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Managing the risk of misleading financial metrics in annual reports: A first step towards providing assurance over management's discussion

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ABSTRACT

Recent public policy initiatives seek greater transparency in financial reporting through an honest, balanced and thorough management discussion of company performance in the annual report. Management's discussion invariably includes key performance indicators, such as financial ratios, relevant to external stakeholders. We model the impact of accounting estimates, assumptions, choices and errors on the risk of misleading financial ratios. This framework is illustrated through good and bad examples of financial reporting practices and by simulation of financial data of public companies. We provide a structured approach to inform policymakers, auditors and other stakeholders of the incremental financial reporting risk that accompanies current regulatory efforts.

Keywords: MD&A; financial reporting transparency; audit risk; financial ratios

1. Introduction

In the aftermath of the 2008 financial crisis, the Financial Accounting Standards Board (FASB), the Financial Reporting Council (FRC), the European Financial Reporting Advisory Group (EFRAG) and others have issued discussion papers and new rules to enhance financial reporting transparency. Much of their focus is on management's discussion in the annual report to ensure that it is fair, balanced and thorough. Auditing regulators and professional bodies such as the International Auditing and Assurance Standards Board (IAASB), the Institute of Chartered Accountants of Scotland (ICAS), the Institute of Chartered Accountants in England and Wales (ICAEW), and the Center for Audit Quality (CAQ) have reacted to this development by exploring opportunities for auditors to expand their assurance role over the annual report.

Management's discussion often includes key performance indicators (KPIs) that managers believe are important to financial statement users. In particular, financial analysts view financial ratios as "extremely powerful tools" for assessing a company's prospects (Revsine et al. 2012, 250). Examples of ratios are easy to find in the annual reports of public companies worldwide and include profitability, leverage and operating ratios. Since many of these KPIs are based on information contained in the audited financial statements, the CAQ, ICAS and ICAEW are exploring whether auditors should extend their assurance function over these metrics (CAQ, 2012; ICAS, 2013; ICAEW, 2013). However, non-linear relationships between audited account balances and financial ratios do not allow for a straightforward extension of the audit risk model to the risk of misleading KPIs. Even small and immaterial errors in account balances can lead to material errors in financial ratios. The ensuing risk, though long recognized, has not been formally modeled, and little guidance exists in the professional and academic literatures. This paper develops a framework for assessing financial reporting risk associated with financial ratios.

There are several reasons that financial ratios could be misleading. The most obvious causes are errors in an account balance that is included in the financial ratio. While previous research has considered only this source (Dutta & Graham, 1998), we argue that financial reporting risk also emanates from accounting estimates, assumptions and choices that affect the component account balances. Our argument is motivated by examples, both good and bad, of financial ratio disclosures and related management discussions. Some companies, such as Nordstrom and Union Pacific, compute key profitability ratios as if operating leases were capitalized.[1] The voluntary disclosure of these less favorable metrics may be driven by management's desire for a balanced discussion and the belief that KPIs based on GAAP measures can be misleading. On the other hand, some companies present favorable non-GAAP metrics that could create engagement risk (Chen, Krishnan, & Pevzner, 2012). In some well-publicized cases (e.g. Lehman), controversial accounting choices, estimates and assumptions were made to window-dress key financial ratios (Dutta, Caplan, & Lawson, 2010). In summary, the use of financial ratios in annual reports is pervasive and policymakers are considering changes to the auditor's role relative to such information. However, the potential effects of these changes on financial reporting risk and the auditor's evaluation of evidence require further investigation (Mock et al., 2013, 341). The analytical framework developed in this paper helps inform policymakers of the challenges auditors confront when providing assurance on MD&A.

The remainder of the paper is organized as follows. Section 2 discusses recent regulatory and professional developments and relevant academic research. In the following three sections we model three scenarios using examples of commonly-used leverage, profitability and liquidity ratios. In Section 3 we model the impact of an aggressive interpretation of GAAP on the

[1] The examples were obtained from the respective 2012 annual reports.

numerator of a leverage ratio, and the effect on financial reporting risk. In Section 4, we model the effect of capitalizing operating leases on the denominator of a profitability ratio. Using data from 20 well-known companies we estimate the effect of capitalizing operating leases on ROA. In Section 5, we model the effect of accounting choices or errors that equally affect both the numerator and denominator of a liquidity ratio. We perform a simulation analysis on the Fortune 200 and find that the liquidity ratio is highly sensitive to small offsetting errors in the underlying account balances. In Section 6, we discuss how our results can be generalized to additional scenarios in which accounting errors, estimates and policy choices affect commonly-used financial ratios. Section 7 provides concluding remarks. In Appendix B we show that the framework developed in this paper applies to traditional audit settings, such as assessing the risk of misstating depreciation expense.

2. Public policy initiatives and academic research

2.1. Public policy efforts to enhance financial reporting transparency

In the wake of the 2008 financial crisis, a common criticism has been that financial reporting is not consistently driven by the needs of financial statement users. In response, accounting standard setters and other policymakers have initiated discussions of how to improve financial reporting transparency. Auditing regulators and self-regulatory bodies have reacted to this development and are contemplating an expansion of the auditor's assurance function with respect to the annual report.

In 2009, the U.K. Financial Reporting Council issued the discussion paper *Louder than Words: Principles and actions for making corporate reports less complex and more relevant*. The main objectives of this project were to investigate the complexity and relevance of corporate

reporting and to offer practical recommendations for improvement. After deliberation and feedback from its constituents, the FRC updated the U.K. Corporate Governance Code in 2012 and in 2014. The updated provisions of the Code increase the responsibility of corporate directors to assert that "the annual reports and accounts, taken as a whole, is fair, balanced and understandable and provides the information necessary for shareholders to assess the company's position and performance, business model and strategy" (FRC, 2014, 16). There are similar efforts in other jurisdictions. In 2012, the FASB issued *Disclosure Framework.* Also in 2012, the European Financial Reporting Advisory Group, the FRC, and the French Autorité des Normes Comptables jointly issued *Towards a Disclosure Framework for the Notes.* All these proposals share a common theme in that they advocate improvements for management's discussion and footnote disclosures in the annual report.

The above developments have prompted auditing policy setters to consider the audit implications, as in their view the changing nature of narrative reporting and the need for assurance might lead to "an expectations gap, between what the audit report implies and what readers assume it implies" (ICAEW, 2013, 4). This gap becomes problematic for auditors at times of business crises when attention is directed to the role of auditors (Mock et al., 2013). The increased focus on disclosure, both in the financial statement footnotes and management's discussion, has prompted auditing standard setters to consider the audit of these in addition to account balances. The IAASB in its discussion paper *The Evolving Nature of Financial Reporting: Disclosure and its Audit Implications* noted:

> The auditor's consideration of an entity's financial statement disclosures in an audit of financial statements raises questions regarding: What constitutes sufficient appropriate audit evidence in relation to different categories of financial statement disclosures; and how to apply materiality to, and evaluate misstatements in, disclosures. (IAASB, 2011, 20, bullet-point formatting removed)

A follow-up discussion paper, *Improving the Auditor's Report,* further noted a "clear demand for auditors to provide greater transparency about significant matters in the financial statements" (IAASB, 2012, 4). In May 2014, the IAASB issued an exposure draft *Addressing Disclosures in the Audit of Financial Statements*. This exposure draft proposes changes to International Standards on Auditing that would give more prominence to disclosures that appear in the footnotes or elsewhere in the financial statements, and the auditor's responsibility and procedures for providing assurance over these disclosures. In the U.S., the Center for Audit Quality sponsored a series of roundtable discussions to explore how the auditor's role might evolve. Roundtable participants included investors, corporate managers, auditors, and former regulators. In its summary of these discussions, the CAQ noted:

> Participants thought investors would benefit from auditor association with certain areas of the annual report outside of the audited financial statements to provide investors additional assurance on matters they view as most important to their understanding of a company's financial performance and future prospects. (CAQ, 2012, 6)

Specific information mentioned by roundtable participants included key performance indicators and non-GAAP measures.

In 2013, The Institute of Chartered Accountants of Scotland (ICAS) and The Institute of Chartered Accountants in England and Wales (ICAEW) issued discussion papers on this topic. In April, ICAS published *Balanced and Reasonable: Considerations Related to the Provision of Positive Assurance on Management Commentary,* which resulted from a recommendation by an ICAS Working Group that auditors provide explicit assurance on management commentary included in the annual report. The discussion paper suggests that the auditor's responsibility with respect to management's discussion could take the form of a "medium assurance" engagement

that would provide less assurance than an audit, but more than a review engagement. The auditor would attest to management's narrative as "balanced and reasonable." The discussion paper lists disclosures in management's discussion that the auditor could verify to external or other reliable sources, including key performance indicators. Financial ratios are a common and important class of KPIs. In October 2013, the ICAEW published *The Journey: Assuring all of the Annual Report?* (ICAEW, 2013), which explores auditors' opportunities to provide additional assurance in light of management's increased responsibility for financial reporting under the updated U.K. Corporate Governance Code. The ICAEW discussion paper observes, "there is a market need for more assurance than is required by law" (ICAEW, 2013, 5). The ICAEW identifies four distinct scenarios for the auditor's future assurance role:

- the auditor provides no assurance beyond the financial statements;
- the auditor provides separate assurance on specific pieces of information in management's discussion;
- the auditor provides a single assurance report covering specified portions of management's discussion;
- the auditor provides a single assurance report on the entire annual report.

In April 2014, the ICAS published *Assurance on Management Commentary – Where Next?* (ICAS, 2014). This document summarizes feedback to the earlier discussion paper and proposes next steps, including a project to investigate the additional costs and work involved for auditors to provide positive assurance on the management commentary: "We intend to undertake a project to consider the possibility of providing assurance over discrete areas on the front-half of the annual report, such as key performance indicators …" (ICAS, 2014, 8). This research is ongoing (e.g., Fraser & Lee 2016).

As summarized above, there is a growing momentum to improve financial reporting in general and to expand the auditor's assurance role over the annual report. While qualitative and forward-looking disclosures impose particular challenges to auditors, historical and quantitative disclosures have been identified by ICAS as "factual and verifiable," and by ICAEW as a logical next step for the auditing profession. Quantitative disclosures include operational data, trends in account balances, and financial ratios. Of these, assurance over financial ratios may create the greatest challenge because immaterial errors in account balances may result in misleading financial ratios due to nonlinearity inherent in the computation. While this challenge has been long recognized (Turner, 1997), the professional and academic literatures provide minimal guidance for measuring and managing this risk.

2.2. Academic research on audit risk and materiality

Academic research on the audit risk model and materiality commenced with the issuance of SAS No. 47 in 1983, which was followed by a series of five articles by Graham (1985a; 1985b; 1985c; 1985d; 1985e). Though inextricably linked, academic research on materiality and risk has followed separate paths. The research on materiality, discussed first in this section, has been mostly descriptive of actual audit practice. The research on audit risk, discussed next, has been mostly normative: testing the model's validity by employing analytical and empirical methodologies.

