

**SELL-IN VERSUS SELL-THROUGH REVENUE RECOGNITION:
AN EXAMINATION OF FIRM CHARACTERISTICS AND
FINANCIAL INFORMATION QUALITY**

A Dissertation

by

STEPHANIE JEAN BINGER RASMUSSEN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

August 2009

Major Subject: Accounting

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ABSTRACT

Sell-in versus Sell-through Revenue Recognition: An Examination of Firm Characteristics and Financial Information Quality. (August 2009)

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This study examines revenue recognition methods used by high technology firms for sales to distributors. Revenue is either recognized when products are delivered to distributors (sell-in) or when distributors resell products to end-users (sell-through). This is the first empirical study to examine the firms that use these revenue recognition methods and the quality of financial information reported under the methods.

I use a logistic regression to compare 479 firm-year observations in the computer and electronic equipment industries that use either the sell-in method or the sell-through method. I find that firms with higher growth opportunities and strong corporate governance are less likely to use the sell-in method. In addition, corporate governance strength moderates the association between use of the sell-in method and both capital requirements and management incentive compensation.

Using ordinary least squares regression, I also examine two proxies for financial information quality: the ability of accounting information to predict future cash flows and the association between accounting information and stock returns. Results of these

regressions suggest that financial information quality is higher under a deferred revenue recognition method (sell-through). Specifically, the ability of accounting information to predict future cash flows and the association between accounting information and returns are both higher for sell-through firms than for sell-in firms.

The results of this study suggest that systematic differences exist between sell-in firms and sell-through firms and financial information quality differs between the two revenue recognition methods.

DEDICATION

I dedicate this dissertation to my husband and my parents.

To my husband, Jason, who has made significant personal sacrifices over the past four years so that I could pursue my PhD. Thank you for your constant love and support throughout the ups and downs of my doctoral studies. I am so grateful that you were willing to help me follow my dream.

To my parents, Ron and Jean Binger, who have always encouraged and supported me. Thank you for being incredible parents and role models.

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TABLE OF CONTENTS

		Page
ABSTRACT		iii
DEDICATION		v
ACKNOWLEDGEMENTS		vi
TABLE OF CONTENTS		vii
CHAPTER		
I	INTRODUCTION.....	1
II	BACKGROUND AND PRIOR RESEARCH	8
	Revenue Recognition Practices of High Technology Industries....	8
	Financial Information Quality	10
	Prior Research on Revenue Recognition.....	11
III	HYPOTHESES DEVELOPMENT.....	13
	Costs and Benefits of the Revenue Recognition Methods	13
	Empirical Predictions	15
	Financial Information Quality	20
IV	FIRM CHARACTERISTICS AND REVENUE RECOGNITION	22
	Research Design.....	22
	Sample Selection	26
	Descriptive Statistics and Correlations	27
	Multivariate Analyses	29
	Supplemental Analysis.....	33
V	FINANCIAL INFORMATION QUALITY AND REVENUE RECOGNITION.....	35
	Ability of Accounting Information to Predict Future Cash Flows..	35
	Association between Accounting Information and Stock Returns..	39
	Supplemental Analyses	43

CHAPTER	Page
VI CONCLUSION	45
REFERENCES	47
APPENDIX A	55
APPENDIX B	58
VITA	70

CHAPTER I

INTRODUCTION

This study examines revenue recognition methods used by high technology firms for sales to distributors. Distributors purchase products from manufacturers and resell the products to end-users. This activity is common within high technology industries, and current accounting standards allow firms some discretion on when to recognize revenue from sales to distributors. Two revenue recognition methods exist: the sell-in method and the sell-through method. I address two research questions in this study. First, what firm characteristics are associated with technology firms' choice of revenue recognition method for sales to distributors? Second, does the quality of financial information differ between the two revenue recognition methods?

Under the *sell-in* method, firms recognize revenue when the product is delivered to the distributor (i.e. product is sold *into* the distribution channel). Under the *sell-through* method, firms defer revenue recognition until the distributor resells the product to an end customer (i.e. product is sold *through* the distribution channel). Sales to distributors usually meet the Staff Accounting Bulletin (SAB) No. 104 revenue recognition requirements that persuasive evidence of an arrangement exists and delivery has occurred.¹ The decision to use the sell-in or sell-through method generally depends upon the remaining two SAB 104 requirements: the final selling price is fixed or determinable and collectability is reasonably assured. Sales in high technology

This dissertation follows the style of *The Accounting Review*.

¹ The revenue recognition principles contained in SAB 104 are relatively unchanged from SAB 101 (SEC 1999, 2003). The main purpose of SAB 104 was to rescind accounting guidance within SAB 101 that was superseded by the FASB's Emerging Issues Task Force (EITF) 00-21.

industries are often subject to rights of return and to pricing adjustments due to price reductions in the marketplace. A conservative interpretation of SAB 104 suggests that the final selling price for any distributor sales subject to pricing adjustments or rights of return are indeterminable. However, interpretive guidance within SAB 104 suggests that a selling price is determinable if product returns and pricing adjustments can be reasonably estimated.² The probability of collection depends on the fixed or determinable nature of the final selling price and if collections depend on the distributor reselling the products. Based on these factors, the sell-in method is typically considered the more aggressive method (Glass, Lewis & Co. 2004; Greenberg 2006). However, the discretion provided under SAB 104 allows high technology firms enough flexibility to justify using either revenue recognition method.³

Understanding the characteristics of firms that use different revenue recognition methods and financial information quality under those methods is important for many reasons. First, revenue is arguably the most important component of earnings. Revenue is usually the largest item on the income statement and it is often viewed as a strong indicator of firm performance (Turner 2001). A former chairman of the SEC argued that early or premature revenue recognition is a fundamental problem in accounting (Levitt 1998), and misreported revenue is a leading cause of financial restatements (GAO

² Guidance about fixed and determinable sales prices refers to Statement 48, para. 6 and 8, which state that revenue cannot be recognized if a firm is unable to make a reasonable estimate of product returns (FASB 1981). SAB 104 also directs users to SOP 97-2, para. 26 and 30-33, which states that prices on products sold to distributors are not fixed and determinable if the seller is unable to make reasonable estimates of pricing adjustments (AICPA 1997).

³ The first two disclosure examples in Appendix A suggest that sales arrangements with distributors are essentially identical for the firms identified, yet one firm uses the sell-in method and the other uses the sell-through method.

2007).⁴ Overstated revenue has also been documented as the cause of at least 50 percent of Accounting and Auditing Enforcement Releases (AAER) (Feroz et al. 1991; Dechow et al. 1996; Dechow et al. 2007).

Second, evidence on the effects of sell-in and sell-through methods on firm reporting quality is potentially useful to standard setters. The FASB has undertaken a joint project with the IASB to create a comprehensive revenue recognition standard (FASAC 2006). While it is unclear if the comprehensive revenue recognition standard will allow both the sell-in and sell-through methods, Lynn Turner, former SEC Chief Accountant, has expressed concerns about the sell-in method (Greenberg 2006):

I have had to deal with the issue of whether you recognize revenue upon sell-in versus sell-through as an audit partner, a CFO and as a regulator, and now as an advisor to institutions. In all of these, I found nothing good about revenue recognition upon sell-in. Sooner or later, the urge to stuff the channel, especially when things are not going well and numbers for the next quarter are short, is very tempting.

The FASB's current Statement of Concepts (FASB 1978, para. 37) and a recent exposure draft of the proposed future conceptual framework (FASB 2008) both argue that financial reporting should provide information that capital providers and other parties can use to assess an entity's future net cash flows. Although current period cash flows may be the same under both the sell-in and sell-through methods if distributors settle accounts receivable prior to product resale, the ability of accounting information to predict *future* cash flows may differ between the two methods. It is also unclear whether

⁴ Cost/expense errors and revenue errors were the leading causes of restatements from January 1997-September 2005. In this period, 27.4 (27.2) percent of restatements were due to cost/expense (revenue) errors (GAO 2007).

sell-in or sell-through accounting information is most consistent with firm values.⁵ To my knowledge, this is the first study to empirically examine financial information quality under the sell-in and sell-through methods.

Finally, the evidence presented in this study may be useful for firms in industries that use the sell-in and sell-through methods for revenue recognition. Insights about the characteristics of firms that use different revenue recognition methods and the quality of financial information under the two methods may be helpful to firms that are examining their own revenue recognition practices and/or considering an accounting method change.

In order to address my research questions, I study 479 unique firm-year observations in the computers and electronic equipment industries during 2001-2005. I classify firms in these industries as sell-in or sell-through based on their 10-K revenue recognition disclosures.

I first investigate the characteristics of firms that use the sell-in and sell-through methods. Specifically, I test for associations between use of the sell-in method and proxies for capital requirements, management incentive compensation, growth opportunities, and corporate governance strength. I find that use of the sell-in method is negatively associated with growth opportunities and corporate governance strength. I also find that as capital requirements and management incentive compensation increases,

⁵ Prior research does examine the association between stock returns and accounting information under other revenue recognition practices (e.g. Altamuro et al. 2005; Zhang 2005; Srivastava 2008). These studies all examine firms that were required by standard changes to use less aggressive revenue recognition practices. The evidence presented in these studies suggests that the association between accounting information and stock returns was stronger when firms were allowed to accelerate revenue recognition than when they were required to delay it.

firms with strong corporate governance are less likely to use the sell-in method than firms with weak governance. Thus, corporate governance strength moderates the association between use of the sell-in method and other factors.

Next, I examine whether financial information quality differs between the sell-in method and the sell-through method. It is not clear that one method is consistently more reliable than the other method. The sell-in method may suffer from errors in estimating product return and/or pricing adjustment accruals. Managers may also use the discretion allowed under this method to enhance performance through channel stuffing or accrual manipulation⁶. Meanwhile, reliability concerns exist for sell-through accounting if distributor inventory and resale data contain errors or are not updated on a timely basis. It is also unclear if financial statement users perceive differences in relevance between the two revenue recognition methods. The sell-in method provides timely information about expected future demand but not current end-user demand. On the other hand, the sell-through method more accurately reflects end-user demand and is a signal of conservative accounting practices.

I use two proxies to test for financial information quality differences between the sell-in and sell-through methods: (1) the ability of accrual accounting information to predict future cash flows, and (2) the association between accounting information and contemporaneous stock returns. I find that sell-through firms' accrual accounting information is more highly associated with future cash flows than sell-in firms'

⁶ Channel stuffing occurs when (1) manufacturers pull in and ship distributor orders originally scheduled to be delivered in the next accounting period or (2) distributor inventory levels significantly exceed the amount historically needed to service end customers.

information. These results are consistent with Forester (2008) who finds that the ability of accrual accounting information to predict future cash flows is better for firms using deferred revenue recognition practices. I also find that accounting information reported under the sell-through method is more strongly associated with contemporaneous stock returns than accounting information reported under the sell-in method. This suggests that the sell-through method provides more timely accounting information than the sell-in method. Taken together, the results of these two tests suggest that the sell-through method produces higher quality financial information than the sell-in method.

