ACCOUNTING REGULATION AND INFORMATION ASYMMETRY IN THE CAPITAL MARKETS: AN EMPIRICAL STUDY OF ACCOUNTING STANDARD SFAS NO 87

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Wenshan Lin, B.B.A., M.B.A.
Denton, Texas

August, 1994

ACCOUNTING REGULATION AND INFORMATION ASYMMETRY IN THE CAPITAL MARKETS: AN EMPIRICAL STUDY OF ACCOUNTING STANDARD SFAS NO 87

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Wenshan Lin, B.B.A., M.B.A.
Denton, Texas

August, 1994

Lin

Lin, Wenshan, Accounting Regulation and Information Asymmetry in the Capital Markets: An Empirical Study of Pension Accounting Standard SFAS 87. Doctor of Philosophy (Accounting), August, 1994, 157 pp., 7 exhibits, 10 tables, references, 143 titles.

The Financial Accounting Standards Board (FASB) contends that the pension disclosures mandated by Statement of Financial Accounting Standards No. 87 (SFAS 87): Employers' Accounting for Pensions provide useful information. However, from a societal perspective, usefulness is a necessary but not a sufficient condition for accounting regulation. Instead, accounting regulation is motivated primarily by the need to reduce information asymmetry. This study examines the effect of SFAS 87 disclosures on information asymmetry (as reflected in the bid-ask spread) in the capital markets.

This study uses both basic and self-selection regression models to test three hypotheses about the effect of SFAS 87 disclosures on information asymmetry during 1985-1987. Both types of models test the hypotheses after controlling for changes in the inventory holding and order processing costs of the spread, while the self-selection models also control for potential self-selection bias.

The results suggest that the first-time disclosure of SFAS 87 data significantly reduced information asymmetry by

reducing the informed trading cost of the spread both with and without correction for self-selection bias. The decrease in the spread around the release of the first 10-Ks to contain SFAS 87 data is significantly greater than the decrease around the release of other 10-Ks for both early and late adopters of SFAS 87. Furthermore, the magnitude of SFAS 87 pension variables is negatively associated with changes in the spread. These findings support the mandatory nature of SFAS 87 pension disclosures. Finally, the two groups exhibit systematic financial differences, and the spread changes for their stocks are associated with different pension variables. The substantial financial impact of and the long transition period for SFAS 87 could have deprived market participants of timely information about late adopters and may have had an adverse effect on financial statements comparability. The evidence suggests that the FASB needs to address issues such as the cost-benefits of mandatory disclosures and financial statements comparability as it considers future accounting standards.

TABLE OF CONTENTS

TABLES OF CONTENTS - continued

LIST OF EXHIBITS

LIST OF TABLES

CHAPTER I

INTRODUCTION

In December 1985, the Financial Accounting Standards Board (FASB) issued Statement of Financial Accounting Standards No. 87 (SFAS 87): Employers' Accounting for Pensions after a long and difficult process of deliberation, negotiation, and compromise. The FASB contends that the SFAS 87 reporting requirements provide useful information to financial statement users for making economic decisions.

Accounting regulation, however, has potentially diverse consequences for preparers and various user groups of financial statements. Usefulness of accounting data is an inadequate criterion for accounting regulation (Gaa 1988; Lev 1988; Ohlson and Buckman 1980). Hence, the question remains: what justifies regulation of the production and dissemination of corporate financial information in the U.S. and other market economies? Furthermore, how should the economic consequences of accounting regulation be evaluated? This study addresses the latter issue from an economic equity perspective, as opposed to an economic efficiency perspective taken in prior research (e.g., Benston 1973). Specifically, this study extends extant research on accounting regulatory consequences by explicitly examining

the role of pension disclosures mandated by SFAS 87 in reducing economic inequity (i.e., unequal opportunity or information asymmetry across market participants) in the capital markets.

Motivation and Importance of the Study

The accounting regulatory framework has received detailed attention in the accounting literature in recent decades. Extant studies often examined whether stock prices (or returns) or trading volumes reflected mandatory accounting disclosures. That is, most of the prior studies addressed information efficiency issues in the capital market regarding accounting disclosures (Lev 1988). They provide little evidence on the equity consequences or social desirability of accounting regulation (Lev 1988; Lev and Ohlson 1982).

One line of prior research on the effects of accounting regulation on the capital markets is commonly referred to as "economic consequences" research. This line of research examines the capital markets' reaction (or the cross-sectional differences in that reaction) to deliberations leading to the issuance of new accounting standards. The research results do not provide consistent evidence on market responses to deliberations leading to the issuance of new accounting standards (Bernard 1989). Another line of prior research on accounting regulatory effects, commonly

referred to as "information content" research, examines market responses to the public disclosure of accounting data mandated by new accounting standards. The empirical results on the information content of mandatory accounting disclosures are mixed (Bernard 1989). Bernard (1989) suggests that the poor results may have reflected naive research design and methodological problems. The problems include, but are not limited to, treatment of heterogeneous firms as homogeneous, difficulty in identifying the timing of market impact, weak theoretical underpinning of the study of market reactions, and unavailability of control or comparison groups. Incorporating the heterogeneity of sample firms in the research design or identifying the exact timing of market impact is especially important for research on the effects on the capital markets of new accounting standards that allow a long transition period. Market reactions to disclosures mandated by new accounting standards that allow a long transition period may be different for early and late adopters of the standards or at different point in time for each adopter group. Bernard (1989) suggests that there is room for much more research on market reactions to the disclosure of accounting data other than historical-cost accounting earnings, but only if the research moves beyond application of the current state of the art.

In the case of SFAS 87, most prior studies focused on financial statement effects and the cross-sectional

differences in those effects between early and late adopters of SFAS 87. Norton (1989) suggests that research is needed to examine how the capital markets reacted to the mandated new pension accounting disclosures by early and late adopters. Barth (1991) reported some evidence on the usefulness of supplementary pension assets and obligations data required by SFAS 87 from the information efficiency perspective; she reported that SFAS 87 data were impounded in stock prices. This study examines market reaction to SFAS 87 disclosures from an economic equity (i.e., information asymmetry) perspective rather than from an information efficiency perspective. This information asymmetry analysis is therefore different from, yet complementary to, prior research on the usefulness of pension disclosures.

The evaluation of the consequences of accounting regulation from an economic equity perspective is important for several reasons. While extant research has focused on efficiency issues, Scott (1973) notes that accounting should be concerned with equity or distributive questions. Also, an evaluation of regulatory consequences or effectiveness in achieving socially desirable goals (such as economic equity) should be an integral part of any regulation (Lev 1988; Lev and Ohlson 1982). If the social desirability of accounting regulation were to be ignored, the basis for the existence of accounting regulation would cease to exist (May and Sundem 1976).

Gaa (1988) and Lev (1988) suggest that in the absence of regulation, economic inequity in the capital markets may be present when market participants are endowed with different (asymmetric) information sets about securities or market mechanisms. The recent finance and economic literature, reviewed in chapter III, suggests that information asymmetry does exist. Information asymmetry may lead to adverse economic effects as reflected in wide bid-ask spreads, high transaction costs, low trading volume, and decreased social gains from trades. Voluntary disclosure alone cannot be relied on to mitigate these adverse effects (Glosten and Milgrom 1985; Lev 1988). Gaa (1988) and Lev (1988) suggest that an effective remedy in lessening the above adverse consequences is to remove a major source of inequity -- the informational advantage held by informed investors -- by adopting a policy mandating regular and timely public disclosure of firm-specific information useful in security valuation. The consequences of an economic equity-based disclosure regulation can be assessed by examining changes in variables affected by information asymmetry, such as the bid-ask spread, around the releases of important firm-specific information.

Specifically, this study compares changes in the bid-ask spread around the release of 10-Ks for the years 1985-1987 between firms adopting SFAS 87 in 1986 (early adopters) and firms not adopting it until 1987 (late adopters). This study

tests and corrects for the effect on the spread behavior of potential bias due to a firm's self-selecting into either the early or late adopting group. The self-selection problem pervades much of the empirical market-based research in accounting; however, few studies so far have specifically dealt with the self-selection problem (Abdel-Khalik 1990a; Foster 1980).

Organization of the Study

The remainder of this study is organized as follows. Chapter II discusses economic issues related to accounting regulation in the context of the capital markets. Chapter III reviews three areas of prior research that provide the background for this study: capital market-based accounting studies on pension disclosures, positive theory-based studies on accounting method choices, and studies on the microeconomic model of the bid-ask spread. Chapter IV discusses hypothesis development, research design, sample selection and data sources, and empirical testing procedures. Chapter V discusses the empirical results. Finally, chapter VI presents a summary of results, policy implications, limitations of this study, and suggestions for future research.

CHAPTER II

ECONOMIC ANALYSIS OF ACCOUNTING REGULATION

Corporate financial accounting and reporting operate in a regulated environment that is complex and diverse. Accounting regulation has potentially diverse economic consequences for preparers and various user groups of financial statements with varied preferences and objectives. Therefore, it is of little wonder that over the years some accounting standards have generated a considerable amount of controversy. Thus, many researchers have concluded that accounting regulation is a social choice issue or a matter of social importance (e.g., Beaver 1981; Gaa 1988 SEC 1977; Selto and Neumann 1982).

A fundamental question is what justifies regulation of the production and dissemination of corporate financial information in the U.S. and other market economies. Furthermore, how should the economic consequences of accounting regulation be evaluated? This chapter discusses these issues from an economic perspective in the context of the capital markets.[1] The economic issues regarding

[1] Other researchers have examined these issues from other perspectives such as socio-historical analysis (e.g., Merino and Neimark 1982) and political-economy analysis (e.g., Tinker 1980; Tinker et al. 1982; Cooper and Sherer 1984). Also Cooper and Keim (1983) argue for an aggregate approach that

accounting regulation may be classified into two broad categories: issues of efficiency and issues of equity (Beaver 1981). That is, accounting disclosure requirements may be justified on ground of either efficiency or equity considerations (Gaa 1988).[2]

Information and Economic Efficiency

The economic efficiency argument for accounting regulation derives largely from the "public goods" nature of financial information. Financial information possess both the joint-consumption and non-exclusivity attributes of public goods which give rise to the "free-rider" problem. As a result, there is not sufficient effective demand for financial information. The amount of financial information produced in the absence of regulation is sub-optimal because market participants fail to reveal their true preferences. As a result, the allocation of resources in the economy is not optimal (e.g., Brownlee and Young 1986; Wolf 1988).

However, financial information may not conform to the standard public-goods argument because the use of

---

incorporates all relevant socio-historical and political as well as economic factors before any definite policy conclusion can be reached; however, it may not be feasible to conduct such an empirical study.

[2] There are other arguments for accounting regulation, including the interest-group argument and the power-base increasing argument. Berry (1983) and Lev (1988) provide further discussion on these arguments.

information by one party may alter the quality or reduce the quantity of information available to others (e.g., Brownlee and Young 1986; Watts and Zimmerman 1986). For example, the use of information by its purchaser may reduce the ability of others to use the same information and reap the same returns. When an investor purchases a piece of information and starts to trade based on the information, the security price impounds the information. As a result, the value of the information is radically altered to later recipients (Manne 1974).

Information and Economic Equity

The economic equity argument for accounting regulation focuses on the notion of fair and equal access to information (Lev 1988).[3] There is an ongoing debate whether efficiency or equity concerns should guide public policy choice. Some researchers argue for an efficiency-based approach (e.g., Coffee 1984), while others favor an equity-based approach (e.g., Okun 1975; Wolf 1988). Still others recognize that equity issues regarding public policy are not independent of efficiency issues (Cooper and Keim 1983; Hakansson 1991; Selto and Neumann 1981; Weisbrod

[3] Various concepts of equity have been discussed in the philosophy and economics literature (Foley 1967; Rawls 1971; Varian 1974, 1975; Williams 1987). Following Lev (1988), this study defines equity as "equality of opportunity" or "equal access to financial information" in the context of the capital markets.