2.2.1. Research on Materiality

Professional accounting standards and case law assess the fair presentation of financial statements on the basis of the information they provide to users. Statement of Financial

Accounting Concepts No. 8 states: "Information is material if omitting it or misstating it could influence decisions that users make on the basis of the financial information of a specific reporting entity" (FASB, 2010, §QC 11). Materiality has been the subject of much archival and experimental research. This research has been summarized through 1982 by Holstrum and Messier (1982) and through 2005 by Messier, Martinov-Bennie and Eilifsen (2005). Key findings are the following: (1) the most important factors in determining materiality are the effects of a misstatement on net income and earnings trends; (2) a number of qualitative factors also affect materiality decisions; and (3) there are substantial differences among accounting firms with respect to the quantitative and qualitative materiality guidance provided to their staff. A survey of materiality guidelines at eight of the largest U.S. auditing firms finds widespread use of the following benchmarks: income before taxes, total assets, total revenues, net assets, and total equity. Most firms use materiality thresholds of three to ten percent for income before taxes, and one-half to two percent for total assets and revenue (Eilifsen & Messier, 2015).

While the academic research on materiality has mostly focused on account balances, the IAASB underscores the importance of evaluating materiality more broadly:

> The circumstances related to some misstatements may cause the auditor to evaluate them as material, …, even if they are lower than materiality for the financial statements as a whole. Circumstances that may affect the evaluation include the extent to which the misstatement: … Affects compliance with debt covenants or other contractual requirements … Affects ratios used to evaluate the entity's financial position, results of operations, or cash flows …. (IAASB, 2009, §A16)

Turner (1997) used numerical simulation to demonstrate that immaterial errors in account balances can sometimes combine to materially misstate financial ratios. Hence, existing practices may be ill-equipped to assess materiality in the context of the assurance services suggested by the ICAS and ICAEW.

2.2.2. Research on audit risk

The audit risk model exploits the additive properties of the balance sheet and income statement for determining audit risk and materiality. Academic research has identified the model's limitations (e.g., Cushing & Loebbecke, 1983; Kinney, 1989) and has extended the model to address those limitations through a better mapping between audit evidence and audit risk (e.g., Srivastava & Shafer, 1992; Dutta & Srivastava, 1993). Extensions of the audit risk model examine the fraud triangle (Srivastava, Mock, & Turner, 2009), internal controls (Akresh, 2010) and group audits (Stewart & Kinney, 2013).

Some academics propose decomposing detection risk into two components. The two categories of substantive procedures are (1) audit of the details of transactions and balances and (2) analytical procedures applied to produce circumstantial evidence about dollar amounts in the accounts (Louwers et al., 2011). The latter circumstantial evidence can be obtained through heuristics or more formally using statistical procedures (Knechel, 1988a), structural equations that exploit the relationships among account balances (Chen & Leitch, 1998), or time-series analysis (Lorek, Branson & Icerman, 1992). A few studies have investigated the effectiveness of financial ratios in analytical procedures, which often includes analysis of trends, comparison to industry benchmarks, and identification of internal inconsistencies. For example, Kinney (1987) demonstrates the use and limitations of commonly used financial ratios in analytical reviews. Knechel (1988b) simulates the effectiveness of analytical review procedures, including ratios based on monthly or annual data, and finds that monthly data is more effective. Financial ratios in this stream of research are used as a diagnostic tool to help detect material errors in account balances.

In contrast, the current paper asserts that financial ratios are what financial statement users care about. Therefore, financial ratios are not merely a diagnostic tool. Rather, misleading financial ratios are a direct source of audit risk. There have been few attempts to adapt the audit risk model to situations that involve non-additive combinations of accounts such as financial ratios. Turner (1997) uses numerical simulation to demonstrate that immaterial uncorrected errors in account balances can sometimes combine to materially misstate financial ratios. The current paper uses a similar approach in demonstrating the pervasiveness of the situation by using data from the recent financial statements of public companies. Dutta and Graham (1998) incorporates financial statement user materiality, expressed in terms of sensitivity to financial ratios, into the audit planning process. The current paper extends the Dutta-Graham framework and incorporates simulation techniques as in Knechel (1988a) and Turner (1997) to help evaluate audit risk arising from financial ratios, and identify financial disclosures that can mitigate the auditor's engagement risk with respect to misstated or misleading ratios.

The recent public policy initiatives by ICAS, ICAEW and others envision assurance of quantitative data, such as financial ratios, in management's discussion. In this setting, misleading financial ratios become a direct source of financial reporting risk. The additive nature of the audit risk model is ill-equipped to measure and manage this risk.[2] Our paper models this nonlinear risk, and uses case study methodology and simulation techniques applied to small samples of corporate financial statements, to help evaluate risk arising from potentially misleading financial ratios.

[2] The FASB has noted a similar problem with footnote disclosures: "even when information in notes is quantitative, it may not have a dollar-for-dollar effect on net income, net assets, or any other metric to which an error or omission might be compared in judging materiality" (FASB, 2012, 45).

3. Case 1: Leverage ratios

Financial ratios are derived from account balances, and in some cases operational data. Hence, from an accounting perspective, misleading financial ratios result from the effect of errors, assumptions, estimates and choices on underlying account balances. While the effect of known errors in account balances on financial ratios could be determined through recomputation, the proper evaluation of financial reporting risk from misleading ratios cannot be accurately assessed without modeling the properties of the estimation process as well as the properties of the account balance itself. In this section, we model the relationship between off-balance sheet financing activities that affect the numerator of a leverage ratio and the consequent assessment of the risk that reported leverage will materially mislead financial statement users. Events at Lehman are used to motivate our analysis and illustrate our results.

3.1. Understating leverage at Lehman

Subsequent to Lehman's bankruptcy in 2008, its use of repurchase agreements came under scrutiny (Valukas, 2010; Dutta, Caplan, & Lawson, 2010). Financial institutions commonly use sale-and-repurchase agreements (repos) to obtain short-term financing. Usually the collateral for the repo continues to be reported on the balance sheet of the borrower. However, Lehman used an aggressive interpretation of SFAS No. 140 to treat the repos (called Repo 105s) as a sale of the collateral, thus temporarily removing these assets from its balance sheet (Caplan, Dutta, & Marcinko, 2012). The Repo 105 activity allowed Lehman to lower its leverage ratio, measured as assets divided by equity, as shown in Table 1.

Lehman's rating agencies, regulators and lenders monitored this ratio, and management made numerous assertions regarding its importance (Valukas, 2010). In the aftermath of Lehman's bankruptcy, questions arose about whether the leverage ratio failed to adequately indicate Lehman's business risk. In a presentation entitled "The Watchdog that Didn't Bark … Again," the PCAOB Investor Advisory Group asked: "Did auditors inappropriately allow companies to hide risks off-balance-sheet when the company remained exposed to the risks? Did auditors inappropriately agree to, or even help design, transactions whose sole purpose was to hide from investors the degree of leverage or other risks the company had taken on" (PCAOB Investor Advisory Group, 2011). If auditors are held responsible for disclosing off-balance-sheet risks, even when financial statements comply with GAAP, auditors will need to assess and manage this new source of engagement risk.

3.2. Model development

This section develops a simple model of the risk of reporting a misleading financial ratio. Management's report of an account balance, a financial statement summary measure (such as current assets, total assets, or net income), or a financial ratio, is denoted ρ. The true account balance, financial statement summary measure, or financial ratio is denoted α.[3] Subscripts on ρ and α identify the account balance, financial statement summary measure, or ratio. In this section, these subscripts are *lev* for the leverage ratio, *assets* for total assets from the balance sheet, *equity* for shareholders' equity from the balance sheet, and *repo* for the amount of Repo

[3] "True" in the context of this framework is relative to the financial statement user's perspective. This amount is the user's interpretation of what an account balance or summary measure should include. This value may be unobservable in the present, but disclosure of it in the future may result in controversy regarding the fairness of the disclosures and management assertions.

105 activity. The difference between the reported balance and the true balance is denoted as δ: $\delta_x = \alpha_x - \rho_x$,[4] this amount causes financial ratios to be misleading. We define materiality of an account balance or financial statement total in absolute terms, denoted as v, as the maximum (or minimum) balance that would not influence users' judgments relative to the reported balance. In the case of a ratio, v is the maximum (or minimum) value of the ratio that would not affect users' judgments, relative to the reported ratio. We define the tolerable error (referred to as performance materiality in ISA No. 320) in an account balance as the materiality amount less the reported amount: $\tau_x = v_x - \rho_x$. The tolerable error expressed as a percentage of the reported amount is denoted γ; that is, $\gamma_x = \tau_x/\rho_x$ expressed as a percentage. Notation introduced here is summarized in Appendix A.

We now derive the risk of a material misstatement of the leverage ratio when the only uncertainty pertains to the true amount of Repo 105 activity. As at Lehman, the leverage ratio is defined as total assets divided by equity:

$$\rho_{lev} = \frac{\rho_{assets}}{\rho_{equity}}$$

and

$$\alpha_{lev} = \frac{\alpha_{assets}}{\alpha_{equity}}$$

Lehman used its accounting for its Repo 105 activity to reduce total assets, thus effectively removing some of its financing activities from the balance sheet and reducing the numerator of the leverage ratio. At Lehman, $\rho_{\text{repo}} = 0$ and $\alpha_{\text{repo}} = \delta_{\text{repo}}$,

$$\alpha_{assets} = \rho_{assets} + \delta_{repo.}$$

The financial statement users expect total assets to include assets temporarily removed as a result of Repo 105 transactions. Hence, the true balance α_{assets} adds back the Repo 105 collateral to the

[4] This formulation makes understatement errors positive and overstatement errors negative.

reported asset balance ρ_{assets}. In the absence of disclosure of the Repo 105 activity, its extent was unknown and thus the true balance α_{assets} was unobservable.

Since Lehman's accounting for the Repo 105 activity did not affect income or equity:

$$\alpha_{equity} = \rho_{equity}$$

The true leverage ratio is: $\alpha_{lev} = \frac{\rho_{assets}+\delta_{repo}}{\rho_{equity}}$

The misstatement in the leverage ratio is:

$$\delta_{lev} = \frac{\rho_{assets}+ \delta_{repo}}{\rho_{equity}} - \frac{\rho_{assets}}{\rho_{equity}}$$

Simplifying: $$\delta_{lev} = \frac{\delta_{repo}}{\rho_{equity}} \quad (1)$$

Repo 105 activity cannot be negative, so the only potential misstatements of leverage are understatements. The probability distribution over the values of δ_{repo} is denoted by $f(\delta_{repo})$. These priors might be based on the company's historical use of Repo 105 activity throughout the year and especially at quarter-ends. Financial statement users' materiality threshold of the leverage ratio is higher than the reported value of the ratio (we assume users are concerned only with understatements of leverage). Therefore, the tolerable error of the leverage ratio, denoted τ_{lev}, is positive and can be calculated as:

$$\tau_{lev} = v_{lev} - \rho_{lev}$$

Using this equality, and substituting τ_{lev} for δ_{lev} in Equation 1 and simplifying, we get:

$$1 - \int_0^{(v_{lev}-\rho_{lev}).\rho_{equity}} f(\delta_{repo}) = \theta \quad (2)$$

where θ is the risk that the leverage ratio is misleading given the uncertainty in the extent of Repo 105 activity.[5] Equation (2) can be easily modified for alternative measures of leverage, such as debt-to-equity.