This study contributes to the literature in a number of ways. First, this study examines revenue recognition practices that have not previously been examined: the sell-in method, which offers companies the opportunity to accelerate revenue recognition, and the sell-through method, under which revenues are likely to be recognized relatively conservatively. Second, this study provides additional evidence that use of conservative revenue recognition methods is associated with higher growth opportunities and strong corporate governance (Skinner 1993; Altamuro et al. 2005). In addition, corporate governance strength moderates the association between revenue recognition practices and certain firm characteristics. Finally, this study suggests that financial information quality is higher under a deferred revenue recognition practice. This result is important because prior research offers mixed evidence regarding financial information quality under aggressive and delayed revenue recognition methods (Altamuro et al. 2005; Zhang 2005; Forester 2008). The evidence presented in this study should be of interest to investors, practitioners, auditors, and regulators.

The remainder of this paper is organized as follows. Chapter II discusses background and prior research while Chapter III develops my hypotheses. Chapter IV examines the association between firm characteristics and revenue recognition practices. Chapter V examines financial information quality under the sell-in and sell-through methods. Chapter VI concludes.

CHAPTER II

BACKGROUND AND PRIOR RESEARCH

Revenue Recognition Practices of High Technology Industries

The sell-in and sell-through methods differ with respect to the timing of revenue recognition for sales to distributors. Under the sell-in method, revenue and cost of goods sold are recognized upon product delivery to the distributor. Under the sell-through method, revenue is deferred until notification is received that the distributor has resold the product. Accounts receivable are typically recorded when the distributor receives the products, and the distributor often pays for the products before they are resold.

Distributors typically have some limited right of return, but 10-K filings suggests that most distributors do not have unlimited return privileges on regular purchases.⁷ I expect firms' revenue recognition method to be relatively sticky over time since a cumulative effects adjustment would be needed if firms change accounting methods.

If distributor purchases equal distributor resales, sell-in revenue differs from sell-through revenue by the amount of return and pricing adjustment allowances required under the sell-in method. However, if distributor purchases exceed resales, then revenue is higher under the sell-in method than the sell-through method. For example, Apogee Technology initially reported fiscal 2003 sell-in product revenue of \$9.3 million and later retroactively reported 2003 sell-through product revenue of \$7.8 million when it

⁷ Distribution agreements between manufacturers and distributors typically do include clauses that allow the distributors to return any product on hand if the relationship between the two parties is terminated (e.g. Arrow Electronics 2004 10-K filing; Avnet 2005 10-K filing; Ingram Micro 2005 10-K filing). However, most manufacturers and distributors enter into agreements with the intent of maintaining a long-term relationship.

changed accounting methods (Apogee Technology 2004 10-K/A filing).⁸ The difference is because distributor purchases were significantly higher than resales. This example indicates that revenue recognition practices can significantly affect reported operating performance.

Current U.S. GAAP provides some revenue recognition guidance for product sales to distributors. As discussed earlier, revenue recognition under SAB 104 requires (1) persuasive evidence that an arrangement exists, (2) delivery has occurred, (3) final selling price is fixed or determinable, and (4) collectability is reasonably assured. SAB 104 also notes that product returns estimations, and thus determination of a final selling price, for sales to distributors may be difficult due to the following factors: channel stuffing, difficulty in observing distributor inventory and resale data, and the significance of a distributor to the seller's business.⁹ Estimates of future pricing adjustments may also be difficult, and SAB 104 refers financial statement preparers to SOP 97-2 for guidance on this issue.¹⁰

The distributor is considered the customer for revenue recognition purposes but is not the end-user of the products. Distributors attempt to stock products they can resell, and they purchase inventory based on existing customer orders and expectations

⁸ Apogee adopted the sell-through method after an investigation by its audit committee found that the firm's use of the sell-in revenue recognition method did not comply with U.S. GAAP.

⁹ It is important to note that it would also be difficult for a firm to use the sell-through revenue recognition method if distributor resale and inventory data are not easily obtainable.

¹⁰ High technology firms offer pricing adjustments to their distributors in order to compensate for price reductions in the marketplace or to incentivize sales of certain products (Lee et al. 2000; CSFB 2004). Since the exact amount of pricing adjustments is often not known until the distributor resells the product, firms use historical resale information to estimate pricing adjustment.

about future orders.¹¹ If actual distributor resales significantly vary from forecasted orders and speculative beliefs, sell-in revenue will not provide timely information about future end-user demand.

Accounting for revenue from sales to distributors is important for high technology firms because these firms depend heavily on distributors to service customers. An equity research report suggest that distributors service more than 25 percent of global semiconductor/electronic component sales (CSFB 2004), and manufacturer 10-K filings suggest that 50 percent or more of their sales can go through distributors (e.g. Fairchild Semiconductor 2004 10-K filing; Cypress Semiconductor 2005 10-K filing). Distributors provide (1) access to an additional “sales force,” (2) aggregation and service of small orders, and (3) reduced collection risk (CSFB 2004).

Financial Information Quality

The quality of financial accounting information should be of interest to all parties that create or use financial statements. Earnings quality is often used as an indicator of overall financial information quality in prior studies (Schipper and Vincent 2003; Francis et al. 2006). The FASB’s Conceptual Framework implies that decision usefulness is the appropriate benchmark to assess the effectiveness and quality of accounting information (Concepts Statement No. 2, FASB (1980), paras. 30 and 32). However, financial statement users often define decision usefulness differently.

¹¹ One equity research report suggests that the composition of electronic component distributors’ inventory is as follows: 25 percent to support existing customer orders, 50 percent to support expected future customer orders, and 25 percent as speculative inventory to support unanticipated demand (CSFB 2004).

Prior studies use accounting-based and market-based measures of earnings quality (see Francis et al. 2006 for a thorough discussion).¹² Accounting-based measures assume that higher quality earnings allow for better estimation of future cash flows, earnings, or earnings components. In general, more persistent, more predictive, and less variable earnings are assumed to be of higher quality (e.g. FASB 1980; Penman and Zhang 2002; Zhang 2005). Earnings are also assumed to be higher quality when accrual estimation errors are smaller (e.g. Dechow and Dichev 2002).

Market-based measures assume that higher quality accounting information better represents firm value and reflects the good and bad news in stock returns in a timely manner. Studies using returns-earnings regressions view stronger associations as evidence of more relevant and reliable accounting information, and thus higher earnings quality (e.g. Barth, Beaver, and Landsman 2001). Other studies measure the timeliness and conservatism in earnings using earnings-returns regressions and view more timely and more conservative earnings as being of higher quality (e.g. Basu 1997; Ball et al. 2000).

Prior Research on Revenue Recognition

There is limited research on firms' revenue recognition methods and their impact on financial information quality. Prior research suggests that firms with external financing needs, financial covenants, or weaker corporate governance are more likely to accelerate revenue recognition (Bowen et al. 2002; Marquardt and Weidman 2004;

¹² Additional ex-post indicators of earnings quality include financial restatements, bankruptcies, litigation, and discontinuities around earnings targets (Degeorge et al. 1999; Anderson and Yohn 2002; Ecker et al. 2006).

Altamuro et al. 2005).¹³ Other studies examine firms that adopted accounting standards intended to delay revenue recognition (Altamuro et al. 2005; Zhang 2005; Forester 2008; Srivastava 2008). In general, these studies examine short time periods after standard changes and find that accelerated revenue recognition results in more timely and relevant accounting information.¹⁴ However, Forester (2008) examines a longer period and finds that the initial decline in earnings informativeness is due to a temporary disturbance caused by deferred revenues resulting from SAB 101 adoption. After these deferred revenues are recognized, Forester (2008) finds that the deferred revenue recognition method improves earnings informativeness in later periods.

¹³ Prior research also finds that more than 50 percent of AAERs are due to overstated revenue (Feroz et al. 1991; Dechow et al. 1996; Dechow et al. 2007). Revenue recognition errors are one of the leading causes of restatements from 1997-2006 (GAO 2007) and are associated with more negative stock price reactions and a higher likelihood of litigation than other restatements (Anderson and Yohn 2002; Wu 2003; Palmrose and Scholz 2004). Other research finds that firms manipulate revenue to meet or beat earnings benchmarks (Caylor 2008; Stubben 2006).

¹⁴ Zhang (2005) also finds that accelerated revenue recognition results in less reliable revenue for her sample (i.e. larger accounts receivable errors and less reduced revenue predictability).

CHAPTER III

HYPOTHESES DEVELOPMENT

The first objective of this study is to investigate characteristics of firms that use the sell-in and sell-through methods. Based on the fact that both methods are used in practice and the assumption that SAB 104 generally offers enough discretion for high technology firms to justify using either method, I expect that firms use the method they perceive offers the greatest net economic benefit. I use prior accounting research and anecdotal evidence to identify potential costs and benefits of the sell- and the sell-through methods. I then offer hypotheses about firm characteristics that I expect to be associated with use of the revenue recognition methods.

Costs and Benefits of the Revenue Recognition Methods

Several commentators characterize the sell-in method as more aggressive than the sell-through method (Glass, Lewis & Co. 2004; Greenberg 2006). However, the sell-in method does offer benefits. Because the sell-in method recognizes revenue upon delivery to distributors, it provides a more timely reflection of actual business transactions. Texas Instruments gives this reason for using the sell-in method (Greenberg 2006). Sell-in revenue recognition also provides information about expected product demand (i.e. future distributor resales).

Potential costs of using the sell-in method arise from the estimations and discretion allowed under this method. The requirement to maintain product return and

pricing adjustment accruals creates the possibility of unintentional estimation errors.¹⁵ In addition, managers can manipulate performance by channel stuffing and/or adjusting product return and pricing adjustment allowances. Both of these factors increase the risk of accounting misstatements (Glass, Lewis & Co. 2004). For example, Symbol Technologies restated two years of prior financial statements due to a variety of revenue recognition issues, including selling prices that were later deemed undeterminable because of pricing adjustments subsequently awarded to distributors (Symbol Technologies 2002 10-K filing). This company switched to the sell-through method as part of its financial restatement process.

The benefits of using the sell-through method relate to its conservative nature. This method more accurately reflects end-user demand and offers no incentive to stuff the distribution channel.¹⁶ Accordingly, firms may use the sell-through method to signal the quality of their financial information. Levine and Hughes (2005) model a setting where conservative accounting choices provide positive signals about future cash flows. Conservative accounting should also reduce the risk of shareholder litigation, which is typically associated with overstated rather than understated net assets and earnings (Kellogg 1984; St. Pierre and Anderson 1984; Watts 2003).

Obtaining the benefits of the sell-through method does come at a cost. First, firms using the sell-through method depend on the reliability of distributor resale and

¹⁵ Some firms cite estimation difficulties due to frequent price changes and technological obsolescence as reasons for using the sell-through method (e.g. Intel 2007 10-K filing; Micron 2007 10-K filing; Supertex 2007 10-K filing).

¹⁶ Increased focus on end-user demand and reduction of distributor inventory were both mentioned by ON Semiconductor and International Rectifier when they announced plans to use the sell-through method (ON Semiconductor press release 4/25/01; International Rectifier conference call 8/4/08).

inventory data.¹⁷ Chipalkatti et al. (2007) note that it may be difficult to obtain distributor data, remove data errors, validate the data, and convert data received from multiple distributors into one consistent format.¹⁸ In order to deal with these issues, the sell-through revenue recognition process requires additional internal controls beyond those controls used for revenue recognition of non-distributor customer sales. Second, practitioners have stated that it is difficult to find sell-through accounting resources. Sell-through firms admit to: (1) advising other firms on sell-through accounting practices, and (2) using spreadsheets and home grown systems to facilitate sell-through accounting due to limited off the shelf software products that meet their needs.

