therefore, if either firm numbers in an industry are small or the variation in ROA in an industry is large, a measurement error is generated. In addition, if the hypothesis of earnings management is applied to a firm with an extreme earnings-to-price ratio, firm size, or operating cash flow, Kothari et al.'s ROA-matched discretionary accrual model leads to misspecified tests.

Although [Ball and Shivakumar \(2006\)](#) adopted a piecewise linear regression model to address the impact of losses on accruals, their study does not focus on the coefficient bias resulting from the nonlinear relation between accruals and performance proxies other than economic losses. I examine the variation of coefficients across performance quartiles and the effect of the nonlinear relation between accruals and performance. Because the performance-matched accrual model exhibits these limitations, I adopt a three-breakpoint piecewise linear regression to accommodate the possibility of a nonlinear relation between accruals and performance proxies.

A number of studies show that the Jones model suffers an omitted variable problem ([DeAngelo et al., 1994](#); [Dechow et al., 1995](#); [Jeter & Shivakumar, 1999](#); [Kothari et al., 2005](#); [Rees et al., 1996](#)). However, commonly used accrual models do not include cost- or expense-related variables. According to a U.S. Government Accountability Office ([U.S. Government Accountability Office, 2007](#)) report, revenue recognition issues account for approximately 38% of restatements between January 1997 and June 2002 and are the main reason for restatements during this period. Nevertheless, cost- or expense-related issues account for more than one-third of the restatements from July 2002 through September 2005 and surpass revenue recognition as the most frequently identified cause of restatements in the period after the passage of the Sarbanes–Oxley Act (SOX). Therefore, I further take cost- and expense-related variables into account.

To compare the ability of conventional linear accrual models and my nonlinear expense-related accrual model to discriminate between firms engaging in earnings management and firms not engaging in earnings management, I use [U.S. Government Accountability Office \(2002, 2006, 2007\)](#) reports to identify firms with a financial restatement to proxy for firms with earnings management. The control group is composed of firms in the same industries but not in the GAO reports and without a financial restatement record in Compustat.

The results suggest that the relation between accruals and performance proxies is nonlinear. The findings show that the nonlinear expense-related accrual model is well-specified and enhances the reliability of inferences in earnings management issues. My objective is not to develop a cure-all accrual model, in terms of either accounting theory or empirical fit with accrual data. Rather, I demonstrate a specification improvement in nonlinear accrual models by incorporating the asymmetric influence of performance levels associated with specific earnings management issues (i.e., event-specific studies of earnings management). In addition, I show the robust results after the passage of SOX.

The remainder of the paper is organized as follows. [Section 2](#) presents the variation of coefficients across performance partitions. [Section 3](#) develops the models with consideration for the nonlinear relation between accruals and performance proxies. [Section 4](#) describes the data selection procedure, and [Section 5](#) outlines the results. [Section 6](#) presents my conclusions.

2. Coefficient bias

Prior studies estimate the accrual models using time-series (e.g., [Dechow et al., 1995](#); [Jones, 1991](#)), cross-sectional (e.g., [Cheng, Davidson, & Leung, 2011](#); [Kothari et al., 2005](#); [Shu & Chiang, 2013](#)), and panel (e.g., [Ball & Shivakumar, 2006](#)) regressions. Using samples to estimate coefficients in conventional linear accrual models assumes the slope coefficients are constant within the sample, that is, observations in the sample have a uniform accrual-generating process ([Bartov, Gul, & Tsui, 2000](#)). If an accrual model estimates the coefficient within the same industry, it assumes that firms in the same industry have similar accrual-generating processes. However, the uniform accrual-generating process assumption may not be proper for firms with extreme performance within the industry, leading to biased discretionary accrual estimates. In the following discussion, I review the properties of coefficients in linear regressions and then inspect whether the coefficients are equal across firms in different performance quartiles.

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