3.3. Numerical example

The events at Lehman led some to question the role of the accounting profession in designing and approving the use of transactions such as Repo 105.[6] Since management at Lehman showcased the apparent reduction of the leverage ratio in its annual report, implementation of the recommendations by ICAS and ICAEW would increase audit engagement risk.[7] In this section we examine this increased risk by using data from Lehman's 10-Q for the second quarter of 2008. Lehman's reported net leverage ratio for that quarter-end was 12.1, with reported total assets of about $300 billion and equity of $25 billion. We assume the decisions of financial statement users will not be affected as long as the true net leverage ratio is less than 12.7, about a 5% difference from the reported ratio. The auditor wants to determine whether the company's Repo 105 activity is sufficiently material to require financial statement disclosure.

The extent of off-balance sheet financing activities at the end of a given financial reporting period can be difficult to assess. This difficulty introduces uncertainty into the auditor's decision-making process, which can be characterized by a probability distribution function. We assume

[5] We assume the distribution is truncated at zero since Repo 105 activity cannot be negative.
[6] See, for example the witness testimony presented to the U.S. Senate Banking, Housing and Urban Affairs Committee on April 6, 2011, available at http://www.banking.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_ID=0f533e5b-dc43-4fc2-a415-5df2ae8806da (retrieved 1.05.16).
[7] We use the term engagement risk to differentiate it from the concept of audit risk which is normally associated with the SAS 47 definition (Graham, 1985a, 1985b, 1985c, 1985d, 1985e) and does not include parts of the annual report beyond the financial statements. We do not apply the definition of engagement risk to sources beyond the annual report.

the auditor's assessed probability distribution of the level of the company's Repo 105 activity is normal with a mean of \$13 billion (about 4% of total assets) and a standard deviation of \$2 billion. Since the tolerable error, τ_{lev} is 0.6 billion and the reported value of equity ρ_{equity} = \$25 billion, the upper limit of the integral in Equation (2) is 15 billion, and the auditor's assessed level of risk with respect to the leverage ratio can be represented as:

$$1 - \int_0^{15} \frac{1}{\sigma\sqrt{2\pi}} e^{-\left(\frac{1}{2}\right)\left[\frac{x-\mu}{\sigma}\right]^2} \, dx$$

Letting μ = 13 and σ = 2 and solving the integral, we get 0.16. Thus, there is 16% risk that the leverage ratio is materially misleading due to the Repo 105 activity. If 16% risk for this key metric leads to unacceptable engagement risk, the auditor should recommend disclosure of the Repo 105 activity, even though the volume of activity is probably less than 5% of total assets, which is a common materiality benchmark in audit practice (see Eilifsen & Messier, 2015). There is experimental evidence that audit committees give credence to qualitative materiality judgments and will support the auditor (DeZoort et al., 2003).

This example illustrates that for ratios that are much larger than one, such as banks' leverage ratios, seemingly immaterial errors in the numerator can materially misstate the ratio. However, audit risk is highly sensitive to materiality thresholds. In the above example, if the materiality of the leverage ratio is increased from 5 to 6 percent, the tolerable error τ_{lev} increases to 0.72, and the upper limit of the integral becomes \$18 billion. Keeping μ = 13 and σ = 2 and solving the integral, we get 0.994, which translates to less than 1% risk.

3.4. Relaxing the normality assumption

This numerical example assumes that the volume of Repo 105 activity can be approximated using a normal distribution. Although normality is a common assumption in statistical sampling,

it provides aggressive estimates of assurance when the underlying distributional properties are not satisfied. In a financial reporting context, sometimes the distribution is not bell-shaped and is skewed or truncated.

The formulation of risk as given in Equation 2 does not assume normality and is robust to any distributional assumption. It can also be applied to situations where no distributional assumption is desirable by using Chebychev's inequality (Hoel et. al., 1971), leading to a more conservative estimate. Assuming the materiality of the leverage ratio is 6% and other parameters as above, but relaxing the normality assumption, the resultant risk using Chebychev's inequality increases from less than 1% to 8%. This result assumes a symmetric distribution but does not make any other distributional assumptions. Since most account populations are skewed or truncated, the symmetry assumption can be relaxed which leads to the most conservative estimate of 16%.

The development of the numerical example above illustrates the following about auditor's engagement risk:

- there is incremental engagement risk emanating from misleading financial ratios beyond the risk assessed through balance sheet and income statement materiality thresholds;
- changes in materiality assumptions affect risk in a non-linear manner;
- engagement risk is sensitive to distributional assumptions, and the use of normal distributions when they are not descriptive generally understates risk;
- engagement risk is sensitive to the assumption of symmetry, and truncated or skewed populations usually lead to additional risk.

In the subsequent sections we apply the model using normal distributions, but the above insights remain valid and can be applied to the examples that follow.

4. Case 2: Profitability ratios

In this section we discuss the situation in which an error, estimate or accounting policy choice affects only the denominator of a financial ratio. Accounting treatments that remove productive assets or keep them off-balance-sheet understate assets. Since total assets are the denominator in many performance metrics, a reduction in total assets improves these metrics. We discuss how operating leases underreport total assets and model the risk that reported return on invested capital (ROIC) is misleading. We illustrate the model through a numerical example.

4.1. Operating leases as off-balance-sheet financing

U.S. GAAP for operating leases allows the long-term use of the leased asset without requiring the company to record the asset or the corresponding liability on its balance sheet.[8] Operating leases are widely used by U.S. companies, resulting in $1.25 trillion of off-balance sheet commitments in 2005 (SEC 2005). For example, in its 2012 10-K, United Continental reported approximately $1.5 billion in future payments under capital leases, but approximately $7.5 billion in future contractual obligations on aircraft operating leases and another $9.7 billion in future contractual obligations on other operating leases.

[8] On February 25th, 2016, the FASB issued a new standard on leases that becomes effective for fiscal years beginning after December 15, 2018. The new standard will give balance sheet recognition to many more leases than current GAAP.

Operating lease payments, when capitalized, increase both reported assets and liabilities but usually have minimal effect on equity. The effect of capitalization on key financial metrics may not be straightforward and cannot be inferred from the disclosure of minimum lease payments. Three commonly-used and important financial metrics that are affected by capitalization of operating leases are assets to equity, debt to invested capital, and return on invested capital (or return on assets). In this section we examine the effect of capitalizing operating leases on return on invested capital. ROIC is often used in performance plans and incentive awards and some companies include an explicit analysis of this ratio. In its 10-K for the fiscal year ended January 28, 2012, Nordstrom calculates ROIC using estimates of the adjustments in the numerator and denominator of the ratio that would occur if operating leases were capitalized. In the numerator of ROIC, Nordstrom adds back rent expense of $78 million but deducts estimated depreciation on capitalized operating leases of $42 million. In the denominator, Nordstrom adds $555 million to average total assets. The increase of $36 million in the numerator is small compared to the increase of $555 million in the denominator, and Nordstrom's pro-forma adjustment reduces ROIC for 2012 from 14.7% to 13.3%.

Operating leases are common in certain industries, but not all companies provide details of the impact of such arrangements on financial performance and critical ratios. While some companies allude to the effect, few recompute it. For selected industry leaders in three industries we simulate Nordstrom's process to recalculate return-on-assets (ROA) using financial statement data to estimate the effect of capitalizing operating leases. The three industries selected for our analysis are transportation, retail and restaurant chains. The financial data is obtained from the 10-Ks filed in 2012 and the preceding year. The details of adjustments to income and assets are shown in Table 2.

The ROA measure is computed twice, once using net income and total assets as reported by the company, and again based on adjusted income and assets resulting from capitalization of operating leases. As can be seen in the row "% change in ROA," the impact is usually unfavorable. This change can be compared to the percentage change in income shown in the last row of the table. Although the change in net income is usually negative, the percentage change in ROA is more unfavorable than the percentage change in net income. This effect is graphed in Figure 1.

The revised ROA for all companies in the sample except one was lower than the reported ROA. Hence, the percentage change in ROA was negative for 19 out of 20 companies in the sample. We plot the absolute percentage change in ROA next to the percentage change in net income. For each company two bars are shown. The first (on the left) denotes the absolute percentage change in ROA, and the second bar (on the right) denotes the percentage change in net income. As can be seen from the graph, out of the 20 companies in the sample, nine companies would reduce their ROA by 20% or more if operating leases were capitalized, yet the effect on net income would be less than 10% for four of these nine companies. Additionally, five companies have a reduction in ROA between 10% and 20%. None of these five companies has a change in income of more than 10%.

The effect of capitalizing operating leases on assets-to-equity (a commonly-used leverage ratio) is shown in Table 3.

The leverage ratio is computed twice, once based on reported numbers on the balance sheet and again by adding the net present value of operating lease payments to total assets. Since the impact on equity is minimal, it is ignored in the illustration. The table is divided into three panels, one for each industry: transportation, retail and restaurants. The bottom two rows provide

the percentage change in the leverage ratio which can be compared to the percentage change in income.

Similar to the case of ROA, the percentage change in leverage is usually more extreme than the corresponding change in net income. This is illustrated in Figure 2.

The left-hand bar for each company denotes the percentage change in leverage and the right-hand bar denotes the percentage change in net income for each of the 20 companies in the sample. The percentage change in leverage is higher than the percentage change in income for 18 of the 20 companies in the sample and approximately equal for the other two. The critical examples are those instances in which the change in leverage is greater than 10% but the change in income is less than 10%. In our sample, this occurs 30% of the time. Moreover, there are three companies (United Continental, Saks, and McDonald's) that have less than a 5% change in income but the change in the leverage ratio is greater than 10%. Such instances may impose financial reporting risk.

4.2. Model development

With notation as before, we denote the return on invested capital with the subscript *roic*, net income with the subscript *inc*, total (average) invested capital with the subscript *cap*, and the effect of capitalizing the operating leases with the subscript *leas:*

$$\rho_{roic} = \frac{\rho_{inc}}{\rho_{cap}}$$

Consistent with Nordstrom and many of the companies in Table 2, we assume the effect on income to be minimal, so that the reported balance of *inc* equals the balance as if leases were capitalized. However, the invested capital in the denominator is affected by the capitalization of operating leases.

Thus, $$\alpha_{roic} = \frac{\rho_{inc}}{\rho_{cap} + \delta_{leas}}$$

The difference is

$$\delta_{roic} = \frac{\rho_{inc}}{\rho_{cap} + \delta_{leas}} - \frac{\rho_{inc}}{\rho_{cap}}$$

Simplifying, $$\delta_{roic} = -\rho_{roic} \frac{(\delta_{leas})}{(\rho_{cap} + \delta_{leas})}$$

Rearranging the equation above and expressing δ_{leas} divided by ρ_{cap} in percentage terms as γ_{leas}, we derive the percentage materiality for ROIC as

$$(\gamma_{roic}) = \frac{\delta_{roic}}{\rho_{roic}} = -\left(\frac{\gamma_{leas}}{(1 + \gamma_{leas})}\right) \quad (3)$$

Note that γ_{roic} is negative because as leases are capitalized, assets increase thus reducing the ratio. Rearranging Equation (3):

$$(\gamma_{leas}) = -\left(\frac{\gamma_{roic}}{(1 + \gamma_{roic})}\right) \quad (4)$$

The upper bound for the capitalized value of operating leases is the amount that would materially affect users' judgments about ROIC:

$$\text{Upper Bound} = \rho_{cap}\,(1 + \gamma_{leas}) - \rho_{cap}$$

Substituting Equation (4) in the above expression, we get: ?

$$\text{Upper Bound} = \rho_{cap}\left(1 - \frac{\gamma_{roic}}{1 + \gamma_{roic}}\right) - \quad \rho_{cap} = \frac{-\gamma_{roic}\,\rho_{cap}}{1 + \gamma_{roic}}$$

The cumulative probability distribution function up to that limit determines the risk that reported ROIC will materially mislead financial statement users. Assuming any probability distribution *f(x)*, where *x* is the capitalized amount of operating leases, the risk that the reported ROIC is misleading can be derived as:

$$\int_0^{\frac{-\gamma_{roic}\,\rho_{cap}}{1 + \gamma_{roic}}} f(x)\,dx = \theta \quad (5)$$

We illustrate the model with a numerical example.