Empirical Predictions

The costs and benefits discussion in the previous section leads to a number of predictions about associations between firm characteristics and use of the sell-in and sell-through methods. The first characteristic I expect to be associated with the revenue recognition method used is a firm's capital requirements. Firms with existing capital or need of new capital may use the *sell-through* method in order to signal a commitment to more conservative accounting. Prior research finds that lenders benefit from conservative accounting by receiving more timely signals of default risk, and that lenders reward borrowers using conservative accounting with lower interest rates (e.g. Ahmed et al. 2002; Zhang 2008). In addition, firms undergoing an initial public offering

¹⁷ Distributor data issues also affect sell-in firms' product return and pricing adjustment estimates. However, all revenue recognition for sell-through firms depends on distributor data. I view problems with distributor data to be a greater risk for sell-through firms than for sell-in firms.

¹⁸ Texas Instruments cites its lack of confidence in Asian distributor data as one reason it uses the sell-in method (Greenberg 2006), and a recent KPMG (2006) study indicates that 20 percent of resale reports from channel partners may contain missing data or errors.

have been found to report more conservatively than private firms suggesting that conservative accounting is valued by equity providers (Ball and Shivakumar 2008). Firms with ample capital may use the sell-through method because they attempted to obtain the benefits just described when they issued debt or equity in prior periods.

However, firms with existing capital or need of new capital may instead use the *sell-in* method because it offers greater opportunity to manipulate financial performance through accrual manipulation and/or channel stuffing activities. Sweeney (1994) finds that firms with existing debt implement income increasing accounting changes in order to avoid debt covenant violations. Other research suggests that firms needing new capital manage earnings by accelerating revenue recognition prior to issuing debt or equity (Bowen et al. 2002; Marquardt and Weidman 2004). In both cases, firms attempt to mislead capital providers by reporting better financial performance than they otherwise would. Due to the competing evidence with respect to the association between capital requirements and accounting methods, my first hypothesis is non-directional:

H1: Use of the sell-in method is systematically related to firms' capital requirements.

The second characteristic I expect to be associated with firms' revenue recognition method is the level of incentive compensation available to management. Prior research on management compensation and accounting practices finds mixed results. One stream of this research suggests that executives manage earnings in order to increase current period compensation. Cheng and Warfield (2005) find that as equity

incentives increase firms are more likely to meet or beat earnings benchmarks, and Matsunaga and Park (2001) find that CEO annual cash bonuses are significantly reduced if firms fail to meet quarterly earnings benchmarks in at least two quarters. Other research finds strong positive associations between high equity incentives and both income increasing abnormal accruals (Cheng and Warfield 2005) and the absolute value of discretionary accruals (Bergstresser and Philippon 2006; Cornett et al. 2008). Other studies suggest that firms are more likely to experience accounting restatements or fraud when equity incentives are high (e.g. Burns and Kedia 2006; Efendi et al. 2007).

However, another stream of research finds contrary evidence on the association between management incentive compensation and accounting practices. Hribar and Nichols (2007) find that the positive association between equity incentives and absolute discretionary accruals does not hold after controlling for cash flow volatility. Erickson et al. (2006) and Armstrong et al. (2008) find no evidence of an association between equity incentives and accounting fraud or restatements. In fact, Armstrong et al. (2008) find evidence that accounting fraud is less likely when management's equity incentives are high, suggesting that equity incentives align manager and shareholder interests. Because it is unclear from prior research if firms with incentive compensation will use more aggressive or more conservative accounting methods, my second hypothesis is non-directional:

H2: Use of the sell-in method is systematically related to management incentive compensation.

The third characteristic I expect to be associated with revenue recognition practices is firms' growth opportunities. Growth opportunities increase uncertainty

because growth firms have options to make future investments that are difficult to observe (Watts and Zimmerman 1986). Watts and Zimmerman (1986) argue that firms may enter into contracts that restrict managers' accounting choices in order to compensate for uncertainties associated with growth opportunities. In addition to this expectation, uncertainty in general should result in more conservative accounting to reduce the likelihood of inappropriate payments to managers and/or shareholders (Ahmed et al. 2002; Watts 2003). The FASB defines conservatism as "a prudent reaction to uncertainty to try to ensure that uncertainty and risks inherent in business situations are adequately considered" (Concepts Statement No. 2, FASB 1980). Based on the expectation that firms with higher growth opportunities, and thus more uncertainty, use more conservative accounting methods my third hypothesis is as follows:

H3: As growth opportunities increase firms are less likely to use the sell-in method than the sell-through method.

The firm characteristics discussed thus far can be viewed as incentives that that may be associated with firms' accounting methods. However, accounting methods may also be associated with corporate governance mechanisms put in place to constrain or monitor managers. Prior research suggests that corporate governance strength is associated with accounting choices, and that managers are more likely to exercise their accounting discretion to increase income when corporate governance is weak (e.g. Becker et al. 1998; Klein 2002; Altamuro et al. 2005; Bowen et al. 2008). Prior research also suggests that accounting is increasingly conservative as corporate governance strength increases (Beekes et al. 2004; Ahmed and Duellman 2007; Garcia Lara et al.

2009). Since the sell-through method is considered the more conservative approach and allows for less accounting discretion by management, my fourth hypothesis is as follows:

H4: Firms with strong corporate governance are less likely to use the sell-in method than the sell-through method.

While corporate governance strength may directly affect firms' accounting methods as predicted by Hypothesis 4, it is also possible that corporate governance indirectly affects firms' accounting practices. An indirect effect would occur if corporate governance weakens or strengthens the associations predicted in Hypotheses 1-3. For example, assume that use of the sell-in method is positively associated with management incentive compensation because managers prefer an accounting method that allows more opportunities to manage earnings. Strong governance mechanisms' demand for conservative accounting may reduce managers' willingness to choose more aggressive accounting practices, thus weakening the association between use of the sell-in method and management incentives. While many accounting studies examine the direct effect of corporate governance by simply adding governance proxies to the empirical model, some recent accounting studies examine the indirect effect of governance by partitioning samples based on corporate governance strength or by examining the interaction of governance proxies with other variables of interest (e.g. DeFond and Hung 2004; Larcker and Richardson 2004; Lee et al. 2008). Although these studies address different research questions, they typically find evidence that the

predicted associations between dependent and independent variables are significantly affected by corporate governance strength.¹⁹

The board of directors, institutional shareholders, and the external auditor all act as monitors over management (Fama and Jensen 1983; Shleifer and Vishny 1986; Beasley and Salterio 2001). I expect that the monitoring strength of these parties will impact the association between incentives and accounting methods used by managers. Under strong monitoring, the accounting methods used will likely be influenced by both management incentives and demands of the corporate governance mechanisms. Thus, I expect that corporate governance strength will affect the associations examined in the first three hypotheses. Because Hypothesis 4 predicts that strong governance mechanisms will demand conservative accounting and less accounting discretion, my fifth hypothesis is as follows:

H5: Firms with capital requirements, management incentives, and growth opportunities are less likely to use the sell-in method when corporate governance is strong than when corporate governance is weak.

Financial Information Quality

The costs and benefits of the sell-in and sell-through methods discussed earlier suggest that relevance and reliability of information produced under the two methods may differ. Both methods can suffer from unintended reductions in reliability. Under the sell-in method, managers may misestimate product return and/or pricing adjustment accruals. Under the sell-through method, revenues may be less reliable if: (1)

¹⁹ For example, DeFond and Hung (2004) find that the association between poor firm performance and likelihood of CEO turnover is stronger when strong country-level corporate governance mechanisms exist. This finding suggests that corporate governance plays an important role in the identification and removal of poorly performing CEOs.

distributor inventory and resale data contain errors that are not detected by management, (2) distributor inventory and resale data are not updated on a timely basis, or (3) proper internal controls do not exist for this revenue recognition process. The sell-in method may also yield unreliable revenue estimates if managers use their discretion to enhance performance through channel stuffing or accrual manipulation.

Financial statement users may perceive relevance differences between the two methods. The sell-in method provides timely information about expected future demand but not current end-user demand. On the other hand, the sell-through method reflects end-user demand and is a signal of conservative accounting practices. Due to potential relevance and reliability differences between the sell-in and sell-through methods, it is an empirical question if financial information quality differs between the two methods.

My final hypothesis is non-directional:

H6: Financial information quality differs between the sell-in and sell-through revenue recognition methods.

CHAPTER IV

FIRM CHARACTERISTICS AND REVENUE RECOGNITION

Research Design

U.S. GAAP requires that firms disclose their revenue recognition policies (APB 1972; SEC 1999, 2003). Each year I classify firms as using the sell-in or sell-through revenue recognition method for sales to distributors based on their 10-K revenue recognition disclosures. *Sell-In* is a dichotomous variable equal to one if the firm uses *only* the sell-in method to recognize revenue for distributor sales and equal to zero if the firm uses the sell-through method to recognize revenue for all sales to one or more distributors.²⁰ Because this definition of *Sell-In* classifies firms using both the sell-in and sell-through methods as sell-through firms, it should bias against finding results in all my empirical tests. Appendix A contains examples of revenue recognition disclosures and classification of the method as either sell-in or sell-through.

I use the following logistic regression model to test Hypotheses 1-4 which predict the characteristics of firms that use the sell-in method²¹:

$$\begin{aligned}
 \text{Sell-In}_{it} = & \alpha_0 + \alpha_1 \text{Lev}_{it} + \alpha_2 \text{IntCover}_{it} + \alpha_3 \text{RaisedCapital}_{it} + \alpha_4 \text{Bonus}_{it} \\
 & + \alpha_5 \text{EquityIncent}_{it} + \alpha_6 \text{R\&D}_{it} + \alpha_7 \text{MTB}_{it} + \alpha_8 \text{Gov}_{it} + \alpha_9 \text{LnAsset}_{it} \\
 & + \alpha_{10} \text{ROA}_{it} + \alpha_{11} \text{Retvol}_{it} + \alpha_{12} \text{Age}_{it} + \alpha_{13} \text{Comp}_{it} + \varepsilon \quad (1)
 \end{aligned}$$

where

²⁰ Firms may use the sell-in method as their primary method for revenue recognition but use the sell-through method in order to recognize revenue for new products that have little or no sales history. SAB 104 would require the sell-through method for new product sales because no historical information is available to estimate product returns and pricing adjustments for these new products (SEC 2003). I classify firms in this situation as sell-in firms because the revenue recognition method used is related to the *product sold* and not the *customer*.

²¹ The sample used to estimate Model 1 includes multiple annual observations per firm. Since I expect revenue recognition method usage to be relatively sticky over time, I also estimate Model 1 with only one observation per firm. Results of this supplemental test are discussed at the end of this section.