1978). However, most researchers agree that equity should be an explicit concern for policy-makers (Baumol 1982; Lev 1988; Weisbrod 1978). Accountants have traditionally adopted the expedient of some economists by resorting to "the Kaldor Compensation Principle" (Williams 1987, 176), which in effect assumes away equity concerns. However, Scott (1973) notes that accounting should be concerned with distributive questions. In the past decade, accountants began to address the distributive aspects of financial accounting and reporting, mostly from socio-historical and political-economy perspectives (e.g., Cooper and Sherer 1984; Tinker 1980; Tinker et al. 1982).

The equity concerns regarding financial information are that in the absence of regulation, there may exist an asymmetric distribution of information (Lev 1988). Information asymmetry may exist because the incentives facing various groups of market participants (such as private gains from information-based trading) may lead to the lag or suppression of public disclosure of financial information (Cooper and Keim 1983; Hakansson 1991). Such information asymmetry may bring about "adverse selection" and agency (due to moral hazard) problems that are not amenable to a market solution (Lev 1988). Furthermore, such information asymmetry is inherently unfair and violates the meaning of "fair" disclosure requirements of the Securities and Exchange Commission Acts because informed (or more

informed) investors with superior access to information may profit from trading based on the information (Beaver 1981; SEC 1977).

Lev (1988), among others, suggests that when uninformed (or less informed) investors perceive significant information asymmetry, they may adopt measures to protect themselves against exploitation by the informed (or more informed), rather than being defenseless or at the mercy of the informed as suggested by the traditional views (Ross 1979). These defensive measures may include a buy-and-hold strategy, minimizing trade with the informed, prohibiting or limiting insiders such as management from trading in the securities of their firms through legal or contractual arrangements, and, in the extreme, withdrawing from the capital markets altogether (Beaver 1981; Lev 1988). However, the protective action taken by the uninformed may have socially adverse economic effects. In particular, prior studies on the capital market microstructure (e.g., Amihud and Mendelson 1980; Copeland and Galai 1983; Demsetz 1968; Glosten and Milgrom 1985; Hamilton 1978; Karpoff 1986; Mendelson 1985) show that increased information asymmetry (or economic inequity) in the capital markets is associated with a wider bid-ask spread, fewer investors, higher transaction costs, lower liquidity of securities, thinner markets, decreased social gains from trade in securities, and even a market breakdown. Herein lies the policy concern

with inequity in the capital markets, which arises from the socially adverse economic effects brought about by the action of uninformed market participants who perceive significant inequity or information asymmetry in the markets.

While there is a general agreement on the need for timely and relevant financial disclosures, researchers disagree about how to achieve timely and relevant disclosures (Hakansson 1991). Lev (1988) suggests an economic equity-based regulatory remedy.[4] The idea is to remove a major source of inequity -- the informational advantage held by informed investors -- by mandating regular and timely public disclosure of information useful in security valuation.[5] Lev (1988) argues that such an equity-based accounting policy, if consistently applied, contributes to the equality of opportunity in the capital markets by removing a major source of information asymmetry. Such a policy mitigates the socially harmful economic consequences of the defensive measures taken by the

---

[4] Gaa (1988) also suggests that one function of accounting standards is to reduce information asymmetry to mitigate the adverse selection problem. Other suggested remedies include self-regulation or market solution such as "the signaling hypothesis" (Ross 1979), and the rewriting of investor-manager contract (Hakansson 1991).

[5] Glosten and Milgrom (1985) also suggest public dissemination of some of information held by the informed to open a "shut down" market.

uninformed, and, thus, improves overall welfare.[6] The effectiveness of an economic-equity approach to disclosure regulation can be measured by changes in the degree of information asymmetry around events of mandatory financial disclosures such as pension accounting disclosures required by SFAS 87. Empirical tests may examine changes in variables affected by information asymmetry, such as the bid-ask spread, around the release of SFAS 87 pension data.

[6] Admati and Pfleiderer (1984, cited in Hakansson 1991) analyze the role of information in the financial markets with two group of traders, one informed and one uninformed. They show that the larger the proportion of the informed relative to the uninformed, the worse off both groups are.

CHAPTER III

LITERATURE REVIEW

This chapter reviews three areas of prior research that provide the background for this study. The three areas are (1) empirical studies on capital market responses to pension accounting disclosures in the 10-K or the annual report, (2) positive theory-based studies on accounting method choices, and (3) studies on the microeconomic model of the bid-ask spread. The implications of these areas of research for this study are discussed at the end of the chapter.

Market Studies on Pension Disclosures

Since the seminal paper by Ball and Brown (1968), extensive research has assessed the incremental information content of various accounting disclosures over historical-cost accounting earnings. The review here is limited to empirical studies examining capital market responses to mandatory pension disclosures. Lev and Ohlson (1982) and Bernard (1989) review other areas of capital market-based research in accounting.

Empirical research on various pension accounting disclosures to date provides consistent evidence on the usefulness of pension disclosures (from the perspective of

information efficiency in the capital markets). Various pension disclosures are shown to be useful in explaining cross-sectional differences in stock prices or returns, systematic risk assessment, bond ratings, etc. Exhibit 1 (p.126) summarizes these empirical results.

Daley (1984) examined how various accounting measures of pension costs were related to the market value of common stock. Those measures were periodic pension expenses, unfunded vested pension benefits, and unfunded past service costs. He used a cross-sectional equity valuation model to assess whether, and to what extent, the three measures were consistent with the value of pension costs impounded in stock prices. Daley (1984) found that periodic pension expenses provided the most consistent estimate of pension costs. He also found that actuarial discount rates had no impact on equity valuation with respect to pension costs.

Dhaliwal (1986) examined whether capital market participants viewed the off-balance sheet unfunded vested pension benefits (UVB) as a form of debt when assessing a firm's systematic risk. He used a model relating a firm's systematic risk to its operating risk, financial risk, and effective tax rate. He then tested the effect of including UVB in the measurement of financial leverage on the explanatory power of the model. He found that the inclusion of UVB significantly increased the model's explanatory power. Moreover, the effect of UVB on systematic risk was

not significantly different from other debts reported on the balance sheet. Dhaliwal (1986) concluded that market participants viewed the off-balance sheet UVB as a form of debt of the sponsoring firm.

Maher (1987) investigated whether measures of net pension liability (or asset) were impounded in bond ratings. He found that net pension liabilities calculated using a common discount rate (3%) were significant in explaining bond ratings. But net pension assets as disclosed in the footnotes to financial statements were insignificant or not as significant as pension liabilities in explaining bond ratings. The author concluded that net pension liabilities were considered to be a firm's liabilities but net pension assets were not viewed in the same way as other assets of the sponsoring firm. This finding on the effect of net pension asset on bond ratings was inconsistent with Landsman (1986). Maher (1987) also suggested that bond analysts could "see through" high discount rates used by some firms to lower reported pension liabilities.

Landsman (1986) studied the property ownership right of pension assets and obligations. Specifically, he examined whether the off-balance sheet pension assets and liabilities were valued by the stock market as corporate assets and liabilities. He investigated the respective effects on equity valuation of pension assets (at market value) and liabilities (measured as accumulated benefit obligations),

instead of net pension assets or liabilities. His findings was consistent with Dhaliwal (1986) in suggesting that pension assets and liabilities are valued by the stock market not differently from other corporate assets and liabilities. Landsman (1986) also adjusted pension assets and liabilities to reflect a common discount rate (10%). This adjustment did not change the conclusion.

Landsman and Ohlson (1990), hereafter LO, investigated whether stock prices fully impounded the information inherent in net pension assets (or liabilities). Prior research had documented the importance of pension data in security valuation. However, LO argued that the high standard errors of regression coefficients made it unclear whether stock prices fully reflected pension data. LO showed that significant excess returns, adjusted for firm size, beta, and industry effects, could be earned using net pension asset or liability data for portfolio selection. LO concluded that the stock market was informationally inefficient because of its under-reaction to net pension liabilities. However, as Pastena (1990) pointed out, LO's results could be due to additional information contained in the trading rule not available to other investors on a priori basis. LO also suffered from survivorship and self-selection biases (Pastena 1990).

Barth (1991) examined which measures of pension assets and liabilities disclosed under prior pension accounting

standards and SFAS 87 most closely reflected those used in security valuation by investors. Prior equity valuation studies have ignored the bias in the regression coefficients arising from measurement errors in the explanatory variables. Barth (1991) modeled the measurement errors and their impact on estimated regression coefficients. The results indicated that footnote pension disclosures under SFAS 87 were closer to those assessed by investors than the measures recognized in the balance sheet. Also, investors appeared to include expectations about future salary progression in assessing pension obligations.

Barth et al. (1992) studied whether or not, and to what extent, stock prices reflected the components of pension expense as required by SFAS 87. They used a cross-sectional security valuation model by regressing the market value of common equity on both pension and non-pension components of reported income. The findings indicate that pension expense components, except the amortization of transition amount, are impounded in stock price and the coefficients of pension components significantly differ from one another.

Research on Accounting Method Choice

Watts and Zimmerman (1978) have developed a positive theory of accounting policy choice. They maintain that the choice of accounting methods has economic consequences because the resulting accounting numbers can affect a firm's

political visibility and contracting and monitoring costs. Watts and Zimmerman's (1978) theory suggests that managers will choose income-increasing accounting methods if the firm (1) is less visible politically, (2) ties management compensation to accounting measures of profitability, or (3) faces greater probability of violating debt agreements.

Two types of tests of the positive theory of accounting have been conducted: stock price tests and accounting method choice tests (Watts and Zimmerman 1990). Accounting choice studies attempted to explain or predict the choice of alternative accounting procedures by management. Most studies dealt with the choice of a single accounting method (e.g., depreciation). Some studies sought to explain the management choice of accounting method portfolios (e.g., Zmijewski and Hagerman 1981) or accounting accrual policy (e.g., Healy 1985). Ayres (1986) and Trombley (1989) extend this line of research to the selection of adoption dates for new accounting standards. This section reviews selected empirical accounting choice studies. Christie (1990) and Watts and Zimmerman (1986, 1990) provide more comprehensive reviews of empirical studies on accounting choice.

Typically, accounting choice studies use a probit or logit model,[7] with accounting method choice represented by

[7] Noreen (1988) and Stone and Rasp (1991) discuss the use of appropriate statistical methods for accounting choice studies.

a dummy (0 or 1) dependent variable. The explanatory variables proxy for contracting and monitoring costs include the existence of bonus plans tied to accounting income, earnings growth rate and volatility, financial leverage, interest coverage ratio, dividend constraints, and ownership structure of the firm. Proxies for political visibility include firm size, industry concentration ratio, capital intensity, and systematic risk. Despite some inconsistencies and criticisms by various researchers, accounting choice studies to date provide evidence generally consistent with the predictions of Watts and Zimmerman's (1978) theory.[8] However, the result on political costs appears either to hold for very large firms or to be driven by the oil and gas industry (Christie 1990; Watts and Zimmerman 1990). These empirical results are summarized in Exhibit 2 (p.127).

Studies of Single Accounting Choice

Hagerman and Zmijewski (1979), hereafter HZ, were among the first to provide empirical evidence on Watts and Zimmerman's (1978) theory. HZ examined separately four accounting choices: depreciation, inventory, investment tax credit, and amortization of past service pension cost. The results were mixed. Some variables were significant in explaining one accounting choice but not the other choices. Also HZ did not examine measures of debt covenants (e.g.,

[8] See Watts and Zimmerman (1990) for discussion of these criticisms and their rebuttal.

interest coverage and dividend pay-out ratios) that were found to be significant in explaining accounting choice in subsequent studies. Zmijewski and Hagerman (1981), reviewed later, extended HZ by combining the four accounting choices into an overall accounting income strategy and found stronger results.