4.3. Numerical example

Nordstrom's reported ROIC for the fiscal year ended January 2012 was 14.7%, with reported total assets of about $5,345 million and operating income of $786 million. The company estimates the present value of operating lease payments to be $555 million, which implies a discount rate of about 8%. The $555 million is about 10% of total assets. Uncertainty about operating leases in this scenario stems from many factors including undisclosed lease arrangements and the estimate of the discount rate. We assume user materiality for reported ROIC is 10% and the probability distribution of the appropriate amount to be capitalized is normal with a mean of $555 million and a standard deviation of $30 million.[9] Since the reported value of assets ρ_{cap} = $5,345 million, the upper limit of the integral in Equation (5) is about $594 million, and the financial reporting risk can be represented as:

$$\theta = 1 - \int_0^{594} \frac{1}{\sigma\sqrt{2\pi}} e^{-\left(\frac{1}{2}\right)\left[\frac{x-\mu}{\sigma}\right]^2} dx$$

Letting μ = 555 and σ = 30 and solving the integral, we get 0.097. Hence, there is a 9.7% risk that the ROIC is misleading due to uncertainty in the amount to be capitalized.

To conclude this section, when financial reporting risk is based solely on the income statement, non-capitalization of operating leases has minimal impact. When the risk assessment also considers the effect on the balance sheet, the $555 million understates reported assets by about 10%. If the risk assessment is expanded to include ROIC, which is an important profitability metric emphasized by Nordstrom in its MD&A, capitalizing the leases lowers ROIC from 14.7% to 13.3% (a change of 9.5%). While the decrease of 9.5% may be substantial, it does

[9] We estimate the standard deviation from a sensitivity analysis of the capitalized amount to changes in the discount rate.

not lead to incremental engagement risk if user materiality for the ratio is 10%. However, additional risk arises from uncertainty regarding the amount to be capitalized. In this example, a seemingly insignificant amount of uncertainty (a standard deviation of $30 million, or about 0.5% of total assets) generates a substantial risk that ROIC is misstated by more than 10%. However, this risk could be mitigated through appropriate disclosures.

5. Case 3: Liquidity ratios

Short-term liquidity is an important financial metric for many companies and is often discussed in their annual reports. In this section we model the situation in which an error, estimate or accounting policy choice affects both the numerator and the denominator of a financial ratio by the same amount. This occurs for liquidity ratios when there are offsetting errors in current assets and current liabilities. Such errors occur, for example, when trade receivables and advances from customers are mistakenly offset. Ceridian Corporation restated its 2003 and 2002 financial statements for this reason amongst others. Correction of the offset between trade receivables and advances from customers increased Ceridian's current liabilities as of December 31, 2003 by 4.8% (Ceridian Corporation, 2005). The accounting treatment of accounts receivable factoring arrangements is sometimes equivalent to off-balance sheet financing that offsets current assets and liabilities. We use Crown Crafts, Inc. as such an example. Later, we illustrate through simulation analysis how small errors can materially distort liquidity ratios.

5.1. Factoring receivables at Crown Crafts

Crown Crafts, Inc. manufactures infant and toddler products and sells to retailers. The company factors its receivables to the CIT Group and its 2011 10-K includes the following description:

> To reduce its exposure to credit losses and to enhance the predictability of its cash flow, the Company assigns the majority of its trade accounts receivable to CIT pursuant to factoring agreements. … If a customer fails to pay CIT by the due date, the Company is charged interest at prime plus 1.0%, which was 4.25% at April 3, 2011, until payment is received. The Company incurred interest expense of $77,000 and $67,000 in fiscal years 2011 and 2010, respectively. (Crown Crafts, Inc., 2011, 13)

The amount of factoring by Crown Crafts is significant. At the end of 2011, the company's current assets were approximately $35 million, about half of which was due from the factor.

Factoring arrangements provide a reliable source of cash. There are three possible scenarios. When customers pay on time, the factoring arrangement has no impact on balance sheet accounts. When customers default, factoring creates a contingent liability. When customers pay late, some factoring arrangements constitute a type of off-balance-sheet financing.[10] From this perspective, when compared to other short-term financing arrangements, factoring sometimes improves liquidity measures such as the current and quick ratios.

Crown Crafts incurred $77,000 in interest expense in 2011 because some customers paid late. Using the stated interest rate of 4.25%, we estimate that accounts receivable overdue at the factor was $1.8 million, for which Crown Crafts had already received cash. Without the factoring agreement, this $1.8 million would have been a current liability owed to the factor, adversely affecting liquidity ratios as shown in Table 4.

[10] This also applies when the company receives payment from the factor in advance of the customer due date.

In effect, by financing $1.8 million through factoring instead of through a short-term loan, Crown Crafts increased its quick ratio 7% from 1.76 to 1.89, and increased its current ratio 12% from 3.15 to 3.54.

5.2. Model development

We use notation as before. The current ratio is denoted with the subscript *crat*, the sum of current assets is *rec* and the sum of current liabilities is *pay*. A critical feature of the modeling in this section is that the numerator and denominator are related in such a way that a misstatement in one causes a corresponding misstatement in the other. The reported current ratio without the effect of factoring is:

$$\rho_{crat} = \frac{\rho_{rec}}{\rho_{pay}}$$

The current ratio incorporating the effects of factoring is

$$\alpha_{crat} = \frac{\alpha_{rec}}{\alpha_{pay}}$$

The difference is due to the off-balance sheet financing component implicit in the factoring arrangement, $\delta_{rec} = \delta_{pay}$, so that:

$$\alpha_{rec} = \rho_{rec} + \delta_{pay} \text{ and } \alpha_{pay} = \rho_{pay} + \delta_{pay}$$

Thus:
$$\alpha_{crat} = \frac{\rho_{rec}+\delta_{pay}}{\rho_{pay}+\delta_{pay}}$$

and
$$\delta_{crat} = \frac{\rho_{rec}+\delta_{pay}}{\rho_{pay}+\delta_{pay}} - \frac{\rho_{rec}}{\rho_{pay}}$$

Simplifying:

$$\delta_{crat} = (1 - \rho_{crat})\left[\frac{\delta_{pay}}{\rho_{pay}+\delta_{pay}}\right]$$

Expressing the error as a percentage, γ_{pay}, and simplifying:

$$\delta_{crat} = (1 - \rho_{crat}) \left[\frac{\gamma_{pay}}{1 + \gamma_{pay}} \right]$$

Rearranging in terms of γ_{pay}:

$$\gamma_{pay} = \frac{\delta_{crat}}{(1 - \rho_{crat} - \delta_{crat})}$$

Delinquent customer payments create an obligation for the company to the factor. There are various sources of uncertainty regarding the amount of these delinquent customer payments which leads to a probability distribution on γ_{pay} denoted by $f(\gamma_{pay})$. The risk θ of reporting a misleading ratio can be derived as:

$$\theta = \int_0^{\frac{\delta_{crat}}{(1-\rho_{crat}-\delta_{crat})}} f(\gamma_{pay})\, d\gamma_{pay} \qquad (6)$$

The above integral can be solved for any probability distribution.

5.3. Numerical example

Based on Crown Crafts' 2011 balance sheet, its current ratio is approximately 3.54, as shown in Table 4. The off-balance sheet financing component of factoring is approximately $1.8 million, which is roughly 10% of net accounts receivables and 5% of current assets. The reported balance of current liabilities is approximately $10 million. Assume that as long as the current ratio is greater than 3.0 (based on a materiality threshold for this ratio of 15%, since 3.54 x 0.15 = 0.531), it will not mislead financial statement users. Further assume that the probability distribution of the off-balance sheet financing component of the factoring arrangement at year-end is normal with a mean of $1.8 million and a standard deviation of $800,000.

The ramification being explored is whether omitting the off-balance sheet financing component of the factoring arrangement from the computation of the current ratio would mislead investors and creditors. Since the tolerable error of the current ratio, τ_{cr} = -0.54, and the reported

value of the current ratio is ρ_{cr} = 3.54, the upper limit of the integral in Equation (6) is 0.27. This implies that financial statement users will not be misled if the amount of receivables factored is less than 27% of current liabilities. The cumulative probability of the current ratio being greater than 3.0 is obtained by solving the following integral:

$$\int_0^{0.27} \frac{1}{\sigma\sqrt{2\pi}} e^{-\left(\frac{1}{2}\right)\left[\frac{x-\mu}{\sigma}\right]^2} dx$$

where *x* is the amount factored, as a percentage of payables.

Since the mean amount of financing implicit in the factoring arrangement is $1.8 million or 18% of payables, substituting μ = 18% and σ = 8% ($800,000 ÷ $10 million) into the above integral yields approximately 0.86. Hence, there is an 86% likelihood that the factoring arrangement would not mislead users; alternatively, there is a 14% risk that the current ratio is misleading.

5.4. Sensitivity analysis

From an auditing perspective, the above numerical example transforms into 14% audit risk. Of course, audit risk is sensitive to the estimates of the mean and standard deviation; hence, the auditor may perform a sensitivity analysis of the parameters. In Figure 3 we plot the changes in audit assurance based on exogenous materiality of the current ratio. Debt covenants often specify the minimum current ratio that the company is required to maintain. The auditor should be cognizant of these requirements and assess the risk that the current ratio violates a debt covenant. Figure 3 graphs achieved assurance that the current ratio does not violate the debt covenant, based on the data in the example above. Recall that the reported current ratio was 3.54 when the mean of the distribution was $1.8 million, and the example above computed assurance (and risk) based on the assumption that the minimum acceptable current ratio was 3.0. Figure 3 relaxes the

assumption that the required minimum current ratio is 3.0, and the graph depicts audit assurance for required minimum current ratios ranging from 2.5 to 3.5. When the reported current ratio of 3.5 far exceeds the minimum required in the debt covenant, a high level of audit assurance is achieved, as illustrated on the left side of the graph. As the value of the required minimum current ratio increases and approaches the reported amount, audit assurance decreases due to the uncertainty regarding the actual amount of accounts receivables factored.