<i>Sell-In</i>	= an indicator variable equal to 1 if the firm uses the sell-in revenue recognition method for sales to distributors, and otherwise 0;
<i>Lev</i>	= long-term debt scaled by fiscal year-end total assets;
<i>IntCover</i>	= interest expense scaled by operating income before depreciation;
<i>RaisedCapital</i>	= an indicator variable equal to 1 if the firm issued new debt and equity greater than 20 percent of average annual assets during the current fiscal year, and otherwise 0;
<i>Bonus</i>	= the CEO's annual bonus compensation scaled by the sum of the CEO's annual salary and bonus, averaged over years $t-2$ through t ;
<i>EquityIncent</i>	= the percentage of a CEO's total compensation that would result from a one percent increase in stock price, averaged over years $t-2$ through t ;
<i>R&D</i>	= R&D expenses scaled by fiscal year-end total assets;
<i>MTB</i>	= the market value of equity divided by the book value of equity at fiscal-year end;
<i>Gov</i>	= an indicator variable equal to 1 if the firm is classified as having strong corporate governance, and otherwise 0;
<i>LnAsset</i>	= the natural log of fiscal year-end total assets;
<i>ROA</i>	= net income scaled by average total assets;
<i>Retvol</i>	= the standard deviation of daily stock returns over the prior fiscal-year (minimum of 100 daily observations for each firm-year to calculate the daily stock return);
<i>Age</i>	= the number of years since the firm was first listed in CRSP; and
<i>Comp</i>	= an indicator variable equal to 1 if the firm's primary industry is computers, and otherwise 0.

Hypothesis 1 predicts that an association exists between capital requirements and use of the sell-in method. I use "capital requirement" to encompass the ability to maintain existing capital as well as obtain additional capital. *Lev* proxies for the firm's

debt level which has been found to be significantly associated with accounting choice across a variety of studies (Christie 1990; Fields et al. 2001). *IntCover* proxies for the risk of debt covenant violation because Dichev and Skinner (2002) find that the interest coverage ratio is one of the most commonly used accounting measures in debt agreements. *RaisedCapital* proxies for the firm's need to raise new equity and/or debt, and prior research suggests that firms requiring new external financing accelerate revenue recognition (Bowen et al. 2002; Marquardt and Weidman 2004). Positive (negative) and significant coefficients on *Lev*, *IntCover*, and *RaisedCapital* would suggest that firms are more (less) likely to use the sell-in method as capital requirements increase.

Hypothesis 2 predicts that an association exists between management incentive compensation and use of the sell-in method. *Bonus* captures the CEO's non-salary cash compensation while *EquityIncent* captures potential equity related incentive compensation for the CEO. I include proxies for both types of compensation since prior research finds that associations often differ between accounting methods used by firms and the two types of incentive compensation (e.g. Aboody et al. 2000; Aboody et al. 2004; Efendi et al. 2007). Average values of the measures over the past three years are used instead of current year values in an attempt to capture the persistence of executive compensation over time. Positive (negative) and significant coefficients on *Bonus* and *EquityIncent* suggest that firms are more (less) likely to use the sell-in method as management incentive compensation increases.

Hypothesis 3 predicts that use of the sell-in method is less likely as growth opportunities increase. *R&D* and *MTB* proxy for growth opportunities. Intuitively, R&D expenditures likely lead to growth opportunities (Ahmed 1994). *MTB* is also likely to capture growth opportunities (Lindenberg and Ross 1981). However, a limitation of *MTB* is that it also proxies for economic rents earned on assets-in-place (Lindenberg and Ross 1981; Ahmed 1994; Roychowdhury and Watts 2007). I expect negative and significant coefficients for both *R&D* and *MTB*.

Hypothesis 4 predicts that use of the sell-in method is less likely when corporate governance is strong. *Gov* proxies for corporate governance strength and is defined based on board size and independence, institutional ownership, and industry specialist auditor usage. Stronger governance, or oversight, is suggested by smaller boards (Lipton and Lorsch 1992; Jensen 1993), higher board independence (Beasley 1996; Klein 2002), higher institutional ownership (Shleifer and Vishny 1986), and use of an industry specialist auditor (Owhoso et al. 2002; Balsam et al. 2003). A detailed definition of *Gov* is available in Table 1. I expect a negative association between *Gov* and *Sell-In*.

The remaining variables in Model 1 control for other firm characteristics that may be associated with firms' revenue recognition methods. I control for firm size (*LnAsset*), profitability (*ROA*), business uncertainty (*Retvol*), age (*Age*), and industry (*Comp*).²² Table 1 provides detailed definitions of all variables included in Model 1.

²² Ideally, I would also like to control for how much of the firms' revenue comes from distributor customers (i.e. the importance of the distributor to the seller's business). I attempted to hand collect this information at the same time I reviewed 10-K filings in order to classify firms as using the sell-in method or the sell-through method. Some firms report the percentage of annual revenue attributable to all distributors or some set of top distributors (i.e. top 2 or top 3) either in aggregate or separately by distributor. Other firms do not provide any information about the percentage of revenue attributable to

Hypothesis 5 predicts that firms with capital requirements, incentive compensation, and growth opportunities are less likely to use the sell-in method when corporate governance is strong than when it is weak. I use the following logistic regression model to test this hypothesis:

$$\begin{aligned}
 Sell-In_{it} = & \alpha_0 + \alpha_1 Lev_{it} + \alpha_2 Lev \times Gov_{it} + \alpha_3 IntCover_{it} + \alpha_4 IntCover_{it} \times Gov_{it} \\
 & + \alpha_5 RaisedCapital_{it} + \alpha_6 RaisedCapital_{it} \times Gov_{it} + \alpha_7 Bonus_{it} \\
 & + \alpha_8 Bonus_{it} \times Gov_{it} + \alpha_9 EquityIncent_{it} + \alpha_{10} EquityIncent_{it} \times Gov_{it} \\
 & + \alpha_{11} R\&D_{it} + \alpha_{12} R\&D_{it} \times Gov_{it} + \alpha_{13} MTB_{it} + \alpha_{14} MTB_{it} \times Gov_{it} \\
 & + \alpha_{15} Gov_{it} + \alpha_{16} LnAsset_{it} + \alpha_{17} ROA_{it} + \alpha_{18} Retvol_{it} + \alpha_{19} Age_{it} \\
 & + \alpha_{20} Comp_{it} + \varepsilon
 \end{aligned} \tag{2}$$

Under Hypothesis 5, I expect negative and significant coefficients for each of the interaction terms between *Gov* and other variables of interest.

Sample Selection

Table 2 presents the steps utilized to obtain a sample of firms. I first obtain all firm-year observations from the Compustat Annual database for 2001-2005 in the computer and electronic equipment industries. I choose this time period because SAB 101 or SAB 104 was in effect for the entire period. SAB 101 offered additional guidance on revenue recognition disclosures, and revenue recognition disclosures may have been less reliable prior to the issuance of this guidance. I select the computer and electronic equipment industries because these industries use sell-in and sell-through accounting (Glass, Lewis & Co. 2004; Greenberg 2006; Chipalkatti et al. 2007).²³ After these restrictions, 4,515 firm-year observations remain.

distributor customers. Due to the variation in reporting methods and the fact that many firms choose not to disclose information about the percentage of revenue attributable to distributor customers, I was not able to obtain a measure of revenue from distributors to include in Model 1.

²³ I follow Fama and French's (1997) industry classifications, as updated on Kenneth French's website to reflect 49 industries, such that computers includes SIC 3570-3579, 3680-3689, and 3695; electronic

I exclude observations missing data required for the firm characteristic and revenue recognition method model (Model 1). Specifically, I delete observations missing necessary Compustat data (1,470 observations), ExecuComp data (2,341 observations), RiskMetrics (formerly IRRC) data (141 observations), and CRSP data (1 observations). These restrictions result in a sample of 562 firm-year observations. I hand collect revenue recognition disclosures for these firms. I exclude 83 firm-year observations because either the firm does not sell products to distributors or an annual 10-K filing was unavailable. The final sample consists of 479 firm-year observations for 119 unique firms.²⁴

Descriptive Statistics and Correlations

Panel A of Table 3 presents descriptive statistics for firm characteristic and revenue recognition method variables. The sell-in method is used by 66 percent of the firm-year observations while the sell-through method is used by 34 percent of the firm-year observations. Nine of the 119 unique firms switched methods during the years they appear in my sample. In all but one case, the firms switched from the sell-in method to the sell-through method. All remaining variables are winsorized at the top and bottom one percent except *IntCover*, natural logs, and indicator variables. *IntCover* is capped at

equipment includes SIC 3622, 3661-3666, 3669, 3670-3679, 3810, and 3812 (<http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>). The definition of computer industry used in this study excludes software firms. This choice is made because the revenue recognition decisions made by software firms are often not easily comparable to the revenue recognition decisions of other firms in this study due to the multiple-element arrangements inherent in many software sales.

²⁴ In addition to the computer and electronic equipment industries, Glass, Lewis and Co. (2004) also suggest that the sell-in and sell-through methods are used by pharmaceutical companies. However, they indicate that nearly all of the pharmaceutical firms they examine use the sell-in method. I hand collected revenue recognition disclosures for 195 pharmaceutical firm-year observations during the sample period and found that 97 percent of these observations used the sell-in method. Due to the small amount of variation in revenue recognition method use among these firms, I exclude the pharmaceutical industry from all analyses reported in this study.

2.0, and the ratio is set to 2.0 for all observations with negative operating income before depreciation. Based on mean and median tests, the univariate statistics indicate that sell-in firms are significantly older, have higher leverage, and are more likely to have issued new debt or equity in the past year than sell-through firms. However, sell-in firms have significantly lower R&D expenditures, lower stock return volatility (*Retvol*), and lower CEO equity incentives than sell-through firms. Thirty-six percent of the sample firms are classified as having strong corporate governance, and sell-in and sell-through firms do not significantly differ with respect to governance strength.

Panel B presents descriptive statistics by industry. Use of the sell-in method significantly differs between the two industries: 81 percent of computer firms and 62 percent of electronic equipment firms use the sell-in method. Sell-in usage differences between the computer and electronic equipment industries may be due to differences in the importance of distributors for these industries. As noted in footnote 25, the amount of manufacturer revenue attributable to distributor customers is not reported by all manufacturers. However, for sample firms that did report this information, a firm's top distributor accounts for 12 percent and 26 percent of total revenue, on average, for firms in the computer and electronic equipment industries respectively. This suggests that use of the sell-in method may be more likely in industries with fewer sales through distributors.²⁵ Other than use of the sell-in method, the computer and electronics firms

²⁵ Commentators suggest that use of the sell-in method decreased in the computer and electronic equipment industries over the past decade, but this trend has not occurred in the pharmaceutical industry (Glass, Lewis and Co. 2004; Greenberg 2006). Use of the sell-in method appears to be an accepted practice in the pharmaceutical industry.

are relatively similar and only significantly differ with respect to size and CEO equity incentives.

Panel C of Table 3 presents correlations for the firm characteristic and revenue recognition method variables. These univariate statistics support many of the inferences suggested by the mean and median statistics. The correlations suggest that use of the sell-in method is more likely for older firms and firms with higher leverage, but less likely as business uncertainty (*Retvol*), R&D expenditures, equity incentives, and *MTB* increase. All variance inflation factors are below 3.0, suggesting that multicollinearity will not pose a problem in the multivariate analyses.

Multivariate Analyses

Table 4 presents results for the models that examine firm characteristics and revenue recognition methods. Since the sample used for these analyses contains multiple observations for each firm, Z-statistics are calculated using Rogers' (1993) standard errors clustered by firm to correct for correlated firm-level errors. Using the sample average of 66 percent as the probability that a firm will use the sell-in method, Model 1 classifies 73 percent of all observations correctly, 73 percent of known sell-in observations correctly, and 75 percent of known sell-through observations correctly. The area under the receiver operating characteristic (ROC) curve is 80 percent, suggesting that the model has excellent predictive power (Hosmer and Lemeshow 2000).²⁶

²⁶ The area under the ROC curve measures the probability that a randomly selected sell-in firm would have a higher fitted value from the model than a randomly selected sell-through firm.