Dhaliwal (1980) argued that due to possible violation of debt covenants, oil and gas firms with higher financial leverage ratios would prefer the full-cost to the successful-efforts accounting method. The use of the full-cost method, as compared to the successful-efforts method, generally increases reported earnings and thus reduces the possibility of violating debt covenants. Dhaliwal (1980) examined the difference in mean leverage ratios of pairs of full-cost and successful-efforts firms matched by sales. The finding indicated that, as expected, firms using the full-cost method had significantly higher leverage ratios than firms using a successful-efforts method.

Lilien and Pastena (1982) extended Dhaliwal (1980) and included variables for political visibility and management compensation in their analysis. The results suggested that oil and gas firms choosing the income-increasing full-cost procedure were smaller in size and had higher debt to equity ratios as predicted. Lilien and Pastena (1982) also examined the association between accounting choice and potential variability of reported earnings (due to accounting

procedures used). Ceteris paribus, the successful-efforts method, as compared to the full-cost method, increases earnings variability. Greater earning variability increases the variability of bonus payments, the possibility of violating debt covenants, and the possibility of government intervention (Watts and Zimmerman 1978). As a result, managers will choose the full-cost method. Lilien and Pastena (1982) presented evidence consistent with this prediction. The relationship between accounting method choice and potential variability of reported earnings due to accounting procedures used is also supported by the findings in Malmquist (1990) and Shehata (1991).[9]

Bowen et al. (1981) examined management's choice between capitalizing and expensing interest cost associated with capital projects. Capitalizing interest cost, ceteris paribus, results in higher income than expensing interest cost. The authors studied the effects of management compensation, debt contracts, and political visibility on the choice of accounting methods. They used firm size to measure political cost and a dummy variable (for the use of accounting income-based bonus plans) to measure the effects

---

[9] While Lilien and Pastena (1982) assumed the choice between a full cost and a successful efforts accounting methods is relevant to oil and gas firms engaged in drilling activities, Malmquist (1990) showed that the choice is also relevant to pipeline companies and public utilities. Shehata (1991), though not designed to test accounting choice per se, presented evidence consistent with the accounting choice literature.

on accounting choice of management compensation tied to reported income. In assessing the effects of debt contracts, they used common debt covenants such as dividend constraint, interest coverage ratio, and leverage ratio. Bowen et al. (1981) found that firms with more constraining financial ratios were more likely to capitalize interest cost as expected.

The results on firm size were mixed. The subsample of large oil and gas firms were less likely to capitalize interest cost as predicted. However, the association between size and accounting choice for the full sample was not significant and had an unexpected sign. Moreover, the existence of bonus plans was insignificant in explaining accounting choice. One problem is that the use of a dummy variable is a weak test of management compensation effect because it fails to capture the details of individual compensation plans (Watts and Zimmerman 1986). Healy (1985), reviewed below, attempted to correct this problem by examining the association between the upper and lower bounds of income specified in bonus plans and the income effects of overall accounting choices (as reflected in the size of net accruals). Also, Ayres (1986), discussed later, used earning growth rate to measure the effect of management compensation tied to accounting income on the choice of an adoption date for the accounting standard (SFAS 52) on foreign currency translation.

Zimmer (1986) analyzed the choice between capitalizing and expensing interest cost for real estate developers. Intra-industry analysis provides more powerful tests because accounting numbers are often used differently across industries (Watts and Zimmerman 1990). He found size significant, but financial leverage insignificant, in explaining the choice.

Dhaliwal et al. (1982) examined the effect of ownership structure on the choice of depreciation methods. They found that manager-controlled firms were more likely to choose income-increasing straight-line depreciation, after controlling for the effects of leverage and firm size. The association between ownership structure and accounting choice is further supported in Ayres (1986) and Trombley (1989), who reported that the percentage of stock owned by insiders was significant in explaining management choice of adoption dates for new accounting standards.

Daley and Vigeland (1983) studied managers' choice between capitalizing and expensing research and development (R & D) costs. Other things being equal, capitalizing R & D costs will result in higher reported income than expensing R & D costs. They found that firms with more constraining leverage, dividend payout, and interest coverage ratios were more likely to capitalize R & D costs as expected. Daley and Vigeland (1983) also found that managers of firms with more public debt were more likely to capitalize R & D costs.

However, contrary to prior research and theoretical prediction, they found that larger sample firms were more likely to capitalize R & D costs than smaller sample firms.

Lee and Hsieh (1985) examined the factors associated with a firm's choice between LIFO (last-in first-out) and FIFO (first-in first-out) for inventory accounting. They found that, as expected, firms with lower inventory variability and turnover, lower income variability, and larger in size relative to other firms in the same industry were more likely to choose LIFO. But, size and long-term debt to equity ratio were not significant in explaining inventory accounting choice.

VanDerhei and Joanette (1988) examined the determinants of management's choice between an accrued benefit actuarial cost method and a projected benefit actuarial cost method for pension accounting. The use of the former method results, ceteris paribus, in higher income. The findings suggested that firms choosing an accrued benefit method had higher financial leverage ratios and lower interest coverage ratios, and greater systematic risk as expected.

Ghicas (1990) studied the determinants of a firm's switch from a cost-allocation actuarial cost method to a benefit-allocation actuarial cost method. Such a switch generally decreases pension expense and funding to a defined-benefit pension plan. He compared the characteristics of industry-matched pairs of switch and non-

switch firms. The results showed that switch firms had higher long-term debt to assets ratios, lower current ratios, and lower ratios of new investment to assets than non-switch firms as predicted. Also, switch firms had better pension funding status, which motivated management to align pension assets with pension obligations by switching to a benefit-allocation method to reduce pension funding. These findings were as predicted and consistent with the findings of prior studies on pension funding strategy (e.g., Francis and Reiter 1987). However, earnings growth rate and size were not significant in explaining the switch.

Studies of Overall Accounting Strategy

Watts and Zimmerman (1986) contended that studies of a single accounting method choice reduce the power of the test and might explain the inconsistent results. Zmijewski and Hagerman (1981), hereafter ZH, and Healy (1985) attempted to rectify this deficiency. ZH examined management's overall accounting income strategy as proxied by the combined choice of accounting for inventory, depreciation, investment tax credit, and amortization of past service pension cost. ZH used a n-chotomous probit model to predict accounting income strategy choice as a function of the existence of a bonus plan, firm size, industry concentration ratio, systematic risk, capital intensity, and leverage. The four accounting procedures were given various weights to construct three proxies for the overall accounting policy choice. The

results were consistent with theoretical predictions of Watts and Zimmerman (1978) except for capital intensity and systematic risk (both of which were proxies for political costs), which had expected signs but were insignificant.

Healy (1985) conducted a more direct test of the association between accounting choice and accounting income-based bonus plans by incorporating the details of individual bonus plans (i.e., upper and lower bounds of earnings specified in the bonus plans) in the analysis, instead of a dummy variable for the use of accounting income-based bonus plans. In addition, he used net accruals to capture the effects of many difficult to observe accounting choices on income. The results indicated a significant association (1) between accrual policies of managers and income-increasing incentives associated with their bonus contracts and (2) between accounting changes by managers and the adoption or modification of their bonus plans. One problem with Healy (1985) is the lack of "expected" accruals in the absence of managers' manipulation (Watts and Zimmerman 1986).

Studies of Choice of Adoption Date

Ayres (1986) and Trombley (1989) extended the research on accounting method choice to the selection of adoption dates for new accounting standards. Ayres (1986) examined the association between a firm's financial characteristics and its choice of adoption dates (1981, 1982, or 1983) for SFAS 52 on accounting for foreign currency translation.

Under SFAS 52, gains and losses from foreign currency translation no longer flow through income as previously required by SFAS 8. The results showed that, as predicted, early adopters of SFAS 52 (1) had lower income growth from the prior year,[10] (2) had a lower percentage of stock owned by directors and officers, (3) were smaller in size, and (4) had more constraining financial leverage, interest coverage, and dividend pay-out ratios than late adopters.

Trombley (1989) studied the factors influencing firms in the software industry in choosing between an early (in 1981) and a required (in 1982) adoption dates for accounting for software development costs. He found that early adopters were smaller in size than late adopters as predicted, after controlling for the effects of earnings growth, financial leverage, and insiders' stock ownership percentage.

Research on Models of Bid-Ask Spreads

The securities markets are often used as an example of a market where buyers and sellers come together and trade at a common price, the price at which supply equals demand. In fact, however, security trading occurs over time and some

---

[10] Based on the evidence in Healy (1985) and a survey by M. E. Segal and Company in 1983, Ayres (1986) suggested that management might strive to attain an earnings growth target. The Segal survey showed that a modest (0-5%) increase in income is associated with a large (35.5%) increases in bonuses. Thus, managers of firms with income below an upper-ceiling target may be motivated to adopt an income-increasing policy.

institutional arrangements are necessary to help match the asynchronous arrival of random buy and sell orders. As a result, security trading involves the services of a specialized financial intermediary known as market makers. Market makers are dealers in the OTC (over-the-counter) market or specialists in the NYSE (New York Stock Exchange) who stand ready to trade for their own account when an order arrives. Traders may purchase (sell) securities at the market makers' ask (bid) price. The market makers are compensated by the spread (difference) between the ask and the bid prices. This section reviews research on the microeconomic model of the bid-ask spread.

Extant research on the microeconomic model of the bid-ask spread has identified three components of the spread set by market makers: inventory holding costs, order processing costs, and information-based trading costs. Market makers, like other investors, desire to properly diversify and have preferences regarding the return-risk characteristics of their portfolios. However, requests by the public to trade may move the market makers away from their desired portfolios or proper diversification. These are the sources of inventory holding costs that must be recovered. Order processing costs are incurred to communicate and execute orders. Information-based trading costs arise because some traders may trade based on information not available to

market makers or other market participants and profit at the market makers' expense.

Earlier studies focused on the inventory holding costs and viewed the bid-ask spread as the cost of immediacy or predictable liquidity to traders (e.g., Demsetz 1968; Ho and Stoll 1981; Stoll 1978a, 1978b; Tinic 1972; Tinic and West 1972). These studies show that the percentage spread (i..e, dollar spread divided by price per share) for a stock is a positive function of the riskiness and a negative function of price per share, trading volume, and competition for the stock. Order processing costs are normally assumed to be a fixed amount per transaction or less than a proportional increase relative to volume traded. Thus, the percentage spreads due to order processing costs should be negatively related to price per share (Stoll 1978b).

Later studies, especially Jaffe and Winkler (1976), Copeland and Galai (1983), and Glosten and Milgrom (1985), analyzed the potential loss incurred by market makers to informed traders as an additional determinant of the bid-ask spread. These studies suggest that market makers face two types of traders -- uninformed (liquidity-motivated) traders and informed (information-motivated) traders. The latter group is assumed to have information not available to market makers or uninformed traders. Informed traders will trade only if they expect to earn abnormal profit from the trading. Thus, market makers are confronted with an adverse

selection problem and always lose to informed traders. Specifically, these studies show that the probability of informed trading and informed trading cost to market makers depend on the proportion of informed traders (relative to uninformed traders), the arrival pattern of buy and sell orders for a security, the amount (in terms of quantity and quality) of special information possessed by informed traders, and the revision in the market makers' expectation about a stock's equilibrium value.

Theoretical Research on Spread

Stigler (1964) was among the first to study the transaction process in a financial market. Although he was not concerned with the spread per se, his study provided the impetus to the bid-ask spread literature which followed. Stigler (1964) raised several issues in the operations of the capital markets that were examined in subsequent studies: economies of scale in market making and performance measure of individual market makers and security exchanges.