Additional sensitivity analysis of the example is illustrated in Figure 4. In Panel A of Figure 4 the mean amount factored is allowed to vary. Panel A draws three plots for different assumptions of the mean amount factored. The center plot is the base-line example presented in the text. The upper plot is based on the assumption that the mean amount factored is $0.1 million. The lower plot is based on the assumption that the mean amount factored is $3.0 million. As expected, higher assurance is achieved when the mean amount factored is lower. As the amount factored increases, the plot shifts to the left denoting lower assurance. In Panel B of Figure 4, the standard deviation of the factored amount is varied while the mean amount factored is fixed at $1.8 million. The standard deviation measures the level of uncertainty regarding the estimate. A higher standard deviation implies greater uncertainty. The base-line case of the numerical example above is represented by the solid line. The dashed line above denotes a standard deviation of $0.1 million or very low uncertainty regarding the amount factored. The dotted and the dot-dashed lines below the base-line denote standard deviations of $1.2 million and $1.8 million, respectively. Unlike the plots in Panel A, the plots in Panel B intersect indicating that increase in standard deviation does not monotonically reduce assurance. While the increase in standard deviation reduces assurance for lower values of the minimum required

current ratio, it provides more assurance for higher values of the minimum required current ratio. The switch occurs at the point estimate of the current ratio once the expected effect of factoring is incorporated. However, since the assurance at the switching point is less than 0.5 in all instances, the higher achieved assurance for higher standard deviation lacks practical significance. The relevant portion of the plot is in the upper-left-hand corner.

5.5. Simulation analysis of the current ratio

To examine the risk that immaterial financial statement errors could materially affect liquidity ratios, we conduct simulation analysis on a subset of 127 companies drawn from the Fortune 200. The subset excludes financial institutions, insurance companies, and a small number of other companies that present unclassified balance sheets. For our sample, we seed an adjusting journal entry equal to 5% of 2012 income before taxes, which many auditors would consider borderline immaterial (Eilifsen & Messier, 2015). We assume that the adjusting journal entry debits an expense account and credits a current liability, and we calculate the percentage change in the current ratio that results from posting the adjusting journal entry. Panel A of Figure 5 groups the 127 companies according to the magnitude of the change in the current ratio caused by the adjusting journal entry.

For most of the companies in our sample, the change in the current ratio is smaller than 5%. However, for 11% of the companies in our sample, the change in the current ratio is greater than 5%, and for two companies (McDonald's and Union Pacific) it exceeds 10%. For ExxonMobil, the current ratio drops from 1.01 to 0.95, and for DirecTV it drops from 1.00 to 0.96, which may be significant to users who view 1.00 as a focal point for the current ratio. We conducted a

similar analysis using 0.66% of revenue as the amount of the adjusting journal entry.[11] In that simulation, the current ratios of 15% of the companies in our sample decreased between 5 and 10 percent, and one company (World Fuel Services) decreased by 11.96%.[12]

Panel B of Figure 5 reports the results of a simulation analysis for a journal entry that reclassifies 1% of total assets from current to noncurrent assets.[13] For 17% of our sample, the current ratio decreases by more than 5%. For six of these companies the decrease is greater than 10%, and the largest decrease is 15% (Union Pacific). For several companies, including Hess and DirecTV, the current ratio falls from above the focal point of one to below it.

6. Discussion

The model and examples presented in the previous sections can be adapted to a wide array of financial ratios. Table 5 identifies additional sources of financial reporting risk arising from accounting errors, estimates or choices that can cause commonly-used financial ratios to be misleading. We present two to three common ratios for each of the four categories: short-term liquidity, long-term solvency, profitability and asset utilization. The sources of risk are presented across three columns: those affecting the numerator of the ratio; those affecting the denominator of the ratio; and those affecting both the numerator and denominator. These three columns

[11] 2/3rds of 1% was chosen because it is the mean of the lower end of the range of revenue materiality thresholds reported by the audit firms surveyed by Eilifsen and Messier (2015).
[12] These two simulations are mechanically related, because if a company's Return on Sales (ROS) is greater than 13.33%, a decrease of 0.66% in revenue will decrease pre-tax income by more than 5%. However, the ROS of the companies in the sample varies widely, and there is no overlap between the companies in the top ten for the largest decrease in the current ratio when we use 5% of pre-tax income, and the companies in the top ten when we use 0.66% of revenue.
[13] See Ceridian Corporation's 10-K/A (2005, 89) for an example of such a reclassifying entry. We use 1% because it is the lower end of the range of the materiality threshold for total assets used by four of the eight firms surveyed in Eilifsen and Messier (2015).

correspond to the material presented in the previous three sections of this paper. The scenarios identified in Table 5 are illustrative, not exhaustive.

A particular accounting error, estimate or choice might affect multiple financial ratios. An example is a cutoff error in the disbursements system affecting the quick ratio, current ratio and interest coverage. Further, the effect could differ from one metric to another. Capitalization of operating leases affects the numerator in assets to equity but the denominator in ROA.[14]

The scenarios described in the left column of Table 5 can be modeled using the technique developed in Section 3. For example, operating leases or debt held by variable interest entities (VIE) affects the numerator of the leverage ratios but has minimal effect on equity. For all of the scenarios in the left column of Table 5, when the ratio is greater than one, the materiality of a misstatement in the numerator should be assessed in relation to the denominator.

The scenarios presented in the middle column of Table 5 can be modeled using the technique developed in Section 4. These scenarios correspond to accounting errors, estimates or choices affecting only the denominator of the ratio. For example, some e-commerce businesses such as Groupon have reported revenue at the gross amount when the net method is more appropriate (Dutta, Caplan, & Marcinko 2013). The gross method overstates revenue which affects the denominator of the gross margin percentage but not the numerator. Finally, the scenarios presented in the right column of Table 5 can be modeled using the technique developed in Section 5. For example, certain accounting errors could overstate revenue and total assets by the same amount. A common example is an overstatement of work completed on a percentage-of-

[14] Capitalization of operating leases also affects expenses and hence net income. As discussed earlier, we assume that the payment under an operating lease is approximately equal to the sum of the depreciation expense and interest expense if the lease were capitalized.

completion contract when the costs incurred on the contract are properly recorded, but revenues and accounts receivable are overstated.

In summary, management often discusses financial ratios and other metrics in the annual report. Some companies, like Union Pacific and Nordstrom, go further; these companies adjust their reported metrics for accounting policy choices in order to give financial statement users a fair and balanced picture of the company's performance and prospects. Managers who are committed to transparent financial reporting should make similar assessments with respect to their significant accounting estimates and policy choices. Also, auditors can use these techniques to assess and manage engagement risk.

The model and examples presented in this paper can also be adapted to situations that are not normally thought of as ratios. Depreciation expense, for example, is the ratio of the cost of an asset divided by its useful life. In Appendix B, we discuss the effect of management's estimate of useful life on depreciation expense, and describe a well-known instance in which such estimates were manipulated to mislead financial statement users.

7. Conclusions

This paper is motivated by recent worldwide efforts to enhance the relevance and reliability of financial reporting. These public policy initiatives point toward increased scrutiny of the annual report and pose serious ramifications for company managers, directors and auditors. Annual reports contain qualitative and forward-looking disclosures as well as historical and quantitative disclosures. This paper has examined the latter because policymakers assert that assurance on these factual and verifiable disclosures is currently achievable. We demonstrate that assurance on management's discussion imposes incremental financial reporting risk. Since risk

must be assessed before it can be managed, we develop a framework for measuring this risk from the preparer's and auditor's perspectives. We explore how accounting errors, assumptions, estimates and choices can affect financial ratios to an extent that misleads users even when the corresponding changes in the component account balances are immaterial.

The paper has modeled three scenarios in which accounting errors, estimates or choices can result in misleading financial ratios due to their impact on either the numerator of the ratio, the denominator of the ratio, or both. First we modeled the financial reporting risk in the presence of uncertainty about the correct balance for the numerator of an important leverage ratio. We then modeled risk in the presence of uncertainty about the denominator of a common profitability ratio arising from the use of operating leases. Using data from financial statements of 20 large companies we demonstrate that the effect of capitalizing operating leases, although minimal on the income statement, has a greater impact on ROA. Next we modeled risk for a liquidity ratio when the amount and direction of potential misstatements are the same for both the numerator and denominator of the ratio. Simulation analysis shows that the liquidity ratios of about 11 to 17 percent of our sample, drawn from the Fortune 200, were highly sensitive to small deviations in the underlying account balances.

The analysis in this paper is meant to be illustrative, not exhaustive. There is enormous variety in the financial metrics that are reported and discussed in annual reports. The framework demonstrated here on some common financial ratios can be extended to other ratios. From an audit perspective, although the framework lacks the parsimony of the audit risk model, the volume and variety of financial disclosures does not make implementation unmanageable. Audits are conducted using a risk-based approach, and that approach can easily apply to disclosures in management's discussion. In summary, our paper provides a structured approach that informs

policymakers of incremental financial reporting risk borne by preparers and auditor in the pursuit of greater financial reporting transparency.

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Appendix A
Notation

Notation	Description
ρ	Reported balance or amount.
α	True balance or amount.
$\delta = \alpha - \rho$	Difference between reported balance and true balance.
v	User materiality: the maximum (or minimum) value that would affect users' judgments.
$v*$	Derived materiality
$\tau = v - \rho$	Tolerable error
$\gamma = \tau/\rho$	Percentage materiality
θ	Measure of reporting risk
$f(\bullet)$	Probability distribution function
$F(\bullet)$	Cumulative distribution function
Subscript	A symbol is subscripted with the abbreviation of the account balance, financial statement total, or ratio that it pertains to.

Appendix B
Extension of the model to depreciation expense

The use of management estimates in financial reporting is widely accepted. Since key financial metrics are often linked to these estimates, it is important that auditors assess the sensitivity of these metrics to management estimates in order to determine the adequacy of disclosure about the estimates. This appendix extends the framework developed in the paper to examine one such estimate, the useful life of long-lived assets. The model applies to this setting because the useful life of an asset is the denominator in a ratio that determines depreciation expense, and hence, affects net income. The formulation helps quantify the relationship between estimates of useful lives of long-lived assets and audit risk arising from potential misstatement of depreciation expense. Estimates of useful life have sometimes been manipulated to understate depreciation expense, thereby overstating income.

In March 2002, the SEC charged the founder and five top officials of Waste Management, Inc. with fraud beginning in 1992 and continuing for more than five years. The SEC alleged that the company and its management used multiple improper accounting practices. An investigation led to the largest restatement of a company's financial statements in U.S. history as of that date, a restatement of approximately $1.7 billion in pre-tax earnings. Waste Management engaged in about six schemes to defer or underreport expenses. One of these improper practices involved underreporting depreciation expense on their trucks by both inflating salvage values and extending the useful lives of these assets.

Arthur Andersen, Waste Management's auditor, was accused of complicity in the fraud. In general, auditors do not seem to apply a formal mechanism to assess materiality of management estimates except when management directly estimates an account balance, such as the allowance

for doubtful accounts. For example, even though estimates of useful lives of depreciable assets are widespread and the effect is usually material, auditors do not usually establish materiality guidelines and assess audit risk for a nonfinancial number such as a useful life.

We denote depreciation expense with the subscript *depr*, the cost of the depreciable asset with the subscript *ppe*, and the life of the depreciable asset (in years) with the subscript *life*. Hence:

$$\rho_{depr} = \frac{\rho_{ppe}}{\rho_{life}}$$

We assume the cost of the asset is known with certainty, so that the reported balance of *ppe* equals its true balance. However, the useful life is unknown and management's estimate is assumed unbiased and normally distributed.