Model 1 examines Hypotheses 1-4. Hypothesis 1 predicts an association between *Sell-In* and firm capital requirements. The results for Model 1 indicate that the *Lev*, *IntCover*, and *RaisedCapital* coefficients are all insignificantly different from zero. These results suggest that use of the sell-in method is not influenced by firms' capital requirements.²⁷ Hypothesis 2 predicts an association between *Sell-In* and management incentive compensation. Both *Bonus* and *EquityIncent* are insignificantly different from zero.²⁸ These results suggest use of the sell-in method is not sensitive to bonus and equity incentives. Hypothesis 3 predicts a negative association between *Sell-In* and growth opportunities. *R&D* is negatively and significantly associated with *Sell-In* ($p < 0.01$), but the *MTB* coefficient is insignificantly different from zero.²⁹ The insignificant *MTB* coefficient is not surprising since *MTB* is not a clean proxy for growth opportunities, as discussed in earlier in this section. These results provide some evidence that use of the sell-in method is less likely for firms with high growth opportunities.

Hypothesis 4 predicts that use of the sell-in method is less likely when corporate governance is strong. The negative and significant *Gov* coefficient supports this prediction ($p = 0.01$). With respect to the control variables, *Age* and *Comp* are both positively and significantly associated with *Sell-In* ($p = 0.03$ for both coefficients). The

²⁷ In an untabulated test, I estimated Model 1 separately by industry. None of the capital requirement proxies are significant for the electronic equipment industry. However, the *Lev* coefficient is positive and significant ($p = 0.04$) and the *RaisedCapital* coefficient is negative and significant ($p = 0.07$) for the computer industry.

²⁸ Results are unchanged if current year *Bonus* and *EquityIncent* measures are used instead of three year averages. Excluding the industry indicator variable or all control variables from Model 1 does result in a negative and significant *EquityIncent* coefficient ($p = 0.05$ and $p = 0.01$, respectively).

²⁹ When Model 1 is estimated separately by industry, the *R&D* coefficient is negative and significant for the electronic equipment industry.

Age coefficient suggests that older firms may use the sell-in method because they likely have a more reliable sales history which they can use to estimate product returns and pricing adjustments. In summary, the results obtained from estimating Model 1 provide support for Hypotheses 3 and 4 only.

Model 2 examines Hypothesis 5 and also re-examines Hypotheses 1-4.

Hypothesis 5 predicts that firms with capital requirements, management incentives, and growth opportunities are less likely to use the sell-in method when corporate governance is strong than when corporate governance is weak. Model 2 classifies 75 percent of all observations correctly, 75 percent of known sell-in observations correctly, and 73 percent of known sell-through observations correctly. The area under the ROC curve is 82 percent.

In terms of the capital requirement proxies, *RaisedCapital* is positively and significantly associated with *Sell-In* ($p = 0.07$), and *RaisedCapital*×*Gov* is negatively and significantly associated with *Sell-In* ($p = 0.04$). These results indicate that firms with weak governance that raised new capital are more likely to use the sell-in method than the sell-through method. However, when corporate governance is strong, firms raising new capital are significantly less likely to use the sell-in method than firms with weak governance, and financing is not associated with the revenue recognition method for strong governance firms (*RaisedCapital* + *RaisedCapital*×*Gov*). These results support Hypotheses 1 and 5.

In terms of the management incentive proxies, *Bonus*×*Gov* and *EquityIncent*×*Gov* are both negatively and significantly associated with *Sell-In* ($p = 0.02$

and $p = 0.01$, respectively). The main effect of the *Bonus* and *EquityIncent* coefficients for firms with strong governance ($Bonus + Bonus \times Gov$ and $EquityIncent + EquityIncent \times Gov$) are also negative and significant ($p = 0.03$ and $p = 0.01$, respectively). These results indicate that use of the sell-in method is sensitive to the amount of cash and equity based management incentive compensation, but only when corporate governance is strong. These results support Hypotheses 2 and 5.

Interactions between *Gov* and growth opportunity proxies are insignificantly different from zero, yet the main effect of *R&D* remains negative and significant ($p < 0.01$). This result supports Hypothesis 3 and indicates that as R&D expenditures increase firms are less likely to use the sell-in method regardless of corporate governance strength. After interacting *Gov* with the capital requirement, management incentive, and growth opportunity proxies, the main effect of governance is insignificantly different from zero.³⁰

In summary, the evidence presented in Table 4 provides some support for Hypothesis 1-5. Firms that raise new capital are more likely to use the sell-in method than the sell-through method when corporate governance is weak. However, strong corporate governance reduces the association between *Sell-In* and the proxy for new capital. Use of the sell-in method is less likely as bonus and equity incentives increase, but only for firms with strong corporate governance. Finally, use of the sell-in method is less likely

³⁰ Inferences with respect to all interactions in Model 2 are unchanged if the industry indicator variable or all other control variables are excluded from the model. I also substitute revenue volatility (based on the prior 12 quarters) for stock return volatility, and inferences related to the variables of interest and interactions are unchanged. In this specification, the revenue volatility coefficient is positive and significant ($p = 0.06$).

as R&D expenditures increase and for firms with strong corporate governance.

Although prior research examines the association between revenue recognition methods and corporate governance (Bowen et al. 2002; Altamuro et al. 2005), I show that strong governance is not simply additive. In this study, the associations between revenue recognition methods and firm characteristics differ based on corporate governance strength.³¹

Supplemental Analysis

As mentioned previously, only 9 of 119 sample firms changed their revenue recognition method during the years they are included in the analyses. This indicates that the revenue recognition choice is sticky over time for my sample firms. As an alternative test, I re-estimate Model 2 with only one observation per firm. Untabulated results are consistent using either the first or last year that each firm appears in the sample. Use of the sell-in method is significantly less likely as cash bonus compensation (*Bonus*) and R&D expenditures increase, regardless of corporate governance strength. Use of the sell-in method is less likely as equity incentives (*EquityIncent*) increase, but only when corporate governance is strong. Finally, *Age* remains positively and significantly associated with *Sell-In*. None of the capital requirement proxies and their

³¹ Because the definition of *Sell-In* classifies firms that use the sell-through method exclusively as well as firms that use both sell-in and sell-through methods as sell-through firms, I also estimate a multinomial logit model which differentiates between exclusive use of sell-in, exclusive use of sell-through, and combined use of both methods. Only 40 of the 479 observations exclusively use the sell-through method, which results in low power for comparisons of these observations to the other categories of revenue recognition methods used. However, inferences gleaned from the analysis contrasting firms exclusively using the sell-in method to those firms that use both sell-in and sell-through are largely consistent with the results tabulated in Table 4.

interactions with *Gov* are significantly associated with *Sell-In* when only one observation per firm is used to estimate the model.

CHAPTER V

FINANCIAL INFORMATION QUALITY AND REVENUE RECOGNITION

Ability of Accounting Information to Predict Future Cash Flows

Research Design

Hypothesis 6 predicts that the quality of financial information differs between the sell-in and sell-through methods. The first construct of financial information quality that I examine is the ability of accrual accounting information to predict future cash flows. Statement of Financial Accounting Concepts No. 1 posits that “financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise” (FASB 1978, para. 37). If distributors settle accounts receivable shortly after they receive inventory, current period cash flows would be the same under the sell-in and sell-through methods. However, it is unclear if the ability to predict *future* cash flows differs between the two methods.

Accounting studies often examine the ability of current period earnings to predict future cash flows (e.g. Dechow et al. 1998; Barth, Cram, and Nelson 2001; Altamuro et al. 2005). Prior research implies the following cash flow and earnings models for my study:

$$OCF_{i,t+1} = \alpha_0 + \alpha_1 Sell-In_{it} + \alpha_2 Earnings_{it} + \alpha_3 Sell-In_{it} \times Earnings_{it} + \varepsilon \quad (3)$$

$$\Delta OCF_{i,t+1} = \alpha_0 + \alpha_1 Sell-In_{it} + \alpha_2 \Delta Earnings_{it} + \alpha_3 Sell-In_{it} \times \Delta Earnings_{it} + \varepsilon \quad (4)$$

where

- OCF* = quarterly cash flow from operations scaled by total assets;
- Earnings* = quarterly earnings scaled by total assets;
- ΔOCF = change in quarterly cash flow from operations from the same quarter of the preceding fiscal year, scaled by total assets, and;
- $\Delta Earnings$ = change in quarterly earnings from the same quarter of the preceding fiscal year, scaled by total assets.

Sell-In is as previously defined.³²

Model 3 examines the association between earnings levels and future cash flows levels.

Model 4 controls for seasonal effects on earnings and cash flows by examining the association between unexpected earnings (i.e. seasonal change) and unexpected future cash flows.

Because the timing of revenue recognition for sales to distributors differs between the sell-in and sell-through methods, the accounts primarily affected by these methods are revenue and cost of goods sold. Gross margin is the first subtotal on the income statement that captures this information. Although earnings also captures revenue and cost of goods sold information, many other line items impact earnings that are not affected by the revenue recognition method used. Decomposing earnings into gross margin and other expenses allows me to examine how use of the sell-in method affects the association between gross margin and future cash flows.³³

Because the high technology industries included in this study are likely to experience seasonality in earnings, I examine Hypothesis 6 with a model similar to

³² Because a firm's choice to use either the sell-in or sell-through is endogeneity, I conduct supplemental tests at the end of this section to correct for potential endogeneity in all financial information quality tests.

³³ Although other line items below gross margin will be affected by use of the sell-in or sell-through method, such as income taxes and management compensation, the vast majority of the impact from the revenue recognition method should occur in gross margin.

Model 4, after decomposing earnings into gross margin and other expenses. I use the following model to determine if the ability of accrual accounting information to predict future cash flows differs between sell-in and sell-through firms, controlling for fixed firm and time effects:

$$\Delta OCF_{i,t+1} = \alpha_0 + \alpha_1 Sell-In_{it} + \alpha_2 \Delta GrossMargin_{it} + \alpha_3 \Delta OtherExp_{it} + \alpha_4 Sell-In_{it} \times \Delta GrossMargin_{it} + \alpha_5 Sell-In_{it} \times \Delta OtherExp_{it} + \varepsilon \quad (5)$$

where

$\Delta GrossMargin$ = change in quarterly gross margin from the same quarter of the preceding fiscal year, scaled by total assets, and;

$\Delta OtherExp$ = change in quarterly other expenses (gross margin minus earnings) from the same quarter of the preceding fiscal year, scaled by total assets.

The main variable of interest in Model 5 is $Sell-In \times \Delta GrossMargin$, which is used to test Hypothesis 6. A positive (negative) and significant coefficient on $Sell-$

$In \times \Delta GrossMargin$ indicates that use of the sell-in method increases (decreases) the ability of unexpected gross margin to predict unexpected future cash flows compared to the sell-through method. Stated differently, a positive (negative) and significant coefficient on $Sell-In \times \Delta GrossMargin$ suggests that use of the sell-in method increases (decreases) financial information quality.