Demsetz (1968) was the first to formalize a model of the bid-ask spread. He treated the spread as a transaction cost to traders for predictable immediacy of exchange in organized markets and analyzed it in a static supply and demand framework. Demsetz (1968) pointed out that several factors would keep the observed spread close to cost. These factors include (1) the time rate of transactions, (2) competition, and (3) security price per share. Demsetz

(1968, 41) argued that "the greater the frequency of transacting, the lower the cost of waiting ... and, therefore, the lower will be the spread". In short, there should be an inverse relationship between the spread and time rate of transactions. Second, competition reduces the spread and arises from (a) rivalry for the specialist's job, (b) competing markets, (c) traders submitting limit orders, (d) floor traders bypassing the specialist by crossing buy and sell orders themselves, and (e) other specialists (Demsetz 1968). Finally, the dollar spread per share tends to increase, although less than proportionally due to attenuate effect of commission and other fixed costs, with an increase in price per share. Demsetz (1968) also presented empirical evidence that was generally consistent with his theoretical arguments.[11]

Since Demsetz's (1968) seminal paper, a number of studies have examined the optimal behavior of a market maker and the existence of the bid-ask spread. These studies represent two lines of thought about the theory of the bid-ask spread. The first approach, following Stigler (1964) and Demsetz (1968), views the spread as the cost of immediacy to

---

[11] In Demsetz' (1968) empirical model, the dependent variable is the spread per share and the explanatory variables include price per share, trading volume and the number of shareholders as proxies for short-run and long-run time rates of transaction, and the number of markets that a security is listed as the proxy for competition. He did not include any risk measures of the security.

traders and examines the management of inventory by a market maker and the factors affecting the inventory holding costs. Earlier studies along this line examined the spread of a single non-competitive market maker under a one-period scenario (e.g., Stoll 1978a, 1978b; Tinic 1972). Subsequent studies extended the literature to include the cases of multiple competitive market makers in a single period, a single market maker in a multi-period dynamic model, and a multi-market-maker and multi-period model (e.g., Amihud and Mendelson 1980; Bradfield 1979; Garman 1976; Ho and Stoll 1980, 1981, 1983; O'Hara and Oldfield 1986).

The second approach follows Bagehot (1971) and is based on the idea that the spread can be a purely informational phenomenon even if other costs such as the inventory holding and order processing costs are zero and market makers earn no profits. The spread exists because market makers face an adverse selection problem. That is, the possibility of information-motivated trading can induce a spread between bid and ask prices. This phenomenon was formally analyzed by Jaffe and Winkler (1976), Copeland and Galai (1983), Glosten and Milgrom (1985), and Easley and O'Hara (1987).

Inventory Holding Costs: This section reviews theoretical studies that focused on the inventory holding cost component of the bid-ask spread. Tinic (1972) examined the determinants of individual market-maker spread. She considered the spread as the price of marketability (i.e.,

liquidity) services. Tinic (1972) suggested that the supply of these services on the NYSE resulted from the presence of specialists whose willingness to carry inventories mitigated temporal imbalance in the arrival of buy and sell orders. The price of supplying liquidity services was primarily determined by factors influencing the inventory holding costs and policies of the specialists.

Tinic (1972) categorized these factors into three broad groups: (1) factors affecting the cost of holding inventory in a stock (price, trading volume, institutional ownership, and price risk of holding a stock), (2) factors affecting the cost structure of an entire specialist unit (capitalization, and the size and the number of stocks included in the specialty portfolio), and (3) factors affecting the specialist's profit margin (exchange surveillance and evaluation, and competition). Tinic (1972) argued that the dollar spread for a stock was a positive function of price and riskiness and a negative function of trading volume for the stock, capitalization, competition, and exchange surveillance and evaluation. However, the directional effects on the spread of institutional ownership ratio and the size and number of stocks held for market-making function are uncertain. Tinic (1972) also presented empirical findings consistent with her theoretical analysis.

Stoll (1978a) pointed out that earlier studies on the market making function lacked an explicit and rigorous

theoretical foundation. Accordingly, he developed a supply-side model of the cost of dealer service to rectify this shortcoming. Stoll (1978a) suggested that in providing immediacy service a dealer incurred three kinds of costs: inventory holding costs, informed trading costs, and order processing costs. Inventory holding costs include the price risk and opportunity costs of holding securities for the dealer's market making functions. Inventory holding costs arise from trading requests by investors that may move the dealer to a level of risk and return which may be inconsistent with the dealer's personal preferences. Informed trading costs arise from trading with individuals who have information not available to dealers. Finally, order processing costs involve the costs of arranging, recording, and clearing trades.

Stoll (1978a) showed that the percentage spread due to the inventory holding costs depended on the following factors: (1) dealer characteristics: the spread is a positive function of a dealer's relative risk aversion, and a negative function of a dealer's equity in a security, (2) characteristics of the security: the spread is a positive function of both the price variance of the security and the number of periods the security is expected to be held; (3) the size of transaction in a security: the spread is a positive function of transaction size. Stoll (1978a) also

showed that a dealer's bid-ask spread is independent of his inventory position.

Stoll (1978a) also analyzed, although only briefly, informed trading costs and order processing costs. He assumed that order processing costs were a constant dollar amount per trade and, therefore, a declining proportion to each additional dollar of trading. Informed trading costs reflect the expected value of loss incurred by a dealer due to information-motivated trading and are positively related to a stock's turnover ratio (trading volume to shares outstanding). Finally, Stoll (1978a) also examined the relative desirability of monopolistic and competing dealer systems. He showed that the spread was negatively related to the degree of competition. The negative effect of competition among dealers on the spread are also supported by the findings in Ho and Stoll (1980, 1983). Stoll (1978b), reviewed later, presented empirical results on the spread determinants that were consistent with his theoretical analysis discussed above.

Ho and Stoll (1981) extended Stoll's (1978a) single-period model to a multi-period case. The economic setting of both studies is pretty much the same. One major difference is that Ho and Stoll (1981) introduced the transaction uncertainty and the demand for dealer services in an explicit treatment of the dealer's multi-period pricing strategies using stochastic dynamic programming. Consistent

with the results reported in Stoll (1978a), Ho and Stoll (1981) showed that the percentage spread depended on the dealer's risk attitude, transaction size, and return variance of a security. In addition, the percentage spread is independent of the dealer's inventory position except that inventory affects the rate of return on the dealer's total wealth. This last result was also supported by the theoretical analyses in Bradfield (1982) and Zabel (1981).

Garman (1976), Amihud and Mendelson (1980), and O'Hara and Oldfield (1986) also presented dynamic programming models of optimal monopolistic dealer spread in a multi-period framework. However, the three studies were concerned with a security's equilibrium price and required a dealer to maximize profits from market making, while Stoll and Ho (1981) were concerned with the equilibrium price of dealer immediacy services and required the dealer to maximize expected utility instead of profits. All three studies showed that a dealer's spread strongly depended on his inventory position. In contrast, Ho and Stoll (1981) showed that the dependency was weak at best.

Most theoretical studies on models of spread behavior have recognized that dealers may face competition from other dealers or investors placing limit orders. However, these studies either modeled a competitive dealer but ignored the interaction of his quotes with other dealers' (e.g., Stoll 1978a) or analyzed a single representative dealer (e.g.,

Demsetz 1968; Garman 1976; Ho and Stoll 1981; Tinic 1972). In other words, they analyzed individual dealer's spread, not the market spread.[12]

Ho and Stoll (1980, 1983) were among the first to rectify this deficiency by developing a model of the effects of competing dealers on the spread. Ho and Stoll (1980, 1983) reached the following conclusions:

First, there is a negative relationship between the spread and competition among dealers measured as the number of dealers in a security. Second, stocks traded more often have lower bid-ask spread than stocks traded less frequently. The reason is that frequently traded stocks have a higher probability of trading in the next period or moment. Hence, the transaction uncertainty facing a dealer is reduced and this makes it easier for the dealer to adjust his inventory position. Inventory holding costs and, thus, the spread becomes smaller. Finally, in a multi-dealer environment, there is an incipient "gravitational pull effect" that causes incoming orders to be traded in a way that limits the divergence of inventories among dealers and the divergence of their reservation bid and ask prices.[13]

---

[12] Market spread is the difference between the lowest individual dealer's ask price i.e., the market ask price, and the highest individual dealer's bid price, i.e., the market bid price (Cohen et. al. 1979).

[13] This potential gravitational pull effect was first suggested by Cohen et. al. (1978). The reservation bid and ask prices are a dealer's maximum bid and minimum ask prices such

Ho and Stoll (1983) concluded that the reservation spread of each dealer did not depend on his inventory position. Assuming a similar degree of risk aversion of dealers, all dealers will have a similar reservation spread and the observed market spread tends to be the reservation spread of any dealer. Thus, any mean-preserving increase (decrease) in spreads by all dealers would increase (decrease) the market spread.

The above theoretical analysis is supported by empirical results using both the market spread and the average dealer spread. More importantly, Hamilton (1978) used both the market spread and the modal spread in separate empirical tests for a sample of OTC stocks and found virtually identical results.[14] These theoretical and empirical results should ease the concerns about applying the theoretical models of monopolistic dealer spread to study the spread behavior in the OTC market where there are competing dealers (Ho and Stoll 1983).

---

that the dealer's expected utility of terminal wealth will remain the same if trading at these prices (Ho and Stoll 1980).

[14] Hamilton (1978) suggested that bid and ask price quotations would not vary widely among dealers in a stock. First, if one myopic dealer did have different quotations, some traders would find them attractive and trade with the dealer and correct the imbalance between buy and sell orders that had induced the dealer to set those quotations in the first place. Second, dealers would, in fact, observe one another closely.

Informed Trading Costs: Bagehot (1971) was the first to point out that the spread could be an informational phenomenon. Bagehot (1971) suggested that market makers faced two basic groups of traders: information-motivated (informed) traders and liquidity-motivated (uninformed) traders. Informed traders are those who have special or non-public information which allows them to estimate future security price more accurately than others, including market makers. Uninformed traders are those who have no special information but merely want to sell or buy securities to rearrange their portfolios.

Bagehot (1971) argued that market makers could always expect to lose to informed traders because these traders had the option of not trading with the market makers at the quoted bid or ask prices. On the other hand, market makers always gain from their transactions with uninformed traders. Under current institutional arrangement market makers do not know the identity of traders. As far as market makers are concerned, the two groups of traders are largely indistinguishable. Thus, market makers face an adverse selection problem. To survive and prosper, market makers must offset their losses to informed traders by their gains from uninformed traders. This is achieved by setting a spread between the ask and the bid prices. The wider the spread is, the lower the market makers' losses due to informed trading and the higher their gains from uninformed

trading. Jaffe and Winkler (1976), Copeland and Galai 1983), and Glosten and Milgrom (1985) have since provided theoretical support for Bagehot's (1971) arguments.

Jaffe and Winkler (1976) were the first to formally analyze the adverse selection problem facing a market maker. They showed that a market maker could always expect to lose in his trades with informed traders even after including the bid-ask spread. Jaffe and Winkler (1976) also showed that the probability that an informed trader would trade is a decreasing function of the spread and an increasing function of the quantity and quality of private information possessed by informed traders. That is, the larger the spread is, the lower the possibility of informed trading will be and, thus, the lower the loss a market maker will suffer from trading with the informed. Also, the precision of the market maker's estimate of security price improves relative to that of an informed trader's estimate when the informed trader has less (in terms of quantity or quality) private information vis-a-vis the market maker. Hence, the market maker can set a lower spread and still survive and prosper.

Since a market maker can always expect to lose to informed traders, a purely speculative market, i.e. all trades are information-motivated, will be unstable. In other words, the market maker will set the spread equal to infinity or so wide as to preclude any trade and, thus, avoid losses from informed trading. As a result, the market

may break down unless the market maker is subsidized or the size of the spread is limited in some way. Milgrom and Stockey (1982) also demonstrate that all trading motivations cannot be strictly speculative. If traders are solely information-motivated, any uninformed traders will do better by leaving the market rather than facing a certain loss from trading, and the market maker will set the spread so wide that no trading will occur. To avoid this no-trade equilibrium, the uninformed traders trade, at least partially, for liquidity reasons. This exogenous demand may arise either from an imbalance in the timing of consumption and income or from portfolio considerations. On the other hand, Glosten and Milgrom (1985), reviewed later, suggested public disclosure of information possessed by the informed to open a closed market.