Thus, $$\alpha_{depr} = \frac{\rho_{ppe}}{\rho_{life} + \delta_{life}}$$

and $$\delta_{depr} = \frac{\rho_{ppe}}{\rho_{life} + \delta_{life}} - \frac{\rho_{ppe}}{\rho_{life}}$$

Simplifying, $$\delta_{depr} = -\rho_{depr} \frac{(\delta_{life})}{(\rho_{life} + \delta_{life})}$$

Expressing in terms of the percentage tolerable error, γ:

$$(\gamma_{depr}) = -\left(\frac{\gamma_{life}}{(1+\gamma_{life})}\right) \quad \text{(B.1)}$$

Rearranging Equation (B.1):

$$(\gamma_{life}) = -\left(\frac{\gamma_{depr}}{(1+\gamma_{depr})}\right) \quad \text{(B.2)}$$

One common method by which auditors assess materiality is to determine the level of misstatement in net income that would affect financial statement users' judgments. This level of misstatement is the auditor's planning materiality, and it is used to establish materiality for individual income statement line-items such as depreciation expense, in accordance with the

audit risk model and professional standards. The materiality threshold for depreciation expense determines the percentage materiality in Equation (B.2). Based on γ_{depr}, the acceptable range of the useful life can be computed. Further, given the probability distribution of the useful life, audit risk arising from a material misstatement of income can be derived.

For example, if materiality for overstatement of net income is set at 10%, the tolerable error is calculated by taking 10% of reported net income, and this amount is allocated to income statement line-items including depreciation expense. Understating depreciation expense is equivalent to overstating the useful life.

Assuming that the auditor can ascertain the probability distribution of the true value of the useful life, the upper bound for the useful life is:

$$\text{Upper Bound} = \rho_{life}\,(1 + \gamma_{life})$$

Substituting from Equation (B.2) in the above expression, we get:

$$\text{Upper Bound} = \rho_{life}\left(1 - \frac{\gamma_{depr}}{1+\gamma_{depr}}\right)$$

Simplifying,

$$\text{Upper Bound} = \frac{\rho_{life}}{1+\gamma_{depr}}$$

The cumulative probability distribution function up to that limit determines the audit risk of material misstatement. Assuming a normal probability distribution with mean μ and variance σ, the auditor's decision problem can be derived as:

$$\int_0^{\left(\frac{\rho_{life}}{1+\gamma_{depr}}\right)} \frac{1}{\sigma\sqrt{2\pi}} e^{-\left(\frac{1}{2}\right)\left[\frac{x-\mu}{\sigma}\right]^2}\, dx \;\leq\; \theta \qquad \text{(B.3)}$$

where θ is the acceptable level of audit risk. Equation (B.3) helps the auditor to formally relate the sensitivity of the estimated useful life to the potential misstatement of net income.

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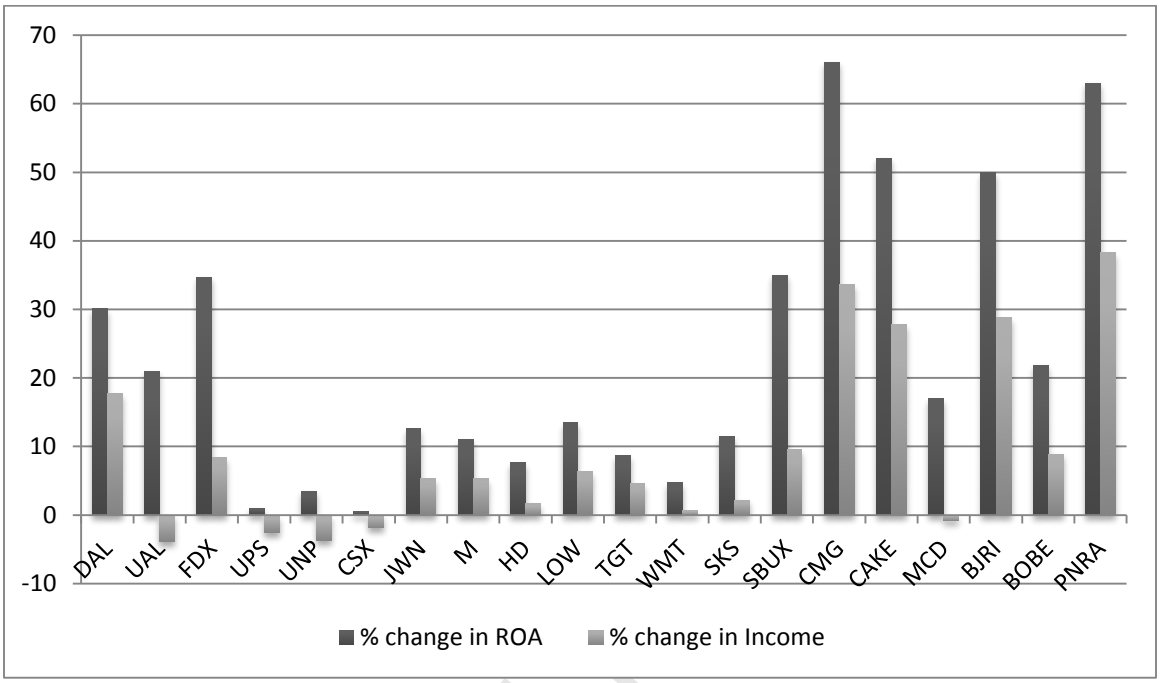
Figure 1
The effect of capitalizing operating leases on ROA and income

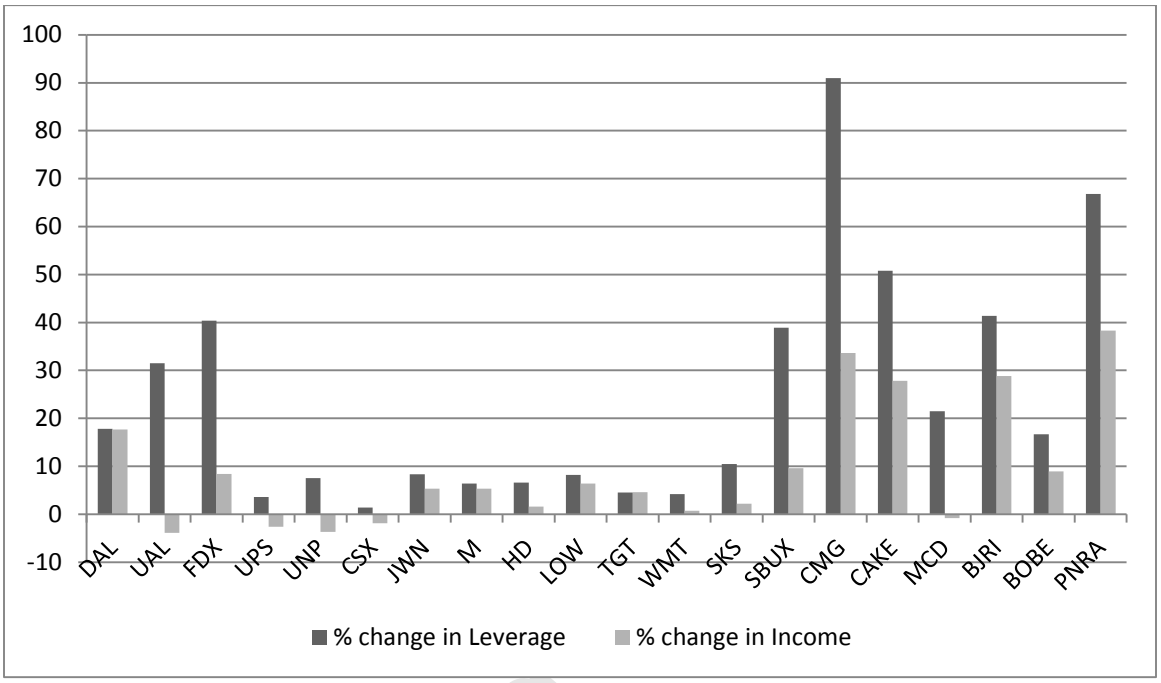


Notes:

1. DAL = Delta Airlines; UAL = United-Continental; FDX = Federal Express; UPS = United Parcel Service; UNP = Union Pacific; CSX = CSX Corp, JWN = Nordstrom; M = Macy's; HD = Home Depot; LOW = Lowe's; TGT = Target; WMT = Wal-Mart; SKS = Saks, SBUX = Starbucks; CMG = Chipotle Mexican Grill; CAKE = The Cheesecake Factory; MCD = McDonald's; BJRI = BJ's Restaurants; BOBE = Bob Evans Farms; PNRA = Panera Bread
2. The percentage changes are computed as [(revised metric – reported metric)/reported metric], where the metric is ROA or income. As the revised metric is generally smaller than the reported metric, the percentage change is usually negative. However, for ease of illustration the chart shows the absolute value of the percentage change for ROA, and reverses the sign of the percentage change for income. Consequently, for all companies except CSX (for which the change in ROA was very small but positive), the bars above the horizontal axis are in fact negative changes, and those below the axis are positive.

Figure 2

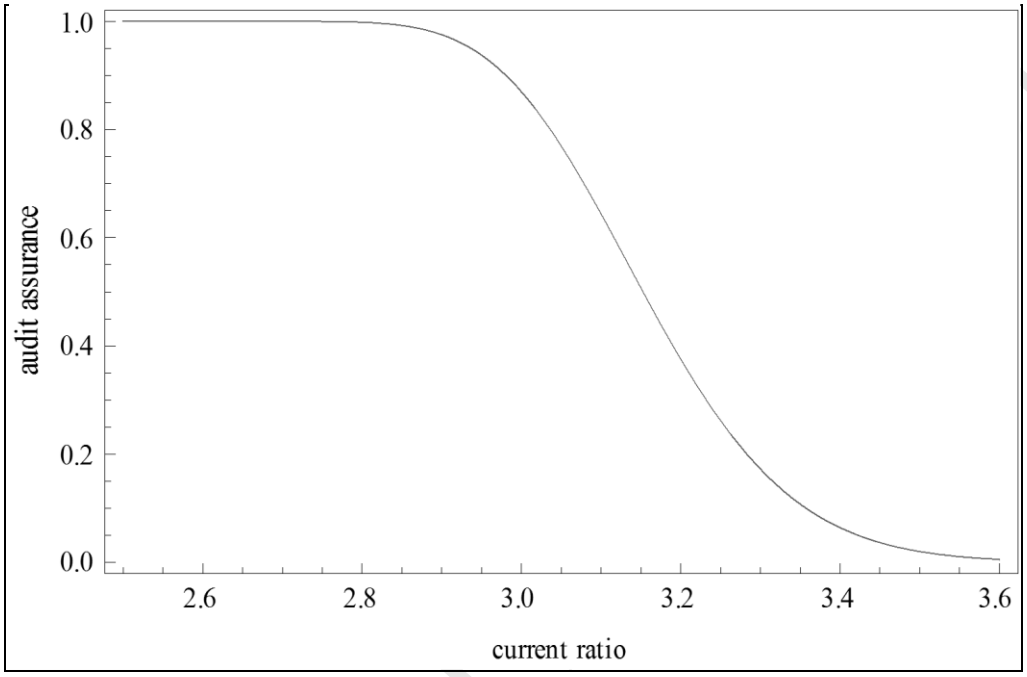
The effect of capitalizing operating leases on leverage (assets to equity)