Multivariate Analysis

Estimation results for the regression of seasonal changes in cash flows during quarter $t+1$ on seasonal changes in gross margin and other operating expenses during quarter t are presented in Table 5. The sample consists of quarterly data for firm-year observations included in the analysis of firm characteristics and revenue recognition

practices. $\Delta GrossMargin$ is positively and significantly associated with the seasonal change in future cash flows ($p < 0.01$) and $\Delta OtherExp$ is negatively and significantly associated with the seasonal change in future cash flows ($p < 0.01$). The main variable of interest, $Sell-In \times \Delta GrossMargin$, is negatively and significantly associated with ΔOCF_{t+1} ($p < 0.01$). This result suggests that the ability of unexpected gross margin information to predict unexpected future cash flows is significantly lower for sell-in firms than for sell-through firms.³⁴ This finding supports Hypothesis 6, which predicts that financial information quality differs between the sell-in and sell-through methods.

The inferences drawn from Table 5 are consistent with Forester's (2008) finding that accrual accounting information better predicts future cash flows for firms that defer revenue recognition. Forester (2008) initially examines cash flow predictability immediately following a revenue recognition policy change. Consistent with Altamuro et al. (2005) he finds a decline in the ability of accounting information to predict future cash flows under a deferred revenue recognition method. However, Forester (2008) finds that this initial decline in predictability is later reversed. Since I do not identify when firms begin using the sell-in or sell-through method and very few of my sample firms change their revenue recognition method during the sample years, my analysis is more like the subsequent periods studied by Forester (2008) than the initial reaction studied by Altamuro et al. (2005).

³⁴ Inference are unchanged if average total assets is used as the scalar for all accounting variables in Model 5. As a sensitivity test, I also use a levels specification of Model 5, where the dependent variable is one, two, three, or four-quarter ahead cumulative cash flows. The interaction between *Sell-In* and *GrossMargin* is negative and significant with a one-tailed test when the dependent variable is four-quarter ahead cumulative cash flows. Lack of significant results for the other quarters is likely due to the fact that this specification does not control for the impact of seasonal differences on operating performance.

Association between Accounting Information and Stock Returns

Research Design

The second construct of financial information quality that I examine relates to the association between accounting information and stock returns. Since stock prices reflect economic events more promptly than accounting information, accounting information is considered more timely if it is more strongly associated with contemporaneous stock returns (Ball et al. 2000; Francis et al. 2006). It is unclear how the market responds to sell-in and sell-through accounting news and which method produces more “timely” information.

I use the following regression model to study the timeliness of accounting information under the sell-in and sell-through methods, controlling for fixed firm and time effects.

$$\begin{aligned}
 \text{GrossMargin}_{it}/\text{MVE}_{i,t-1} = & \alpha_0 + \alpha_1 \text{AdjRet}_{it} + \alpha_2 \text{Sell-In}_{it} + \alpha_3 \text{Neg}_{it} + \alpha_4 \text{Beta}_{it} \\
 & + \alpha_5 \text{MTB}_{it} + \alpha_6 \text{Size}_{it} + \alpha_7 \text{Persist}_{it} \\
 & + \alpha_8 \text{AdjRet}_{it} \times \text{Sell-In}_{it} + \alpha_9 \text{AdjRet}_{it} \times \text{Neg}_{it} \\
 & + \alpha_{10} \text{AdjRet}_{it} \times \text{Beta}_{it} + \alpha_{11} \text{AdjRet}_{it} \times \text{MTB}_{it} \\
 & + \alpha_{12} \text{AdjRet}_{it} \times \text{Size}_{it} + \alpha_{13} \text{AdjRet}_{it} \times \text{Persist}_{it} + \varepsilon \quad (6)
 \end{aligned}$$

where

GrossMargin/MVE = quarterly gross margin, scaled by market value of equity at the beginning of the quarter;

AdjRet = cumulative stock returns beginning 2 days after the prior quarter’s earnings announcement and ending one day after the current quarter’s earnings announcement, adjusted by the value weighted market index in CRSP;

Neg = an indicator variable equal to 1 if *AdjRet* is less than 0, and otherwise 0.

<i>Beta</i>	= an indicator variable equal to 1 if the firm's systematic risk is greater than the sample median for the quarter; and otherwise 0;
<i>MTB</i>	= an indicator variable equal to 1 if the market-to-book ratio is greater than the sample median for the quarter, and otherwise 0;
<i>Size</i>	= an indicator variable equal to 1 if the firm's natural log of assets at the beginning of the quarter is greater than the sample median for the quarter, and otherwise 0; and
<i>Persist</i>	= an indicator variable equal to 1 if gross margin persistence is greater than the sample median for the quarter, and otherwise 0.

Sell-In is as previously defined.

Model 6 is similar to the model Zhang (2005) uses to examine the timeliness of accounting information around a revenue recognition standard change for software firms. Zhang (2005) uses revenue as her dependent variable but I use gross margin because both revenue and cost of goods sold are affected by the sell-in and sell-through methods.

I include five controls for factors expected to affect the association between accounting information and stock returns (Collins and Kothari 1989; Basu 1997). *Neg* proxies for a bad news signal reflected in stock returns. *Beta* proxies for the firm's systematic risk. *MTB* proxies for growth opportunities. *Persist* proxies for the persistence of gross margin based on a seasonal ARIMA model. Finally, I control for firm size (*Size*). Each of these proxies is included in Model 6 and interacted with the market-adjusted stock returns for the quarter (*AdjRet*). Detailed definitions of all variables contained in Model 6 are included in Table 1.

The main variable of interest in Model 6 is $AdjRet \times Sell-In$, which tests Hypothesis 6. A positive (negative) and significant coefficient on $AdjRet \times Sell-In$

indicates that use of the sell-in method increases (decreases) the timeliness of accounting information compared to the sell-through method. Thus, a positive (negative) and significant coefficient on $AdjRet \times Sell-In$ suggests that use of the sell-in method increases (decreases) the quality of financial information.

Multivariate Analysis

Estimation results for the regression of gross margin on market-adjusted stock returns and control variables are presented in Table 6. The sample consists of quarterly data for firm-year observations included in the analysis of firm characteristics and revenue recognition practices.

The $AdjRet$ coefficient is positive and significant ($p < 0.01$). In terms of the control variables, MTB , $Persist$, $AdjRet \times MTB$, and $AdjRet \times Persist$ are all negatively and significantly associated with gross margin. The main variable of interest, $AdjRet \times Sell-In$, is negatively and significantly associated with gross margin ($p = 0.03$).³⁵ This result supports Hypothesis 6 and suggests that gross margin information reported under the sell-in method is actually less timely, or does a poorer job of reflecting information already incorporated into stock returns, than gross margin information reported under the sell-through method.

Although Altamuro et al. (2005) and Forester (2008) do not explicitly examine the timeliness of accounting information under different revenue recognition methods,

³⁵ I conduct two sensitivity tests with respect to the this analysis. First, I estimate Model 6 without fixed effects. The adjusted R^2 drops from 0.74 reported in Table 6 to 0.23. The $AdjRet \times Sell-In$ coefficient remains negative but is insignificantly different from zero. Due to the increased explanatory power when fixed effects are included, I base my inferences on the Model 6 specification reported in Table 6. Second, I estimate Model 6 with seasonal change in gross margin scaled by beginning of quarter MVE as the dependent variable. The adjusted R^2 of this fixed effects model is 0.23, and the $AdjRet \times Sell-In$ coefficient is negative, but insignificantly different from zero.

Zhang (2005) examines timeliness for software firms before and after the adoption of SOP 91-1. She finds that revenue information is more timely when firms recognize revenue *early*. In contrast, I find that revenue recognition is more timely when firms *delay* revenue recognition.

The results reported in my study may differ from Zhang (2005) for at least two important reasons. First, Zhang (2005) examines revenue recognition methods for software sales made to end customers while I examine revenue recognition methods for product sales made to distributors. While distributors attempt to anticipate end customer demand, they are not the end users of the products. In addition, sales agreements for end customers and distributors are likely to differ with respect to product return privileges and the possibility of future pricing adjustments. The timeliness of revenue information could be affected by both of these factors. Second, the transparency of revenue recognition disclosures changed dramatically in the past decade. Firms were not *required* to disclose their revenue recognition policies until SAB 101 went into effect.³⁶ Prior to SAB 101, firms only disclosed revenue recognition policies if they were deemed “significant.” Since Zhang’s (2005) sample period occurs entirely before SAB 101 while my sample period occurs entirely after SAB 101, it is unclear how disclosure transparency differences between the sample periods may have affected the timeliness of revenue information.

³⁶ Zhang (2005) suggests that “one reason for the paucity of research in [the revenue recognition] area is the difficulty in obtaining data related to revenue recognition policies.” For this reason, many revenue recognition studies examine periods before and after standard changes that prompted firms to recognize cumulative effects adjustments or disclose additional revenue recognition information (e.g. Altamuro et al. 2005; Zhang 2005; Forester 2008; Srivastava 2008).

In summary, the results presented in both Tables 5 and 6 support Hypothesis 6 and suggest that the financial information quality is lower under the sell-in method than the sell-through method.

Supplemental Analyses

Use of the sell-in or sell-through method is an endogenous choice made by firms. Econometrically, an endogeneity problem would occur in the financial information quality tests if the firm characteristics associated with *Sell-In* are also correlated with the dependent variables in Models 5 and 6. This could cause *Sell-In* to be correlated with the error term, meaning the expected value of the error term differs from zero and OLS assumptions are violated (Wooldridge 2002; Greene 2003). Because the potentially endogenous variable is an indicator variable, I re-estimate Models 5 and 6 and use the Heckman (1979) two-stage approach to correct for potential endogeneity (Heckman 1979; Wooldridge 2002).

For each potentially endogenous model, I regress *Sell-In* on the accounting variables in the OLS regression model and all independent variables from Model 2. The independent variables from Model 2 act as instrument variables.³⁷ The logit results allow me to calculate inverse Mills ratios, which equal the standard normal density function divided by the cumulative distribution function. I include the appropriate

³⁷ In order to appropriately use the two-stage approach, at least one exogenous instrument variable must be included in the first stage that is not included in the second stage, and the exogenous instrument variable should not be associated with the dependent variable in the second stage model (e.g. Heckman 1979; Wooldridge 2002). I use all independent variables from Model 2 as possible instrument variables in the first stage, but focus on the variables significantly associated with *Sell-In* as possible instruments. I find that *Age* is an appropriate instrument variable for the cash flow analysis while *RaisedCapital* is an appropriate instrument for the timeliness analysis. *Age* is not significantly correlated with ΔOCF , and *Age* is not significantly associated with ΔOCF if included in Model 5. Meanwhile, *RaisedCapital* is not significantly correlated with *GrossMargin/MVE*, and *RaisedCapital* is not significantly associated with *GrossMargin/MVE* if included in Model 6.

inverse Mills ratio as an additional control variable in Models 5 and 6. Untabulated results indicate that inferences gleaned from Tables 5 and 6 are unchanged when the inverse Mills ratio is included in the regression models.

CHAPTER VI

CONCLUSION

This study examines previously unstudied revenue recognition methods (sell-in and sell-through revenue recognition for sales to distributors) and finds distinct differences in the characteristics of firms that use these methods. Firms with higher growth opportunities and stronger corporate governance are more likely to defer revenue recognition (sell-through). In addition, firms with strong corporate governance are less likely to use the sell-in method than firms with weak governance as capital needs and management incentives increase. These results suggest that corporate governance proxies should be included in accounting choices models and also interacted with other factors expected to be associated with the choices.