In the real world, uninformed traders always expect to lose to the market maker and in effect they subsidize the market maker. Thus, the spread will depend, among other factors, on the probability of informed and uninformed trading and the relative value of the two kinds of trading. Copeland and Galai (1983) focused on this point and modeled the spread as the trade-off between a market maker's expected losses to informed traders and expected gains from uninformed traders. Copeland and Galai's (1983) model is applicable to both monopolistic dealer markets such as the NYSE and competitive dealer markets such the OTC.

Copeland and Galai (1983) argued that the market maker's objective was to choose the bid-ask spread to maximize his profits. If the spread too is wide, the market maker loses expected revenues from uninformed traders while reducing potential losses to informed traders. On the other hand, if the spread is too narrow, the expected losses to informed traders increase but the losses are offset by potential increase in revenues from uninformed traders. Thus, the market maker's optimal spread is determined by the trade-off between the expected gains from uninformed trading and the expected losses from informed trading. Copeland and Galai (1983) characterized the informed trading cost component of the spread as a combination of a call and a put options.

Several testable propositions are suggested by the Copeland and Galai's (1983) model. First, as competition intensifies, the bid-ask spread decreases.[15] This is consistent with the theoretical analyses in Ho and Stoll (1980, 1983) and the empirical evidence reported in Benston and Hagerman (1974), Hamilton (1978), Stoll (1978b), and Tinic and West (1972), which are reviewed later.

Second, option pricing theory suggests that as the variance of price (return) of a security increases, ceteris

---

[15] Louge (1975) also considered the relative value of competitive versus monopolistic market makers in an analysis which distinguishes between liquidity and information motivated trading. He concluded that a competitive system would in both cases be superior,i.e., the average spread would be lower.

paribus, the market maker's expected losses to informed traders increase and the spread widens. Another prediction is that as the proportion of informed traders, relative to uninformed traders increases, the probability of informed trading increases and the spread becomes wider. In the extreme, the spread may be so wide that there is no trade, i.e., a market breakdown. To open a "breakdown or closed" market, Glosten and Milgrom (1985) suggested that public disclosure of some of the information held by the informed (or the so-called insiders) was required. In addition, if large price changes arise from informed trading, there should be a positive contemporaneous relationship between large price changes and the bid-ask spread.

Finally, the impact of trading volume on the spread may take two forms. First, the probability of informed trading may be higher for thinly traded securities, which are on average more closely held or issued by smaller companies. Thus, there is a greater information asymmetry for these securities. This suggests an inverse relationship between the spread and trading volume, holding trading size constant. Second, given that informed traders wish to transact, they would prefer to trade at a larger volume. In other words, large trade size may convey special information. Thus, there should exist a positive association between the spread and the size per trade.

Glosten and Milgrom (1985) also examined information effects on both the spread and transaction prices and the processing of privately available information in the capital markets. They essentially extended and generalized the results in Copeland and Galai (1983). The major difference is in how private information is revealed. Copeland and Glosten (1983) assumed that private information became public immediately after each trade. On the other hand, Glosten and Milgrom (1985) allowed for further information-motivated trading until the information asymmetry between the informed and the rest of the market was fully resolved. In sum, Glosten and Milgrom (1985) showed that the average spread depended, among other factors, on the relative ratio and the exogenous arrival patterns of the two types of traders, the quantity and quality of special information possessed by the informed, and the elasticity of demand for immediacy service among uninformed traders. Also, transaction prices were informative and the spreads tended to decrease with each trade.

Easley and O'Hara (1987) also showed that the spread decreased with increased depth (i.e., the proportion of the uninformed relative to the informed trading) and increased with increased price variance. These results were consistent with the analyses in Copeland and Galai (1983) and Glosten and Milgrom (1985) and with the findings in several empirical studies (e.g., Stoll 1978b; Tinic and West 1972).

Empirical Research on Spreads

This section reviews empirical studies on the determinants of the bid-ask spread, economic significance of the spread components, and information effects on the spread.

Determinants of Spreads: The usual approach is to run cross sectional tests with dollar spread per share or percentage spread (i.e., dollar spread over price per share) as the dependent variable. Explanatory variables can be categorized into four groups as follow:

The first variable is stock price per share or its reciprocal. The dollar spread per share increases with an increase in the price per share to compensate dealers for higher inventory costs. However, for stocks which suffer a price decline, the same dollar spread will give the impression of an increase in the percentage spread. Also, the increase in order processing cost is likely to be less than proportional as trading volume increases. Thus, the percentage spread is negatively associated with price per share (Stoll 1978b).

The second group of variables represent the trading characteristics of a stock: trading volume, transaction rate (i.e., trading intensity and continuity), the number of shareholders, concentration of institutional ownership, and volume of insider trading. The dollar or percentage spread is negatively related to trading volume, transaction rate,

and the number of shareholders, and is positively associated with volume of insider trading. The direction of relationship between the spread and institutional ownership is not clear.

The third variable measures competition among dealers: the number of competing dealers or the number of exchanges listed. The spread is inversely related to the degree of competition. The fourth group represent the characteristics of a stock: price or return variance, systematic risk, and unsystematic risk. The relationships between the bid-ask spread and these characteristics are positive. Exhibit 3 (p.129) summarizes the empirical results.

Demsetz (1968) was among the first to present empirical evidence on the determinants of the bid-ask spread for NYSE listed stocks. Demsetz (1968) found that price and transaction rate were highly significant but the number of markets that a stock was traded was insignificant in explaining cross-sectional differences in the spread. He concluded that security trading was subject to scale economies on the NYSE. However, Tinic (1972) argued that the number of markets traded was a poor proxy for effective competition for NYSE stocks because it ignored the volume handled by each market.

Tinic (1972) and Tinic and West (1972) also examined the determinants of the spread for NYSE stocks. Consistent with Demsetz's (1968) findings, Tinic (1972) found that

price, daily average number of shares traded, and the ratio of trading days to the number of days included in the sample period were significantly associated with the spread. Moreover, competition measured as the Herfindahl's (1950) index was highly significant.[16] Tinic (1972) also included price variance to measure price risk to dealers but found no significance.

Tinic and West (1972) provided further evidence regarding the effect of competition on the spread. They found that the number of competing dealers (proxy for competition) was not significant and trading volume had lower significance level than the significance level reported in Tinic (1972). They reasoned that the result was caused by the high correlation between the number of competing dealers and trading volume. They used factor analysis to construct a new variable for the combined effect of the two variables to correct the collinearity problem. They found that the new variable was significant at the 1% level. Thus, Tinic and West (1972) concluded that an increase in competition should reduce the price of dealer service, i.e., the spread, and dealership function did not entail economies of scale as suggested by Demsetz (1968).

---

[16] Herfindahl's (1950) index is measured as the ratio of squared number of shares traded annually in a market to the total number of shares traded in all markets for a stock. The lower the value of the index is, the greater the effective competition is.

However, Tinic and West's (1972) conclusion seems unjustified in light of a higher statistical significance level for trading volume than for competition. Smidt (1971) suggested that the negative relationship between the spread and trading volume was consistent with at least three hypotheses: (1) market making entails scale economies and, thus, is a natural monopoly, (2) market makers face more competition in a stock with higher trading volume, and (3) market makers face lower inventory holding risk in a stock with higher volume because it may be easier for them to adjust their inventory position in an actively traded stock. This unresolved issue of scale economies was further explored by Benston and Hagerman (1974), Branch and Freed (1977), and Hamilton (1976).

Benston and Hagerman (1974) analyzed the determinants of the spread in the OTC market to determine if the dealership function was a natural monopoly. Benston and Hagerman (1974) found that trading scale or intensity measured as the number of shareholders, price per share, the number of competing dealers, and unsystematic risk were highly significant with expected signs. Systematic risk was not significant as expected. The negative relation between the spread and trading scale suggests that scale economies in security trading may exist. However, competition had a stronger impact on the spread than trading scale. In addition, Tinic and West (1972) reported that the number of

dealers increased with an increase in trading volume. Thus, Benston and Hagerman (1974) concluded that economies of scale in security trading existed at the industry level but not at the individual dealer level; that is, dealers faced a positively sloped cost curve which shifted downward as the industry output (i.e., total trading volume) increased.

Benston and Hagerman (1974) explained that if the scale economies existed at the dealer level, there would be only one dealer who would be a natural monopolist making the market for each stock. However, Tinic and West (1972) reported that the number of dealers increased with an increase in trading volume for a stock. This finding is not consistent with the hypothesis of natural monopoly. Thus, Benston and Hagerman (1974) did not resolve the issue of whether the negative relationship between spreads and trading volume was due to competition or scale economies at the industry level.

Branch and Freed (1977) explored further the issue of market making as a natural monopoly by estimating the relative impact of competition and volume on the bid-ask spread. They found that, while both volume and competition exerted a downward pressure on the spread, competition had a stronger impact on the spread for NYSE stocks than for OTC stocks. They estimated that if all trading of NYSE stocks was restricted to the primary exchange, i.e., the NYSE, the net effect of increase in volume and decrease in competition

would increase the spread by more than 10%. Thus, they concluded that there was no scale economies in market making for NYSE stocks.

Hamilton (1976) studied the relationship between the bid-ask spread and the time rate of transactions for NYSE and OTC stocks to determine if scale economies existed for NYSE specialists. He used the number of shareholders and both the number of shareholders and the average number of shares per shareholder as the proxy for transaction rate in two separate models. He argued that if there existed a significant negative relationship between the spread and transaction rate for OTC stocks, market making in the NYSE had no scale economies. Hamilton (1976) found that there was a significant negative relationship between transaction rate and the spread for both NYSE and OTC stocks and the negative relation was stronger for OTC stocks. Thus, Hamilton (1976) concluded that market making function was not a natural monopoly.

Stoll (1978b) empirically examined the determinants of the spread in the OTC market. This study represents several improvements over earlier studies. First, it was based on the explicit theory of dealer costs developed in Stoll (1978a). Second, it included more explanatory variables and used a larger data set than prior studies. Finally, it specifically included the effects on the spread of information-based trading risk measured as a security's

turnover ratio and of dealer wealth measured as absolute daily inventory change per dealer based on the assumption that wealthier dealers tended to take larger positions. Stoll (1978b) found that all explanatory variables were significant with predicted signs. This finding was consistent with results reported in prior studies reviewed earlier. Stoll (1978b) also found that, inconsistent with prior research discussed above, systematic risk was significant. However, systematic risk had the lowest significance level in Stoll's (1978) study.

Tripathy and Peterson (1991) also examined the impact of systematic and unsystematic risks on the spread. Prior empirical studies (e.g., Benston and Hagerman 1974; Stoll 1978b), reported mixed results on the effect of systematic risk. Tripathy and Peterson (1991) found that systematic risk had no significant impact on the spread, which was consistent with the evidence in Benston and Hagerman (1974) and portfolio theory but inconsistent with the finding in Stoll (1978b). More importantly, they found that, while the unsystematic risk affected the spread, the effect was more significant for stocks handled primarily by small, less-diversified dealers. For stocks handled by large dealers (i.e., the twelve largest investment banking firms in the U.S.) with relative low diversification costs, unsystematic risk had little impact on the spread.

Economic Significance of Spread Components: A related line of research on dealer service is to explore the economic significance of the bid-ask spread components. The spread components are estimated using actual transaction price time series.

Glosten and Harris (1988) decomposed the total spread into two parts: one part due to adverse selection (i.e., informed trading cost) and the other due to inventory holding and order processing costs. The two components were estimated for a sample of 250 NYSE stocks during 1981-1983. They found that the adverse selection and the inventory holding and order processing cost components accounted for about 20% and 80% of the total spread, respectively.

Stoll (1989) estimated the adverse selection, inventory holding, and order processing cost components of the total spread for a sample of about 900 OTC stocks. Stoll (1989) found that 43%, 10%, and 47% of the total spread were due to adverse selection, inventory holding costs, and order processing costs, respectively. The higher percentage of the total spread due to adverse selection for OTC stocks than for NYSE stocks probably reflects the fact that OTC firms are smaller, more closely held, and followed by fewer financial analysts. Thus, there exists more potential for information-based trading for OTC stocks than for NYSE stocks; and this is reflected in the greater informed trading cost component of the spread for OTC stocks.