Notes:

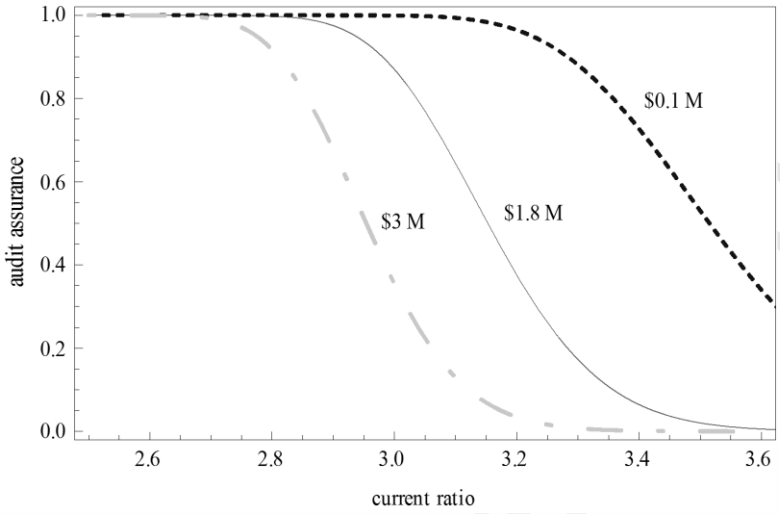
1. DAL = Delta Airlines; UAL = United-Continental; FDX = Federal Express; UPS = United Parcel Service; UNP = Union Pacific; CSX = CSX Corp, JWN = Nordstrom; M = Macy's; HD = Home Depot; LOW = Lowe's; TGT = Target; WMT = Wal-Mart; SKS = Saks, SBUX = Starbucks; CMG = Chipotle Mexican Grill; CAKE = The Cheesecake Factory; MCD = McDonald's; BJRI = BJ's Restaurants; BOBE = Bob Evans Farms; PNRA = Panera Bread
2. The percentage changes are computed as [(revised metric – reported metric)/reported metric], where the metric is assets-to-equity or income. The revised leverage ratio of assets-to-equity is always larger than the reported metric, so the percentage change is always positive. The percentage change in income is usually negative. For ease of illustration the chart reverses the sign of the percentage change for income, so that the bars for income above the horizontal axis are in fact negative changes, and those below the axis are positive.

Figure 3
Audit assurance as a function of the minimum current ratio
Required by the debt covenant

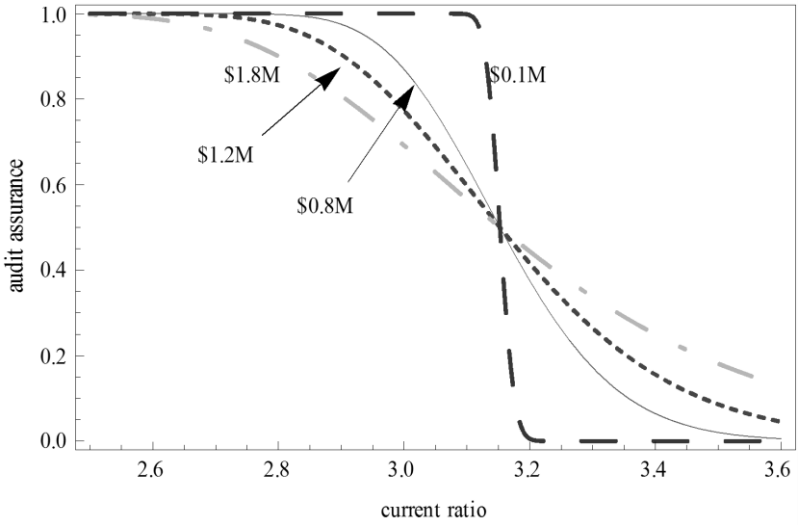


Note: The graph plots changes to audit assurance that the current ratio is fairly stated for varying levels of the minimum current ratio required by a debt covenant. The plot is based on the data provided in the numerical example for Crown Crafts. It assumes the reported value of the current ratio is 3.54 and the expected amount of receivables factored is $1.8 million with a standard deviation of $0.8 million.

Figure 4
Panel A
Audit assurance as a function of the minimum current ratio
Mean of amount factored: $0.1 M, $1.8M and $3M



Panel B
Audit assurance as a function of the minimum current ratio
Standard deviation of amount factored: $0.1M, $0.8M, $1.2M, and $1.8M



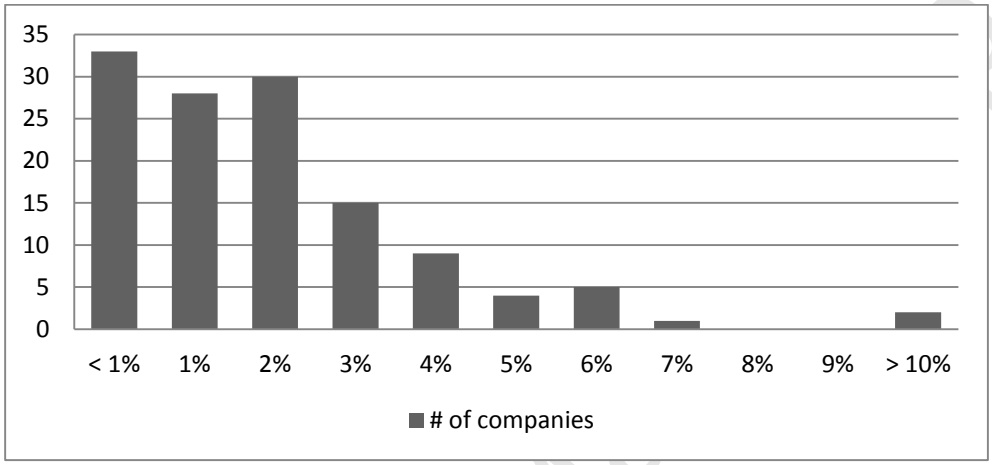
Note: The plots in Panel A (Panel B) represent different assumptions regarding the mean amount factored (the standard deviation).

Figure 5

Simulation analysis: Effect of immaterial financial statement error on the current ratio

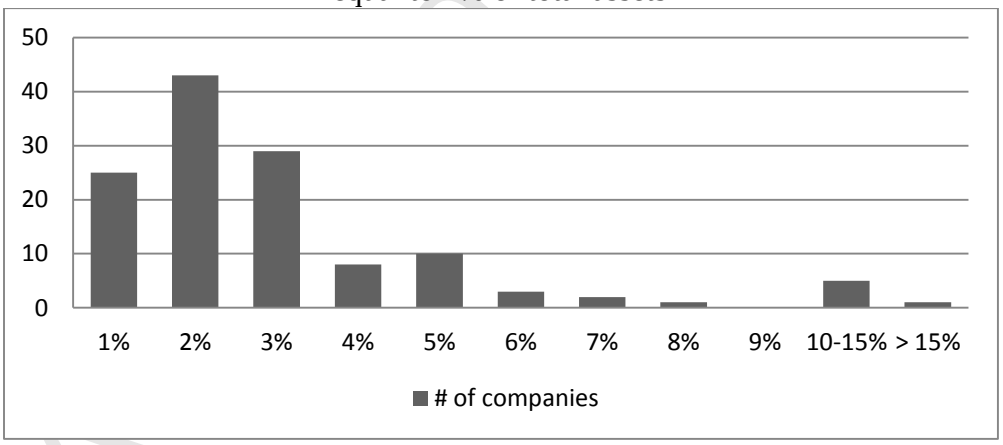
Panel A

Percentage change in the current ratio caused by an adjusting journal entry equal to 5% of income before taxes



Panel B

Percentage change in the current ratio caused by a reclassifying journal entry equal to 1% of total assets



Note: For 127 of the Fortune 200, Panel A shows the absolute value of the percentage change in the current ratio caused by an adjusting journal entry that lowers 2012 pre-tax income by 5% and increases current liabilities by the same dollar amount. The vertical axis shows the number of companies that fall into each group. The far-left column shows the number of companies for which a 5% change in income changes the current ratio by less than 1%. The column for 1% includes all companies for which the change in the current ratio is greater than 1% but less than 2%, and similarly for the columns for 2% through 9%. Panel B shows the percentage decrease in the current ratio caused by a reclassifying entry that decreases (increases) current (noncurrent) assets by 1% of total assets. Financial institutions, insurance companies, and companies with unclassified balance sheets are excluded.

Table 1: Effect of Repo 105 treatment on Lehman's leverage ratio

Quarter	Amount of Repo 105 Activity	Reported Net Leverage	Leverage without Repo 105	Difference	Difference as Percentage of Reported
Q4, 2007	$ 38.6 B	16.1	17.8	1.7	10.56%
Q1, 2008	49.1 B	15.4	17.3	1.9	12.34%
Q2, 2008	50.4 B	12.1	13.9	1.8	14.89%

Note: This table is taken from the Lehman Bankruptcy Examiner's report (Valukas 2010).

Table 2: Effect of capitalizing operating leases on ROA
Panel A: Transportation

Company (Ticker)	**DAL**	**UAL**	**FDX**	**UPS**	**UNP**	**CSX**
Income	$ 854	$ 840	$ 2,032	$ 3,804	$ 3,292	$ 1,822
Total Assets (beg. of year)	43,188	39,598	27,385	33,597	43,088	28,141
Rent Expense	1,420	2,811	1,794	348	613	96
Imputed values:						
Interest Rate	14%	13%	5%	6%	9%	7%
Rate of Depreciation	7.5%	9.1%	13.6%	10.2%	4.2%	4.1%
NPV of Lease Payments	$7,684	$12,475	$11,053	$1,221	$3,214	$390
Adjustments:						
Interest Expense	$ 1,076	$ 1,622	$ 553	$ 73	$ 289	$ 27
Depreciation Expense	576	1,139	1,503	125	136	16
Income	703	873	1,862	3,901	3,414	1,856
Assets	50,872	52,073	38,438	34,818	46,303	28,531
ROA (as reported)	0.020	0.021	0.074	0.113	0.076	0.065
ROA (as revised)	0.014	0.017	0.048	0.112	0.074	0.065
% change in ROA	-30.1%	-21.0%	-34.7%	-1.0%	-3.5%	0.5%
% change in Income	-17.7%	3.9%	-8.4%	2.6%	3.7%	1.9%

Notes:

1. DAL = Delta Airlines; UAL = United-Continental; FDX = Federal Express; UPS = United Parcel Service; UNP = Union Pacific; CSX = CSX Corp.
2. All dollar amounts are in millions. Income is for the most recent year reported in the 10-K filed in 2012. Total assets are from the balance sheet of the 10-K filed in 2011. Rent expense is the Year 1 operating lease payment reported in the footnote of the 10-K filed in 2011.
3. The interest rate used to capitalize the operating lease was either specified as a discount rate by the company in its notes or was imputed based on yearly capital lease payments and the resultant NPV.
4. The rate of depreciation was estimated by dividing the current year depreciation expense by the net property, plant and equipment balance of the previous year.
5. Adjusted income equals reported net income plus the rent expense minus depreciation and interest on the capitalized operating leases, net of taxes.
6. Adjusted assets are total assets plus the net present value of future minimum lease payments reported in the lease footnote discounted by the imputed interest rate. Payments beyond 5 years are discounted for 7.5 years.