This study also finds evidence suggesting that financial information quality is higher under a deferred revenue recognition method. Specifically, the ability of accounting information to predict future cash flows is higher for sell-through firms than for sell-in firms. Accounting information reported under the sell-through method is also more timely, meaning that this information is more strongly associated with contemporaneous stock returns than accounting information reported under the sell-in method. This evidence may be useful to standard setters currently examining existing revenue recognition standards, financial statement users interested in the industries studied, and practitioners within high technology industries.

The findings of this study with respect to financial information quality are important because prior research offers mixed evidence regarding financial information

quality under different revenue recognition methods (Altamuro et al. 2005; Zhang 2005; Forester 2008). Studies that examine short periods following standard changes (Altamuro et al. 2005) and pre-SAB 101 revenue recognition practices (Zhang 2005) suggest that more aggressive revenue recognition results in higher financial information quality. However, my findings support recent work that suggests financial information quality is higher under methods that defer revenue recognition (Forester 2008). Thus, many settings need to be examined in order to more clearly understand the association between revenue recognition practices and financial information quality.

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APPENDIX A

EXCERPTS FROM SELECT 10-K REVENUE RECOGNITION DISCLOSURES

Skyworks Solutions 2005 10-K: Sell-in

Certain product sales are made to electronic component distributors under agreements allowing for price protection and/or a right of return on unsold products. **A reserve for sales returns and allowances for customers is recorded based on historical experience or specific identification of an event necessitating a reserve.**

Silicon Laboratories 2005 10-K: Sell-through

Certain of the Company's sales are made to distributors under agreements allowing certain rights of return and price protection on products unsold by distributors. Accordingly, **the Company defers revenue and gross profit on such sales until the distributors sell the product to the end customer.**

Netgear 2005 10-K: Sell-in

In addition to warranty-related returns, certain distributors and retailers generally have the right to return product for stock rotation purposes. Every quarter, stock rotation rights are limited to 10% of invoiced sales to the distributor or retailer in the prior quarter. **Upon shipment of the product, the Company reduces revenue for an estimate of potential future product warranty and stock rotation returns related to the current period product revenue.** Management analyzes historical returns, channel inventory levels, current economic trends and changes in customer demand for the Company's products when evaluating the adequacy of the allowance for sales returns, namely warranty and stock rotation returns.

Advanced Micro Devices (2004): *Sell-through*

The Company sells to distributors under terms allowing the distributors certain rights of return and price protection on unsold merchandise held by them. The distributor agreements, which may be canceled by either party upon specified notice, generally contain a provision for the return of the Company's products in the event the agreement with the distributor is terminated and the distributor's products have not been sold.

Accordingly, **the Company defers the gross margin resulting from the deferral of both revenue and related product costs from sales to distributors with agreements that have the aforementioned terms until the merchandise is resold by the distributors.** The Company also sells its products to distributors with substantial independent operations under sales arrangements whose terms do not allow for rights of return or price protection on unsold products held by them. **In these instances, the Company recognizes revenue when it ships the product directly to the distributors.**

****Bold emphasis** indicates the information that led to classification as sell-in or sell-through.

APPENDIX B**TABLES**

TABLE 1
Variable Definitions

<i>Sell-In</i>	= an indicator variable equal to 1 if the firm's annual 10-K indicates in the Notes to Financial Statements that it uses the sell-in revenue recognition method for sales to distributors; and otherwise 0.
<u>Variables Included in Revenue Recognition Choice Model</u>	
<i>Age</i>	= the number of years since the firm was first listed in CRSP.
<i>Bonus</i>	= the CEO's annual bonus compensation scaled by the CEO's annual salary [ExecuComp], averaged over years $t-2$ through t .
<i>Comp</i>	= an indicator variable equal to 1 if the firm's primary industry is computers (SIC 3570-3579, 3680-3689, and 3695), and otherwise 0.
<i>EquityIncent</i>	= $\text{Onepct}/(\text{Onepct} + \text{Salary} + \text{Bonus})$ averaged over years $t-2$ through t . Onepct equals the change in value of all granted stock options and common stock owned by the CEO for a one percent change in stock price. See Bergstresser and Philippon (2006) and Core and Guay (2002) [ExecuComp data].
<i>Gov</i>	= an indicator variable equal to 1 if the firm is classified as having strong corporate governance and otherwise 0. Four measures are used to determine corporate governance strength: board size, board independence, institutional ownership, and use of an industry specialist auditor. Board size and board independence data are obtained from RiskMetrics (formerly IRRC). Institutional ownership data are obtained from Thomson Financial. Each firm-year observation is compared to the annual sample median for each of these three measures. A value of 1 is assigned to each measure if it indicates strong monitoring: above median board independence and institutional ownership or below median board size, otherwise a value of 0 is assigned. Compustat data is used to determine if the auditor is an industry specialist based on Mayhew and Wilkins (2003) definition of a differentiated auditor. Auditors considered a specialist are given a value of 1 for the specialist measure and a value of 0 otherwise. The sum of the four governance measures is totaled, and it ranges from 0 to 4. Firm-year governance sums are then compared to the annual median governance sum. <i>Gov</i> equals 1 for values above the median, else <i>Gov</i> equals 0.
<i>IntCover</i>	= interest expense [Compustat Annual # 15] divided by operating income before depreciation [Compustat Annual # 13]. This ratio is capped at 2.0. All observations with negative operating income before depreciation are assigned a value of 2.0 for this ratio.
<i>Lev</i>	= long-term debt [Compustat Annual # 9], scaled by total assets at the end of the fiscal year [Compustat Annual # 6].

TABLE 1 (continued)

<i>LnAsset</i>	= natural log of the fiscal year-end total assets [Compustat Annual #6].
<i>MTB</i>	= the fiscal-year end market value of equity [Compustat Annual # 25 * # 199] scaled by the fiscal-year end book value of equity [Compustat Annual # 60+# 74].
<i>R&D</i>	= research and development expense [Compustat Annual # 46], scaled by total assets at the end of the fiscal year [Compustat Annual # 6].
<i>Raised Capital</i>	= an indicator variable equal to 1 if the firm issued new debt and equity [Compustat Annual # 108 + # 111] greater than 20 percent of average annual assets during the current fiscal year, and otherwise 0.
<i>Retvol</i>	= the standard deviation of daily stock returns over prior fiscal-year (minimum of 100 daily observations for each firm-year to calculate the daily stock return) [CRSP]. Due to the narrow distribution of this variable (0.01 – 0.09), I multiply the value by 10 prior to running Model 1 so that it more closely represents an indicator variable.
<i>ROA</i>	= net income [Compustat # 172], scaled by average total assets.

Variables Included in Accounting Information and Cash Flow Model

<i>ΔGrossMargin</i>	= change in quarterly gross margin from the same quarter of the preceding fiscal year [Compustat Quarterly # 2 - # 30], scaled by quarter-end total assets [Compustat Quarterly # 44].
<i>ΔOCF</i>	= change in quarterly cash flows from operations from the same quarter of the preceding fiscal year [Compustat Quarterly # 108] scaled by quarter-end total assets [Compustat Quarterly # 44].
<i>ΔOtherExp</i>	= change in other expenses from the same quarter of the preceding fiscal year [Compustat Quarterly # 2 - # 30 - #69], scaled by quarter-end total assets [Compustat Quarterly # 44].

Variables Included in Accounting Information and Stock Return Model

<i>Adj_Ret</i>	= cumulative stock returns beginning two days after the prior quarter's earnings announcement and ending one day after the current quarter's earnings announcement, adjusted by the value weighted market index [CRSP].
<i>Beta</i>	= an indicator variable equal to 1 if the Beta is greater than the sample median for the quarter, and otherwise 0. Beta equals the systematic risk from the market model for the twelve month period ending before the start of the current quarter [CRSP].
<i>MTB</i>	= an indicator variable equal to 1 if the market-to-book ratio is greater than the sample median for the quarter, and otherwise 0. Market-to-book ratio equals Compustat Quarterly (#14×#61)/(#59 + #52).

TABLE 1 (continued)

<i>GrossMargin/ MVE</i>	= quarterly gross margin [Compustat Quarterly # 2 - # 30], scaled by market value of equity at the beginning of the quarter [Compustat Quarterly # 14× # 61].
<i>Neg</i>	= an indicator variable equal to 1 if <i>Adj_Ret</i> is less than 0, and otherwise 0.
<i>Persist</i>	= an indicator variable equal to 1 if gross margin persistence is greater than the sample median for the quarter, and otherwise 0. Gross margin persistence equals σ in the following seasonal ARIMA model: $(\text{GrossMargin}_t - \text{GrossMargin}_{t-4}) = \sigma(\text{GrossMargin}_{t-1} - \text{GrossMargin}_{t-5}) + \varepsilon_t - \theta\varepsilon_{t-4}.$
<i>Size</i>	= an indicator variable equal to 1 if the firm's natural log of assets at the beginning of the quarter (Compustat Quarterly # 44) is greater than the sample median for the quarter, and otherwise 0.

TABLE 2
Sample Selection

Compustat firm-years during 2001-2005 Within Computer and Electronics Industries	
Base sample	4,515
Missing Compustat data	(1,470)
Missing ExecuComp data	(2,341)
Missing RiskMetrics (formerly IRRC) data	(141)
Missing CRSP data	(1)
Missing Sell-in classification	(83)
Final sample	
Firm years	479
Unique firms	119

TABLE 3
Descriptive Statistics and Correlations for Variables Included in the Revenue Recognition Choice Model

Panel A: Descriptive Statistics for the Full Sample, Sell-In Firms, and Sell-Through Firms

	Full Sample N = 479				Sell-In Firms N = 318				Sell-Through Firms N = 161			
	Mean	25% Quartile	Median	75% Quartile	Mean	25% Quartile	Median	75% Quartile	Mean	25% Quartile	Median	75% Quartile
<i>Age</i> ^{a,b}	20	8	14	28	22	8	15	32	15	9	13	20
<i>Assets</i>	3,932	349	1,109	2,572	4,213	317	1,004	2,704	3,377	482	1,470	2,408
<i>Bonus</i>	0.31	0.16	0.31	0.47	0.31	0.17	0.31	0.47	0.32	0.16	0.30	0.48
<i>EquityIncent</i> ^{a,b}	0.33	0.13	0.26	0.48	0.29	0.12	0.20	0.37	0.42	0.22	0.39	0.57
<i>Gov</i>	0.36	0.00	0.00	1.00	0.35	0.00	0.00	1.00	0.39	0.00	0.00	1.00
<i>IntCover</i> ^b	0.41	0.00	0.05	0.27	0.38	0.00	0.06	0.27	0.45	0.00	0.01	0.23
<i>Lev</i> ^{a,b}	0.10	0.00	0.01	0.19	0.11	0.00	0.04	0.20	0.08	0.00	0.00	0.14
<i>MTB</i> ^{a,b}	2.87	1.61	2.28	3.45	2.64	1.58	2.14	3.10	3.34	1.75	2.84	4.37
<i>R&D</i> ^{a,b}	0.09	0.06	0.09	0.12	0.08	0.05	0.08	0.11	0.12	0.09	0.11	0.14
<i>RaisedCapital</i> ^{a,b}	0.08	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.05	0.00	0.00	0.00
<i>Retvol</i> ^{a,b}	0.04	0.03	0.04	0.05	0.04	0.03	0.03	0.05	0.04	0.03	0.04	0.05
<i>ROA</i>	-0.02	-0.06	0.02	0.07	-0.01	-0.05	0.02	0.06	-0.03	-0.08	0.02	0.09
<i>Sell-In</i>	0.66	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00