Information Effects on Spreads: More recent empirical work on the bid-ask spread attempted to substantiate the existence of informed trading costs. The usual approach is to examine changes in the spread around firm-specific information events such as earnings or dividend announcements, additional accounting disclosures, takeover bids, etc. Exhibit 4 (p.130) summarizes these empirical results.

Stoll (1976) was among the first to provide empirical support for the existence of information-motivated trading by examining dealer inventory changes. He found that dealer inventories tended to increase (decrease) on days prior to stock price declines (increases) and concluded that a portion of traders profited from superior information and dealers lost to these information-motivated (informed) traders as suggested by Bagehot (1971).

Morse and Ushman (1983) examined changes in the spread around quarterly earnings announcements and large stock price changes used as a proxy for other information releases. They found significant increases in the spread prior to large absolute price changes but no significant change in the spread around quarterly earnings announcements. They explained that the increase in the spread could be attributed to higher inventory holding costs to dealers because of higher price variances around information releases or may be attributed to loss due to

informed trading. However, their empirical design could not differentiate between the two possible explanations.

Venkatesh and Chiang (1986) suggested that dealers widened the spread as a defensive measure when they expected higher losses (due to increased information asymmetry) prior to easily predictable firm-specific information events such as earnings or dividend announcements. They examined the spread behavior for 75 NYSE firms during the period prior to announcements of annual earnings or dividends or both. They found significant increase in the spread prior to the later of earnings or dividends announcements when the two announcements were separated by at least ten days but no more than thirty days. But, they found no significant increases in the spread prior to earnings or dividends announcements that were separated by more than 30 days or joint announcements of earnings and dividends.

Rao et al. (1991) examined the impact of option listing on the bid-ask spread for 49 OTC firms. They found that the spread was significantly lower around the commencement of option trading. They suggested that option listing reduced both dealer inventory holding cost and informed trading cost because of higher trading volume and the reduction in information asymmetry brought about by option listings.

Tripathy and Rao (1992) studied the impact of OTC seasoned equity issuances on the bid-ask spread. The findings suggested that the spread declined prior to the

announcement. They concluded that seasoned equity issuances partially resolved information asymmetry, occurred even before the public announcement, because of due diligence and certification aspects of the investment banking process and the provision of liquidity by dealers surrounding the period of a seasoned equity offering.

Raman and Tripathy (1993) evaluated the usefulness of oil and gas reserve-based present value data by examining the effect of their disclosure on information asymmetry in the stock market. They found that the magnitude of reserve-based accounting data, as hypothesized, were negatively associated with changes in the spread after controlling for changes in the inventory holding and order processing cost components of the spread. The finding suggested that supplementary disclosures of oil and gas reserve data represented relevant information; their disclosure reduced information asymmetry in the capital markets.

Greenstein and Sami (1994) examined the effect of the segment disclosures in the 10-K required by the Securities and Exchange Commission on the spread by comparing the differences in changes in the spread around the 1969 and 1970 10-K releases. The results indicate that the spread was significantly lower around the 1970 10-K release than the spread decline around the 1969 10-K release for firms reporting segment information for the first time in the 1970 10-K, as compared to the spread changes for a control group

consisting either of firms reporting segment information prior to 1970 or of single-segment firms. The findings suggests that the public disclosure of segment data reduced information asymmetry. The results also suggest that the downward shift in the bid-ask spread is a function of the number of segments.

Implications of Prior Research for This Study

Empirical pension accounting research reviewed earlier suggests that pension disclosures, such as periodic pension expense and pension obligations and assets (or changes in these data), are useful in explaining the cross-sectional differences in security prices or returns, firm risk assessments, etc. Hence, these pension disclosures should be relevant to market participants, including the security dealers, for revising their expectation of a security's equilibrium price. Moreover, the disclosure of pension accounting data in the 10-Ks is easily predictable (a firm normally releases its 10-Ks about the same time in each year). In other words, the disclosure of pension accounting data in the 10-Ks represents an easily predictable release of firm-specific useful information; information asymmetry is expected to be greater prior to the release (Venkatesh and Chiang 1986).

During periods of increased information asymmetry, the trading behavior of uninformed and informed traders is likely to change (Cready and Mynatt 1991; Venkatesh and

Chiang 1986).[17] Dealers, who can be thought of as uninformed market participants, can suffer especially heavy losses to informed traders because dealers must stand ready to trade (Venkatesh and Chiang 1986). Informed traders will trade only if they expect to earn abnormal profits. Uninformed traders aware of the increased information asymmetry may minimize trades prior to the disclosure of SFAS 87 data or delay trading until after the disclosure. Hence, the probability of informed trading, relative to uninformed trading, is expected to be higher prior to easily predictable firm-specific information events (Copeland and Galai 1983; Jaffe and Winkler 1976).

The greater informed trading implies that dealers are likely to widen the bid-ask spread (the dealers' source of revenue) as a defensive measure to offset higher expected losses to informed traders (Glosten and Galai 1983; Jaffe and Winkler 1976; Venkatesh and Chiang 1986). If the public disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry, other things being equal, the post-10-K bid-ask spread should be smaller. The effect of pension information required by SFAS 87 on information asymmetry then can be examined by comparing the average spread before and after the release of SFAS 87 information in the 10-Ks.

---

[17] Cready and Mynatt (1991) found that small, presumably uninformed or less informed, investors traded more during the 10-day event period after the release of annual reports as compared to the period before the annual report release.

Prior accounting studies (e.g., Beaver et al. 1979) suggest that both the sign and magnitude of accounting data represent relevant information for security valuation. The change in the equilibrium stock price is associated with both the sign and magnitude of accounting data. Beaver et al. (1979) argue that ignoring the magnitude of accounting data is like throwing away useful information. For similar reason, both the sign and magnitude of SFAS 87 data are expected to be useful to dealers and other traders in revising their expectation of a stock's equilibrium price since new SFAS 87 data are shown to be relevant for the valuation of firms sponsoring the pension plans (e.g., Barth 1991).

As Glosten and Milgrom (1985) point out, the adverse selection component (due to informed trading) of the spread also depends on the revision in a dealer's expectation of a stock's equilibrium value. Prior to reasonably predictable release of accounting data (such as SFAS 87 disclosures in the 10-Ks), a dealer can be expected to revise upward (downward) his expectation of a stock's market value conditional on a buy (sell) order for the stock (Raman and Tripathy 1993). Informed traders are expected to observe the dealer's bid and ask quotes and trade only if they expect to earn abnormal returns (Glosten and Milgrom 1985). As a defensive measure, a dealer is expected to quote a higher ask (lower bid) price based on his expectation of a higher

(lower) stock price prior to an anticipated information release (Venkatesh and Chiang 1986; Raman and Tripathy 1993). Ceteris paribus, an increase in the ask price or a decrease in the bid price both widen the spread. Thus, the magnitude of pension accounting disclosures is expected to be negatively associated with the changes in the spread due to the anticipated revision (induced by the pension disclosures) in a stock's equilibrium price.

As prior research on the determinants of the bid-ask spread suggests, the spread reflects the inventory holding and order processing costs as well as the expected loss incurred by the dealer due to informed trading. Hence, an empirical study on the effect of an information event on information asymmetry (as reflected in changes in the bid-ask spread) must control for potential changes in the inventory holding and order processing costs around the information event being examined. Prior research reviewed earlier suggests that the inventory holding and order processing costs for a stock may be proxied by trading volume, price (return) variance, competition, and price per share for the stock.

The sample firms used in this study include both early (for 1986) and late (for 1987) adopters of SFAS 87. The accounting choice literature suggests some systematic differences in financial characteristics between early and late adopters of a particular accounting standard. These

differences conceivably can affect the bid-ask spread around corporate information events such as the 10-K release. In short, self-selection bias potentially exits and must be controlled for. This study uses a Heckman-Lee two-stage self-selection model as described in Maddala (1983) to test and control for the potential selection bias.

CHAPTER IV

RESEARCH METHODOLOGY

This chapter discusses hypothesis development, research design, sample selection and data sources, and empirical testing procedures. Three hypotheses are developed regarding the relationship during fiscal years 1985-1987 between the bid-ask spread behavior and the new SFAS 87 pension accounting data. This study uses a treated (at a different time) non-equivalent control group design with pretest and posttest to test the hypotheses (Cook and Campbell 1979). When early adopters of SFAS 87 receive the treatment (the adoption of SFAS 87 for 1986), late adopters serve as the control (comparison) group; when late adopters later receive the treatment (the adoption of SFAS 87 for 1987), early adopters serve as the control group.

The empirical testing procedures use both basic regression models and two-stage Heckman-Lee self-selection regression models. Both types of models control for concurrent changes in the inventory holding and order processing cost components of the bid-ask spread, while the self-selection models, as described in Maddala (1983), also control for potential bias due to a firm's self-selecting into the early or late adopting group.

Hypothesis Development

Public concerns about pension plans date back several decades. One concern is about the security of pension assets and benefits, which are an important part of the U.S. economy (Barth 1991; Norton 1988). Another concern focuses on the potential for the "mispricing" of corporate securities because of inadequate, and often non-comparable, pension disclosures (Daley 1984; Landsman 1986). In response, the FASB issued SFAS 87 in 1985. The adoption of SFAS 87 was not required until 1987 but early adoption was encouraged by the FASB. SFAS 87 substantially changes the accounting and reporting requirements for defined-benefit pension plans.[18] Among the important new requirements under SFAS 87 are: (1) more standardized computations of pension expenses and benefit obligations, (2) the disclosure of pension expense components, (3) the disclosure of projected benefit obligations (PBO) in addition to accumulated benefit obligations (ABO) previously required, (4) the recognition of a minimum liability for underfunded pension plans, and (5) additional footnote disclosures.

The new SFAS 87 requirements have substantial impact on the reported income of firms sponsoring defined-benefit

---

[18] These changes and a history of pension accounting standards are provided in Appendix A. Also, Exhibit 5 (p.131) summarizes the major differences between SFAS 87 and previous standards, i.e., Accounting Principles Board Opinions No. 8 (APB 8) as amended by SFAS 35 and SFAS 36.

pension plans. For example, Norton (1989), and Senteney and Strawser (1990) reported that SFAS 87 generally had a favorable impact on pension expense and reported income for most companies. The income effect was greater and more favorable for early adopters than for late adopters. Since the amount (or change in the amount) of pension expense is generally impounded in stock prices (e.g., Daley 1984), the generally larger (smaller) reduction in pension expense due to SFAS 87 adoption for early (late) adopters will likely lead to a larger (smaller) revision in the expectation of market participants (including securities dealers) about the stock market value of early (late) adopting firms.

Prior studies (Norton 1989; Senteney and Strawser 1990) report that the effect of transition to SFAS 87 on the balance sheet was minimal; in fact, few companies reported additional pension liability on their balance sheets. There are several reasons for this. First, the reporting of an additional liability on the balance sheet was not required until 1989. Second, the minimal balance sheet effect also could be attributed to the generally good performance of the stock market during the sample years 1985 through 1987 and, as a result, most pension plans were well funded. However, the situation could change dramatically if the stock market takes a downturn. A downturn in the stock market will reduce the market value of pension assets and, thus, increase the possibility of reporting additional pension liability. The

possibility of reporting additional pension liability is especially high for late adopters, who often have underfunded pension plans. Moreover, PBO disclosed under SFAS 87 represents a substantial increase over ABO disclosed pursuant to prior accounting standards (Norton 1989). Prior studies (e.g., Barth 1991) suggest that PBO or the excess of PBO over ABO is impounded in security prices or reflected in the risk assessment of the sponsoring firms.