Table 2: Effect of capitalizing operating leases on ROA
Panel B: Retail

Company (Ticker)	**JWN**	**M**	**HD**	**LOW**	**TGT**	**WMT**	**SKS**
Income	$ 683	$1,256	$3,338	$1,839	$2,929	$15,699	$ 75
Total Assets (beg. of year)	7,462	20,631	40,518	33,699	43,705	180,663	2,143
Rent Expense	111	245	783	418	190	1,406	61
Imputed values:							
Interest Rate	11%	14%	26%	15%	12%	13%	15%
Rate of Depreciation	16.0%	12.3%	6.6%	6.7%	8.4%	7.5%	13.4%
NPV of Lease Payments	$618	$1,320	$2,655	$2,763	$1,952	$7,631	$224
Adjustments:							
Interest Expense	$ 68	$ 185	$ 690	$ 415	$ 234	$ 992	$ 34
Depreciation Expense	99	163	176	185	163	575	30
Income	647	1,189	3,284	1,721	2,794	15,594	73
Assets	8,080	21,951	43,173	36,462	45,657	188,294	2,367
ROA (as reported)	0.092	0.061	0.082	0.055	0.067	0.087	0.035
ROA (as revised)	0.080	0.054	0.076	0.047	0.061	0.083	0.031
% change in ROA	-12.6%	-11.0%	-7.7%	-13.5%	-8.7%	-4.7%	-11.5%
% change in Income	-5.3%	-5.3%	-1.6%	-6.4%	-4.6%	-0.7%	-2.2%

Notes:
1. JWN = Nordstrom; M = Macy's; HD = Home Depot; LOW = Lowe's; TGT = Target; WMT = Wal-Mart; SKS = Saks.
2. See Notes 2 through 6 for Panel A.

Table 2: Effect of capitalizing operating leases on ROA
Panel C: Restaurant chains

Company (Ticker)	**SBUX**	**CMG**	**CAKE**	**MCD**	**BJRI**	**BOBE**	**PNRA**
Income	$1,384	$ 215	$ 96	$ 5,503	$ 32	$ 73	$136
Total Assets (beg. of year)	7,360	1,122	1,028	31,975	430	1,094	925
Rent Expense	751	115	61	1,201	22	25	93
Imputed values:							
Interest Rate	10%	11%	10%	10%	10%	10%	10%
Rate of Depreciation	23.4%	11.1%	9.5%	6.4%	10.3%	9.1%	18.0%
NPV of Lease Payments	$2,866	$1,073	$522	$6,881	$178	$183	$618
Adjustments:							
Interest Expense	$287	$107	$52	$688	$18	$18	$62
Depreciation Expense	669	119	50	441	18	17	111
Income	1,251	143	69	5,549	23	67	84
Assets	10,226	2,195	1,550	38,856	608	1,277	1,543
ROA (as reported)	0.188	0.192	0.093	0.172	0.074	0.067	0.147
ROA (as revised)	0.122	0.065	0.045	0.143	0.037	0.052	0.054
% change in ROA	-35.0%	-66.1%	-52.1%	-17.0%	-50.0%	-21.9%	-63.0%
% change in Income	-9.6%	-33.6%	-27.8%	0.8%	-28.8%	-8.9%	-38.3%

Notes:
1. SBUX = Starbucks; CMG = Chipotle Mexican Grill; CAKE = The Cheesecake Factory; MCD = McDonald's; BJRI = BJ's Restaurants; BOBE = Bob Evans Farms; PNRA = Panera Bread.
2. See Notes 2 through 6 for Panel A.

Table 3: Effect of capitalizing leases on leverage (assets to equity)
Panel A: Transportation

Company (Ticker)	**DAL**	**UAL**	**FDX**	**UPS**	**UNP**	**CSX**
Total Assets	$43,188	$39,598	$27,385	$33,597	$43,088	$28,141
Total Equity	897	1,727	15,220	8,047	17,763	8,700
Imputed values:						
Interest Rate	14%	13%	5%	6%	9%	7%
NPV of Lease Payments	$ 7,684	$12,475	$11,053	$ 1,221	$ 3,214	$ 390
Adjusted Assets	50,872	52,073	38,438	34,818	46,303	28,531
Leverage (as reported)	48.1	22.9	1.8	4.2	2.4	3.2
Leverage (as revised)	56.7	30.2	2.5	4.3	2.6	3.3
% change in Leverage	17.8%	31.5%	40.4%	3.6%	7.5%	1.4%
% change in Income	-17.7%	3.9%	-8.4%	2.6%	3.7%	1.9%

Notes:

1. DAL = Delta Airlines; UAL = United-Continental; FDX = Federal Express; UPS = United Parcel Service; UNP = Union Pacific; CSX = CSX Corp.
2. All dollar amounts are in millions. Balance sheet amounts are from the 10-K filed in 2011. See notes to Table 2 for additional information and company names.
3. The interest rate used to capitalize the operating lease was either specified as a discount rate by the company in its notes or was imputed based on yearly capital lease payments and the resultant NPV.
4. Adjusted assets are total assets plus the net present value of future minimum lease payments reported in the lease footnote discounted by the imputed rate. Payments beyond 5 years are discounted for 7.5 years.

Table 3: Effect of capitalizing leases on leverage (assets to equity)
Panel B: Retail

Company (Ticker)	**JWN**	**M**	**HD**	**LOW**	**TGT**	**WMT**	**SKS**
Total Assets	$7,462	$20,631	$40,518	$33,699	$43,705	$180,663	$2,143
Total Equity	2,021	5,530	17,898	18,112	15,487	71,247	1,164
Imputed values:							
Interest Rate	11%	14%	26%	15%	12%	13%	15%
NPV of Lease Payments	$ 618	$ 1,320	$ 2,655	$ 2,763	$ 1,952	$ 7,631	$ 224
Adjusted Assets	8,080	21,951	43,173	36,462	45,657	188,294	2,367
Leverage (as reported)	3.7	3.7	2.7	1.9	2.8	2.5	1.8
Leverage (as revised)	4.0	4.0	2.4	2.0	2.9	2.6	2.0
% change in Leverage	8.3%	6.4%	6.6%	8.2%	4.5%	4.2%	10.5%
% change in Income	-5.3%	-5.3%	-1.6%	-6.4%	-4.6%	-0.7%	-2.2%

Notes:
1. JWN = Nordstrom; M = Macy's; HD = Home Depot; LOW = Lowe's; TGT = Target; WMT = Wal-Mart; SKS = Saks.
2. See Notes 2 through 4 for Panel A.

Panel C: Restaurant chains

Company (Ticker)	**SBUX**	**CMG**	**CAKE**	**MCD**	**BJRI**	**BOBE**	**PNRA**
Total Assets	$7,360	$1,122	$1,028	$31,975	$430	$1,094	$925
Total Equity	4,387	811	592	14,634	288	664	596
Imputed values:							
Interest Rate	10%	11%	10%	10%	10%	10%	10%
NPV of Lease Payments	$ 2,866	$1,073	$ 522	$ 6,881	$178	$ 183	$ 618
Adjusted Assets	10,226	2,195	1,550	38,856	608	1,277	1,543
Leverage (as reported)	1.68	1.38	1.74	2.18	1.49	1.65	1.55
Leverage (as revised)	2.33	2.64	2.62	2.66	2.11	1.92	2.59
% change in Leverage	38.9%	91.0%	50.8%	21.5%	41.4%	16.7%	66.8%
% change in Income	-9.6%	-33.6%	-27.8%	0.8%	-28.8%	-8.9%	-38.3%

Notes:
1. SBUX = Starbucks; CMG = Chipotle Mexican Grill; CAKE = The Cheesecake Factory; MCD = McDonald's; BJRI = BJ's Restaurants; BOBE = Bob Evans Farms; PNRA = Panera Bread.
2. See Notes 2 through 4 for Panel A.

Table 4: Crown Crafts' liquidity ratios with and without factoring of accounts receivable

Account	**2011 as reported** ($1,000's)	**2011 as adjusted** ($,1000's)
Cash	$ 205	$ 205
Accounts receivable (due from factor in the as-reported column)	17,819	19,619
Accounts receivable, other	834	834
Inventory	13,560	13,560
Other current assets	2,865	2,865
Total Current assets	$35,283	$37,083
Accounts Payable	$ 5,050	$ 5,050
Notes payable and current maturities of long-term debt	1,952	3,752
Other current liabilities	2,969	2,969
Total Current Liabilities	$ 9,971	$ 11,771
Quick Ratio [(cash + marketable securities + accounts receivable) ÷ current liabilities]	1.891	1.755
Current Ratio (current assets ÷ current liabilities)	3.539	3.150

Note: This Table calculates Crown Crafts' current ratio and quick ratio under two scenarios. The first scenario is based on reported financial statement balances. The second scenario recalculates these ratios assuming that the amount of off-balance sheet financing implicit in the company's factoring arrangements were alternatively obtained through traditional borrowing arrangements. This pro forma scenario involves debiting the amount due from factor and crediting notes payable by an amount equal to the receivables balance for which the factor has advanced Crown Crafts' cash, but for which the factor is earning interest on that advance because the customers' balances are past due.

Table 5: Sources of audit risk in commonly-used financial ratios

	Numerator only	Denominator only	Both
Short-term Liquidity			
Quick ratio	1) Sales cutoff error 2) Inadequate allowance for doubtful accounts	1) Failure to recognize the current portion of a long-term obligation	1) Factoring of accounts receivable 2) Cutoff error in the disbursements system
Current ratio	1) Overstatement of inventory 2) See the examples above for the quick ratio	1) Failure to recognize unearned revenue 2) Misclassification of current and noncurrent liabilities	1) Factoring of accounts receivable 2) Cutoff error in the purchases or disbursements system
Long-term Solvency			
Assets to equity	1) Repo 105 2) Capitalization of operating leases	1) Failure to record contingent liability	1) Fair value transactions affecting assets and OCI
Debt to equity	1) Capitalization of operating leases 2) Failure to consolidate VIE debt	1) Fair value transactions affecting assets and OCI	
Interest coverage (cash flow)	1) Misclassification of cash flows	1) Capitalization of operating leases	1) Cutoff error in disbursements system
Profitability			
Gross margin percentage	1) Costing errors in inventory	1) Gross vs. net method for revenue recognition in e-commerce	1) Recording revenue prior to shipping goods or performing services
Return on assets (ROA)		1) Capitalization of operating leases 2) Improper valuation of goodwill in post-acquisition years	1) Asset impairment in current period 2) Errors in revenue recognition related to performance obligations
Return on equity (ROE)		1) Effect of convertible debt or stock options on equity	1) Errors in computation of current period income
Asset Utilization			
Asset turnover	1) Customer receipt booked as revenue but performance obligation not met	1) Asset impairment. 2) Improper valuation of goodwill	1) Error in revenue recognition on percentage of completion contract
Inventory turnover	1) Cost variances taken to COGS	1) Inventory write-down not affecting COGS	

Note: This table provides examples of accounting errors, estimates and choices that can cause commonly-used financial ratios to be misleading, categorized by whether the effect flows through the numerator of the ratio, the denominator, or both.