TABLE 3 (continued)

Panel B: Descriptive Statistics by Industry

	Computer Firms N = 118				Electronic Firms N = 361			
	Mean	25% Quartile	Median	75% Quartile	Mean	25% Quartile	Median	75% Quartile
<i>Age</i>	18	8	14	21	20	9	15	29
<i>Assets</i> ^{a,b}	6,003	547	1,609	4,855	3,255	337	941	2,404
<i>Bonus</i>	0.33	0.20	0.32	0.47	0.31	0.16	0.29	0.47
<i>EquityIncent</i> ^{a,b}	0.28	0.12	0.18	0.33	0.35	0.14	0.30	0.50
<i>Gov</i>	0.42	0.00	0.00	1.00	0.34	0.00	0.00	1.00
<i>IntCover</i>	0.41	0.01	0.06	0.37	0.40	0.00	0.05	0.23
<i>Lev</i>	0.09	0.00	0.03	0.15	0.10	0.00	0.01	0.19
<i>MTB</i>	2.72	1.56	2.14	3.20	2.92	1.62	2.36	3.58
<i>R&D</i>	0.09	0.05	0.08	0.12	0.10	0.06	0.09	0.12
<i>RaisedCapital</i>	0.07	0.00	0.00	0.00	0.09	0.00	0.00	0.00
<i>Retvol</i>	0.04	0.02	0.04	0.05	0.04	0.03	0.04	0.05
<i>ROA</i>	-0.03	-0.08	0.02	0.06	-0.02	-0.05	0.02	0.08
<i>Sell-In</i> ^{a,b}	0.81	1.00	1.00	1.00	0.62	0.00	1.00	1.00

TABLE 3 (continued)

Panel C: Correlations Based on the Full Sample of Firms

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 <i>Sell-In</i>		0.18	0.10	0.08	0.01	-0.30	-0.36	-0.18	-0.04	-0.05	-0.03	-0.14	0.11	0.17
2 <i>Lev</i>	0.11		0.59	0.20	0.08	-0.16	-0.10	-0.14	-0.04	0.32	-0.25	0.02	0.30	0.03
3 <i>IntCover</i>	-0.05	0.15		0.13	-0.17	-0.11	0.09	-0.35	-0.06	0.06	-0.61	0.22	0.06	0.06
4 <i>RaisedCapital</i>	0.08	0.21	0.02		-0.09	-0.11	-0.05	0.02	0.08	-0.07	-0.04	0.04	0.08	-0.03
5 <i>Bonus</i>	-0.02	-0.01	-0.26	-0.08		-0.20	-0.20	0.24	0.01	0.40	0.39	-0.19	0.25	0.06
6 <i>EquityIncet</i>	-0.25	-0.08	0.02	-0.10	-0.20		0.23	0.33	-0.12	0.24	0.03	0.19	-0.19	-0.12
7 <i>R&D</i>	-0.35	-0.08	0.30	-0.05	-0.22	0.17		0.06	-0.09	-0.22	-0.20	0.33	-0.20	-0.06
8 <i>MTB</i>	-0.17	-0.07	-0.22	0.04	0.24	0.29	0.13		-0.03	0.19	0.50	-0.09	-0.04	-0.06
9 <i>Gov</i>	-0.04	-0.01	-0.03	0.08	0.01	-0.14	-0.10	0.03		-0.14	0.14	0.00	-0.12	0.06
10 <i>LnAsset</i>	-0.01	0.22	-0.19	-0.09	0.44	0.17	-0.23	0.12	-0.16		0.11	-0.24	0.38	0.11
11 <i>ROA</i>	0.06	-0.14	-0.60	-0.05	0.26	0.00	-0.27	0.28	0.17	0.07		-0.47	0.07	-0.06
12 <i>Retvol</i>	-0.13	0.06	0.35	0.04	-0.15	0.18	0.33	0.04	-0.01	-0.22	-0.49		-0.29	-0.04
13 <i>Age</i>	0.20	0.20	-0.19	0.05	0.33	-0.20	-0.25	-0.07	-0.11	0.51	0.14	-0.32		-0.06
14 <i>Comp</i>	0.17	-0.01	0.01	-0.03	0.04	-0.11	-0.06	-0.04	0.06	0.14	-0.02	-0.03	-0.07	

All variables are defined in Table 1 with the following exception. *Assets* is the total fiscal-year end assets (millions of dollars). All variables are winsorized at the top and bottom one percent except for *IntCover* and indicator variables. *IntCover* is capped at 2.0, and the ratio is set to 2.0 for all observations with negative operating income before depreciation. In Panel A, mean (median) differences between sell-in and sell-through firms at $p < 0.10$ using a two-tailed t (Wilcoxon Sum-Rank) test are denoted by ^{a(b)}. In Panel B, mean (median) differences between computers and electronics firms at $p < 0.10$ using a two-tailed t (Wilcoxon) test are denoted by ^{a(b)}. In Panel C, the upper (lower) diagonal of contains Spearman (Pearson) correlations. Bolded correlations are significant at the 0.05 level.

TABLE 4
Coefficients and Z-Statistics from a Logistic Regression Comparing Firm Characteristics and Use of the Sell-in and Sell-through Revenue Recognition Methods

<u>Variable</u>	Dependent variable = <i>Sell-In</i>					
	<u>Prediction</u>	<u>Model 1</u>		<u>Model 2</u>		
		<u>Coeff.</u>	<u>Z-Stat</u>	<u>Prediction</u>	<u>Coeff.</u>	<u>Z-Stat</u>
<u>Capital Requirement Proxies</u>						
<i>Lev</i>	?	1.763	(1.15)	?	2.027	(1.22)
<i>Lev</i> × <i>Gov</i>				-	-0.517	(-0.21)
<i>IntCover</i>	?	0.146	(0.53)	?	0.195	(0.62)
<i>IntCover</i> × <i>Gov</i>				-	0.106	(0.22)
<i>RaisedCapital</i>	?	0.335	(0.73)	?	1.305	(1.82) *
<i>RaisedCapital</i> × <i>Gov</i>				-	-1.929	(-1.81) **
<u>Management Incentive Proxies</u>						
<i>Bonus</i>	?	-1.422	(-1.15)	?	-0.185	(-0.13)
<i>Bonus</i> × <i>Gov</i>				-	-3.709	(-1.99) **
<i>EquityIncent</i>	?	-1.544	(-1.50)	?	-0.308	(-0.31)
<i>EquityIncent</i> × <i>Gov</i>				-	-5.082	(-2.50) ***
<u>Growth Opportunities Proxies</u>						
<i>R&D</i>	?	-1.945	(-3.83) ***	?	-1.971	(-3.74) ***
<i>R&D</i> × <i>Gov</i>				-	-0.576	(-0.68)
<i>MTB</i>	?	-0.011	(-0.12)	?	0.003	(0.03) **
<i>MTB</i> × <i>Gov</i>				-	0.030	(0.16)
<u>Governance</u>						
<i>Gov</i>	-	-0.804	(-2.35) ***	-	2.581	(2.29)
<u>Other Controls</u>						
<i>LnAsset</i>	?	-0.293	(-1.29)		-0.347	(-1.53)
<i>ROA</i>	?	0.972	(0.89)		1.333	(1.07)
<i>Retvol</i>	?	5.978	(0.63)	?	10.573	(1.02)
<i>Age</i>	?	0.037	(2.19) **	?	0.039	(2.29) **
<i>Comp</i>	?	1.251	(2.13) **	?	1.247	(2.20) **
Chi-square Tests					Chi-Sq	
<i>Lev</i> + <i>Lev</i> × <i>Gov</i>				?	1.510	(0.40)
<i>IntCover</i> + <i>IntCover</i> × <i>Gov</i>				?	0.301	(0.42)
<i>RaisedCapital</i> + <i>RaisedCapital</i> × <i>Gov</i>				?	-0.624	(0.67)
<i>Bonus</i> + <i>Bonus</i> × <i>Gov</i>				?	-3.893	(4.91) **
<i>EquityIncent</i> + <i>EquityIncent</i> × <i>Gov</i>				?	-5.390	(6.84) ***
<i>R&D</i> + <i>R&D</i> × <i>Gov</i>				-	-2.547	(8.17) ***
<i>MTB</i> + <i>MTB</i> × <i>Gov</i>				-	0.033	(0.03)

TABLE 4 (continued)

	Model 1	Model 2
N	479	479
Pseudo R ²	0.22	0.26
% Correctly Classified	73%	75%
Area under ROC curve	80%	82%

See Table 1 for definitions of all variables. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 level, respectively, for a one-tailed test when a prediction is made and a two-tailed test when no prediction is made. All z-statistics are calculated using Rogers standard errors clustered by firm.

TABLE 5
**Coefficients and t-Statistics for a Firm and Quarterly Fixed-
Effects Regression of the Association between
One-Quarter Ahead Seasonal Changes in Operating Cash
Flow, Current Period Seasonal Changes in Gross Margin and
Other Expenses, and *Sell-In***

Dependent variable = $\Delta OCF_{i,t+1}$

<u>Variable</u>	<u>Coeff.</u>	<u>t-Stat</u>
Intercept	-0.060	(-3.01) ***
<i>Sell-In</i>	0.040	(3.19) ***
$\Delta GrossMargin$	0.643	(9.13) ***
$\Delta OtherExp$	-0.088	(-2.76) ***
$Sell-In \times \Delta GrossMargin$	-0.267	(-2.98) ***
$Sell-In \times \Delta OtherExp$	0.030	(0.69)
Firm and time fixed effects	Yes	
N	1,899	
Adjusted R ²	0.12	

See Table 1 for definitions of all variables. All continuous variables are winsorized at the top and bottom one percent. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 level, respectively, for two-tailed tests.

TABLE 6
Coefficients and t-Statistics from Regressions of the
Association between Gross Margin, Market-
Adjusted Quarterly Stock Returns, *Sell-In*, and
Control Variables

Dependent variable =
GrossMargin_t/MVE_{t-1}

<u>Variable</u>	<u>Coeff.</u>	<u>t-Stat</u>
Intercept	0.038	(4.34) ***
<i>AdjRet</i>	0.066	(7.89) ***
<i>Sell-In</i>	0.003	(0.57)
<i>Neg</i>	-0.001	(-0.37)
<i>Beta</i>	-0.002	(-1.49)
<i>MTB</i>	-0.014	(-8.41) ***
<i>Size</i>	0.004	(1.23)
<i>Persist</i>	-0.003	(-2.03) **
<i>AdjRet</i> × <i>Sell-In</i>	-0.012	(-2.14) **
<i>AdjRet</i> × <i>Neg</i>	-0.006	(-0.64)
<i>AdjRet</i> × <i>Beta</i>	-0.003	(-0.61)
<i>AdjRet</i> × <i>MTB</i>	-0.027	(-5.30) ***
<i>AdjRet</i> × <i>Size</i>	0.005	(0.93)
<i>AdjRet</i> × <i>Persist</i>	-0.015	(-2.92) ***
Firm and time fixed effects	Yes	
N	1,688	
Adjusted R ²	0.74	

See Table 1 for definitions of all variables. All continuous variables are winsorized at the top and bottom one percent. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 level, respectively, for two-tailed tests.

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