Venkatesh and Chiang (1986) suggest that information asymmetry is expected to be greater prior to easily predictable firm-specific events that may reveal important information for security valuation. The disclosure of SFAS 87 data in the 10-Ks satisfies these criteria. A company normally releases its 10-K about the same time in each year. Also, as discussed above, pension accounting disclosures in the 10-Ks convey firm-specific information useful in explaining cross-sectional differences in stock prices (or returns), systematic risk assessment, etc.

During periods of increased information asymmetry, the trading behavior of uninformed and informed traders is likely to change (Cready and Mynatt 1991; Venkatesh and Chiang 1986).[19] Dealers, who can be thought of as uninformed market participants, can suffer especially heavy

[19] Cready and Mynatt (1991) found that small, presumably uninformed or less informed, investors traded more during the 10-day event period after the release of annual reports as compared to the period before the annual report release.

losses to informed traders because dealers must stand ready to trade (Venkatesh and Chiang 1986). Informed traders will trade only if they expect to earn abnormal profits. Uninformed traders aware of the increased information asymmetry may minimize trades prior to the disclosure of SFAS 87 data or delay trading until after the disclosure. Hence, the probability of informed trading, relative to uninformed trading, is expected to be higher prior to easily predictable disclosure of SFAS 87 data in the 10-Ks. The greater informed trading implies that dealers are likely to widen the bid-ask spread (the dealers' source of revenue) as a defensive measure to offset higher expected losses due to informed trading (Glosten and Galai 1983; Jaffe and Winkler 1976; Venkatesh and Chiang 1986). If the public disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry, other things being equal, the post-10-K spread should be smaller.

Based on the above discussion, it is hypothesized that the change (decrease) in the bid-ask spread around the release of the <u>first</u> 10-Ks to contain SFAS 87 data will be greater than the change in the spread around the release of other 10-Ks. The change in the spread (CHSPD) is computed as the ratio of average percentage spread for the 10-day period after the 10-K release to average percentage spread for the 10-day period before the 10-K release. If the spread ratio is less than one, there is a decrease in the spread after

the 10-K release, and vice versa. Ceteris paribus, if the disclosure of SFAS 87 data reduces information asymmetry, the spread ratio will be less than one.

Specifically, early adopters made the first-time public disclosure of SFAS 87 information in their 1986 10-Ks. For these firms, the 1986 10-Ks contained more pension information than their 1985 10-Ks. If the disclosure of SFAS 87 data reduces information asymmetry, for early adopters, the decrease in the bid-ask spread around the 1986 10-K release (ceteris paribus) is expected to be greater than the decrease around the 1985 10-K release. In comparison, the 1985 and 1986 10-Ks of late adopters did not contain any SFAS 87 pension data. Hence, changes in the bid-ask spread around the release of 1985 and 1986 10-Ks are not expected to be significantly different for late adopters. Thus, it is hypothesized that the spread ratio (used to measure changes in the spread) around the 1986 10-K release minus the spread ratio around the 1985 10-K release will be smaller for early adopters than for late adopters.

As suggested in prior research (e.g., Stoll 1978a) on the determinants of the spread, a dealer's bid-ask spread reflects inventory holding and order processing costs as well as the expected loss incurred by the dealer due to informed trading. Stoll (1989) indicates that the informed trading cost component is about 43% of the total spread for OTC stock. Hence, an empirical study on the effect of SFAS

87 disclosures on information asymmetry (as reflected in changes in the spread) must control for potential concurrent changes in the inventory holding and order processing costs surrounding the information event being examined.

Prior research (e.g., Stoll 1978b) reviewed earlier suggests that the inventory holding and order processing cost components are increasing in price (or return) variability and decreasing in price per share, trading volume, and competition among dealers.[20] This discussion leads to the first hypothesis (all hypotheses are stated as the alternative to their respective null forms):

> H_{A1}: The spread ratio around the release of 1986 10-Ks minus the spread ratio around the release of 1985 10-Ks is smaller for the early adopter (E) group than for the late adopter (L) group, i.e., $(CHSPD_{E,1986} - CHSPD_{E,1985})$ is smaller than $(CHSPD_{L,1986} - CHSPD_{L,1985})$, after controlling for changes in the finance control variables.

Similarly, late adopters disclosed SFAS 87 data for the first time in their 1987 10-Ks. For late adopters, their 1987 10-Ks contained more pension information than their 1986 10-Ks. If the disclosure of SFAS 87 data reduces information asymmetry, for late adopters, the decrease in the spread around the 1987 10-K release (ceteris paribus) is

---

[20] The dealer market structure is assumed to be fairly stable over the 25-day event period (t= -14 to +10). Hence, the number of competing dealers (proxy for competition among dealers) is not included in further discussion or empirical models (Rao et al. 1991). Also the return variance, price per share, and trading volume are collectively referred to as the finance control variables hereafter for the sake of convenience.

expected to be greater than the decrease around the 1986 10-K release. In comparison, early adopters' 1987 and 1986 10-Ks should contain essentially the same pension disclosures as required by SFAS 87. Hence, for early adopters, the decrease in the spread around the 1987 10-K release is expected to be less or not significantly different from the decrease around the 1986 10-K release. The difference between declines in the bid-ask spread around the 1986 and 1987 10-K releases for early adopters depends on whether the reduction in information asymmetry due to SFAS 87 disclosures is one-time, largely fixed, or diminished after the first year of SFAS 87 adoption.[21] This is essentially an empirical question, although conceptually a diminished effect seems more likely.

The above discussions suggest that if the disclosure of SFAS 87 data in the 10-K reduces information asymmetry, the spread ratio around the 1987 10-K release minus the spread ratio around the 1986 10-K release is expected to be smaller for late adopters than for early adopters, after controlling for changes in the finance control variables. This leads to the second hypothesis:

---

[21] In each case, the magnitude of decrease in the spread due to SFAS 87 disclosures around the 1987 10-K release, as compared to the decrease around the 1986 10-K release, is still expected to be greater for late (1987) adopters than for early (1986) adopters. The difference among the cases is in the strength of results of testing hypothesis H_{A2}. The results will be the strongest (weakest) if the effect on information asymmetry of SFAS 87 disclosures is one-time (fixed).

H_{A2}: The spread ratio around the release of 1987 10-Ks minus the spread ratio around the release of 1986 10-Ks is smaller for the late adopter (L) group than for the early adopter (E) group, i.e., $(CHSPD_{L,1987} - CHSPD_{L,1986})$ is smaller than $(CHSPD_{E,1987} - CHSPD_{E,1986})$, after controlling for changes in the finance control variables.

To further test the relationship between the bid-ask spread behavior and pension information, this study also examines whether the cross-sectional difference in the spread ratio surrounding the 10-K releases can be explained by the magnitude of new pension data as required by SFAS 87. Prior accounting studies (e.g., Beaver et al. 1979) suggest that both the sign and magnitude of accounting data represent relevant information for security valuation. The change in the equilibrium security price is associated with both the sign and magnitude of accounting data. Beaver et al. (1979) argue that ignoring the magnitude of accounting data is like throwing away relevant information. For similar reason, both the sign and magnitude of SFAS 87 data should be useful to dealers and other traders in revising their expectations of the equilibrium stock price since new SFAS 87 data are shown to be useful in the valuation of firms sponsoring defined-benefit pension plans (e.g., Barth 1991).

As Glosten and Milgrom (1985) point out, the adverse selection component (due to informed trading) of the spread also depends on the revision in a dealer's expectation of a stock's equilibrium value. Prior to reasonably predictable release of accounting data (such as SFAS 87 disclosures), a

dealer can be expected to revise upward (downward) his expectation of a stock's market value conditional on a buy (sell) order for the stock (Raman and Tripathy 1993). Informed traders are expected to observe the dealer's bid and ask quotes and trade only if they expect to earn abnormal returns (Glosten and Milgrom 1985). As a defensive measure, a dealer is expected to quote a higher ask (lower bid) price based on his expectation of a higher (lower) stock price prior to an anticipated information release (Raman and Tripathy 1993; Venkatesh and Chiang 1986). Other things being equal, an increase in the ask price or a decrease in the bid price both widen the spread. Thus, the magnitude of SFAS 87 pension disclosures is expected to be associated with the changes in the spread due to the anticipated revision (induced by SFAS 87 disclosures) in a stock's equilibrium price.

However, changes in the bid-ask spread are not likely to be related to the sign of accounting disclosures. Raman and Tripathy (1993) suggest that the public disclosure of accounting data relevant for security valuation can be expected to reduce information asymmetry regardless of the good or bad news conveyed by the disclosures. Raman and Tripathy (1993) found that changes in the spread were negatively associated with the magnitude of absolute changes in oil and gas reserve-based present value accounting data. For similar reason, the change in the bid-ask spread is

expected to be associated with the magnitude of the absolute values of new SFAS 87 pension disclosures.

Two measures of new information required by SFAS 87 are examined in this study: (1) the absolute change in the ratio of periodic pension expense to net income (CHPEXP), and (2) the absolute value of the ratio of the excess of PBO over ABO to stockholders' equity (POEQ). If the public disclosure of SFAS 87 data reduces information asymmetry, the change in the spread (after controlling for changes in the finance control variables) should be negatively related to the magnitude of the absolute values of the two pension variables. The change in the bid-ask spread (CHSPD) again is expressed as the ratio of average post-event (i.e., after the 10-K release) percentage spread to average pre-event percentage spread during the 20-day period surrounding the release of 10-K (and SFAS 87 pension data reported therein). This discussion motivates the third hypothesis:

> H_{A3}: There is a significant negative relationship between the spread ratio (CHSPD) around the release of the first 10-Ks to contain SFAS 87 pension data and the magnitude of the absolute value of CHPEXP and POEQ, after controlling for changes in the finance control variables.

Research Design

Since there is a wealth of information contained in the 10-Ks, the effects on the bid-ask spread of information not required by SFAS 87 must be controlled for. This study uses

a treated (at a different time) non-equivalent control group design with pretest and posttest (Cook and Campbell 1979). When the early-adopter group receives the treatment (i.e., the adoption of SFAS 87 for 1986), the late-adopter group serves as a control (comparison) group; and when the late-adopter group later receives the treatment (the adoption of SFAS 87 for 1987), the early-adopter group serves as the control group. The research design is depicted below:

	1985	1986	1987
Early Adopters:	$CHSPD_{E,1985}$	$CHSPD_{E,1986}$ X	$CHSPD_{E,1987}$
Late Adopters:	$CHSPD_{L,1985}$	$CHSPD_{L,1986}$	$CHSPD_{L,1987}$ X

Firms are not randomly assigned to the early or late adopting group. Thus, the two groups are not equivalent as indicated by the dashed line between the two groups. X represents the adoption of SFAS 87 by the early (late) adopting group for 1986 (1987). $CHSPD_{gy}$ represents the spread ratio around the 10-K release for each fiscal year of 1985-1987 for each group (g equals E for early adopters or L for late adopters; y represents years 1985-1987). Hypothesis H_{A1} states that $(CHSPD_{E,1986} - CHSPD_{E,1985})$ is less than $(CHSPD_{L,1986} - CHSPD_{L,1985})$. Similarly, hypothesis H_{A2} states that $(CHSPD_{L,1987} - CHSPD_{L,1986})$ is less than $(CHSPD_{E,1987} - CHSPD_{E,1986})$.

The above design is similar to an interrupted time series with switching replications (Cook and Campbell 1979).

Cook and Campbell (1979) suggest that the design above is a quasi-experimental design permitting strong tests of hypotheses. The power of the design comes from its control for most threats to internal validity and from its potential in extending external validity. The external validity is extended by demonstrating a treatment effect on two populations at different points in time (Cook and Campbell 1979). To further deal with group differences, a two-stage Heckman-Lee self-selection model is also used in combination with the above design.

Consistent with prior research (e.g., Swaminathan 1991), this study assumes that there are no significant, systematic differences in the amount of new information (other than SFAS 87 disclosures) released in the 10-Ks between years for the same firm or between firms for the same year during the sample period. To the extent that such differences exist and are not controlled for by the design here, the results of this study should be interpreted with caution. Given the nature of this study and the state of the art in accounting research, the design used here represents one of the best possible quasi-experimental designs and some improvements over those used in previous studies. For example, Swaminathan (1991) examined changes in price variability and divergence of beliefs around the release of segment data in the 1969 and 1970 10-Ks. He compared the changes between an experimental group consisting of firms

required to adopt the Securities and Exchange Commission segment reporting in 1970 and a control group consisting of firms voluntarily adopting it prior to 1970. The comparison was done with a single treatment and without testing and controlling for potential self-selection bias.

Sample Selection and Data Sources

The initial sample consisted of all OTC (over the counter) firms that sponsored defined benefit pension plans during the period of 1985-1987. Firms retained in the sample met all of the following criteria:

First, no firm was actively involved in lawsuits, mergers, or bankruptcy proceedings during the event period in each year of 1985-1987. Moreover, no firm released information on earnings, dividends, stock splits, and other confounding events during the event period. The Wall Street Journal Index was used to screen for these confounding events. Second, requisite data on daily closing bid and ask prices, trading volume, etc. were available on the CRSP NASDAQ tapes. In addition, requisite financial data were available on the COMPUSTAT II tapes. Finally, no firm adopted both SFAS 87 and SFAS 88 in the same year. This criterion is to avoid the potentially confounding effects from curtailment or settlement of pension plans due to the adoption of SFAS 88. These criteria reduced the final sample to 122, 120, and 123 firms for 1985, 1986, and 1987,

respectively. About one-third of the final sample are early adopters of SFAS 87 (for 1986), while the remaining two-thirds are late adopters of SFAS 87 (for 1987).[22]

Empirical Testing Procedures

The empirical testing procedures are as follow. First, a basic regression analysis compares the differences in the spread ratios (CHSPD) between the early and the late adopting groups around the release of 10-Ks for 1985 to 1987. A similar regression model is used to test the relationship between the spread ratio and the magnitude of two measures of new SFAS 87 information (CHPEXP and POEQ) for the year when SFAS 87 data first became publicly available for each group. This is done after controlling for concurrent changes in the inventory holding and order processing cost components of the bid-ask spread without correcting for potential self-selection bias. Next, this study examines the same issues after controlling for potential self-selection bias using a two stage Heckman-Lee self-selection regression model in addition to controlling

---

[22] The 1985 adopters were not used because there were only 11 OTC firms that met the sample selection criteria. The final sample excluded 6, 7, and 6 firms with extreme spread ratios (i.e., being two or more standard deviations away from the mean) for 1985, 1986, and 1987, respectively. The extreme spread ratios may be due to CRSP data coding error, other confounding events not covered in The Wall Street Journal Index, etc. The exclusion avoids the extreme observations driving or contaminating the results.

for changes in the inventory holding and order processing costs of the spread.

The event period is defined as day -14 through day -5 and day +1 through day +10 during each year of 1985-1987, where day 0 is the event date (the 10-K release date). Note that day -4 through day 0 are excluded to control for contaminating effects on the bid-ask spread of potential information leakage during day -4 through day 0 (Aharony and Swary 1980).

The Basic Regression Model

First, an average percentage spread is computed for firm i during each of the 10-day period before the 10-K release (i.e., day -14 to day -5), denoted as $AVG(PSPD_{iyB})$, and the 10-day period after the 10-K release (i.e., day +1 to day +10), denoted as $AVG(PSPD_{iyA})$, for each year y during 1985-1987. The two average percentage spreads are expressed as follow:

$$AVG(PSPD_{iyB})=(1/10)*(PSPD_{iy,-14} + \ldots + PSPD_{iy,-5}) \qquad (4\text{-}1a)$$

$$AVG(PSPD_{iyA})=(1/10)*(PSPD_{iy,+1} + \ldots + PSPD_{iy,+10}) \qquad (4\text{-}1b)$$

where $PSPD_{iyt}$ is the percentage spread for firm i on day t in year y and defined as $(P_{a,iyt}-P_{b,iyt})/[(P_{a,iyt}+P_{b,iyt})/2]$. $P_{a,iyt}$ and $P_{b,iyt}$ are daily closing ask and bid prices for firm i on day t in year y taken from the CRSP NASDAQ tapes. The change in the spread (CHSPD) is then computed as the ratio of post-10-K average percentage spread to pre-10-K average percentage spread for firm i in year y and is expressed as follows:

$$CHSPD_{iy} = AVG(PSPD_{iyA}) \; / \; AVG(PSPD_{iyB}) \qquad (4\text{-}2)$$

If the disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry, the post-10-K average spread will be smaller than the pre-10-K average spread, i.e., the spread ratio (CHSPD) will be less than one. Since a dealer's total spread includes the inventory holding and order processing costs in addition to informed trading costs, a test of the impact of new SFAS 87 disclosures on the extent of information asymmetry must control for potential changes in the inventory holding and order processing costs. Extant studies (e.g., Stoll 1978a) suggest that the percentage spread for a stock is increasing in price (or return) variability and decreasing in price per share and trading volume for the stock. The following regression model is used to test the differences in the spread behavior between the early and the late adopter groups around the release of 10-Ks for fiscal years 1985 to 1987 as stated in hypotheses H_{A1} and H_{A2}:

$$CHSPD_{iy}=a_0+a_1CHPRC_{iy}+a_2CHVRT_{iy}+a_3CHVOL_{iy}+a_4FY86_{iy}+ a_5FY87_{iy}+a_6CFY85_{iy}+a_7CFY86_{iy}+a_8CFY87_{iy}+e_{iy} \qquad (4\text{-}3a)$$

where all variables are as defined in Exhibit 6 (p.132).

Equation (4-3a) is estimated using 1985 to 1987 data for both early and late adopters. Hypothesis H_{A1} states that the spread ratio around the 1986 10-K release minus the spread ratio around the 1985 10-K release is expected to be smaller for the early adopter group than for the late

adopter group. That is, (a_7-a_6) in equation (4-3a) will be less than zero.[23] Similarly, hypothesis H_{A2} states that the spread ratio around the 1987 10-K release minus the spread ratio around the 1986 10-K release, is expected to be smaller for the late adopter group than for the early adopter group. That is, (a_7-a_8) in equation (4-3a) will be less than zero.[24]

A regression model similar to (4-3a) is used to test the negative relationship between changes in the spread (CHSPD) and the two pension variables (CHPEXP and POEQ) as stated in hypothesis H_{A3}. The regression model is expressed as follows:

$$CHSPD_{iy}=a_0+a_1CHPRC_{iy}+a_2CHVRT_{iy}+a_3CHVOL_{iy}+a_4CHPEXP_{iy}+ a_5POEQ_{iy}+a_6CCHPEXP_{iy}+a_7CPOEQ_{iy}+e_{iy} \quad (4\text{-}3b)$$

where all variables are as defined in Exhibit 6.

Equation (4-3b) is estimated using 1986 data for early adopters and 1987 data for late adopters, i.e., the year

---

[23] Hypothesis H_{A1} states that the difference of the coefficient of dummy variable for year 1986 minus the coefficient of variable for year 1985 for the early adopter group, i.e., $(a_0+a_4+a_7)-(a_0+a_6)$, will be smaller than the difference for the late adopter group, i.e., $(a_0+a_4)-a_0$. That is, $[(a_0+a_4+a_7)-(a_0+a_6)]-[(a_4+a_0)-a_0]=(a_7-a_6) < 0$ in equation (4-3a).

[24] Hypothesis H_{A2} states that the difference of the coefficient of dummy variable for year 1987 minus the coefficient of variable year 1986 for the late adopter group, i.e., $(a_0+a_5)-(a_0+a_4)$, should be smaller than the difference for the early adopter group, i.e., $(a_0+a_5+a_8)-(a_0+a_4+a_7)$. That is, $[(a_0+a_5)-(a_0+a_4)] - [(a_0+a_5+a_8)-(a_0+a_4+a_7)] = (a_7-a_8) < 0$ in equation (4-3a).

when SFAS 87 data first became available for each group. As noted earlier, the effect of SFAS 87 disclosures on information asymmetry may be one-time, largely fixed, or diminished after the first year of SFAS 87 adoption. Hence, the results of hypothesis testing using data for the first year of SFAS 87 adoption are expected to be stronger or less ambiguous (by avoiding the uncertainty about the time length of the effect of SFAS 87 disclosures on information asymmetry). Hypothesis H_{A3} states that there is a significant negative relationship between the spread ratio (CHSPD) and the magnitude of CHPEXP and POEQ. That is, it is hypothesized that in equation (4-3b), a_4 and a_5 (for the late adopting group) and (a_4+a_6) and (a_5+a_7) (for the early adopting group) are all less than zero.

Self-Selection Bias

Selection bias potentially exits whenever a study uses a non-random sample. When the bias arises from individual choice, it is commonly referred to as self-selection bias (Maddala 1983). The self-selection bias problem pervades much of empirical market-based accounting research since sample firms are often those that switched accounting methods voluntarily, chose a particular accounting method from an accepted set of alternatives, adopted an accounting standard early, etc. (Abdel-Khalik 1990a). While accounting researchers have generally acknowledged the self-selection problem, few have specifically dealt with it (Abdel-Khalik

1990a; Foster 1980).[25] The sample firms used in this study could have adopted SFAS 87 early for 1985 or 1986 or defer adoption until it was required for 1987. Ayres (1986) suggests that there may be systematic differences in financial characteristics between early and late adopters. Thus, self-selection bias may potentially arise because these differences conceivably can affect the spread. This study tests and controls for potential self-selection bias using a two-stage Heckman-Lee self-selection model. The self-selection model is formulated below.

Formulation of the Self-Selection Model

The self-selection model consists of three equations. First, let I_i^* be a latent indicator function representing firm i's preference for early adoption of SFAS 87:

$$I_i^* = K'S_i - u_i \qquad (4\text{-}4)$$

for which a dichotomous indicator $I_i = 1$ (i.e., early adoption) is observed if $I_i^* > 0$ (i.e., $K'S_i > u_i$) and $I_i = 0$ (i.e., late adoption) is observed if $I_i^* \leq 0$ (i.e., $K'S_i \leq 0$). S is a matrix of variables that represent the characteristics of firms influencing the adoption date choice; K is a vector of parameters; and u_i is the error term with $E(u_i)=0$. Equation (4-4) is a probit model (estimated by a maximum likelihood method) with probability

[25] For accounting studies that attempted to correct for self-selection bias, see, for example, Abdel-Khalik (1990b) and Shehata (1991).

for $I_i = 1$ (or 0) equals the probability of $I_i^* > 0$ (or $I_i^* \leq 0$). Also let X_E and X_L be matrices of the determinants of the bid-ask spread and A_E and A_L be vectors of parameters for early and late adopter groups. Without correcting for potential self-selection bias, there are two basic equations for the bid-ask spread ratio as follow:

For early adopters: $CHSPD_{Ei} = A_E'X_{Ei} + e_{Ei}$ (4-5a)

For late adopters: $CHSPD_{Li} = A_L'X_{Li} + e_{Li}$ (4-5b)

Note that $CHSPD_{Ei}$ and $CHSPD_{Li}$ are the spread ratios around the release of 10-Ks as defined earlier.[26] However, equations (4-5a & b) can not be estimated directly by an ordinary least square (OLS) method if self-selection bias is present (Maddala 1983). The bias causes e_{Ei} and e_{Li} to be non-zero and correlated with u_i in equation (4-4) (Abdel-Khalik 1990b; Maddala 1983, 1991). Maddala (1983) summarizes the expected values of e_i's conditional on I_i=1 or 0 in equations (4-5a & b) as follow:

For early adopters:

$$E(e_{Ei}|I_i=1) = [-f_i(K'S_i)/h_i(K'S_i)] * COV_{Eu} \quad (4\text{-}5c)$$

For late adopters:

$$E(e_{Li}|I_i=0) = \{f_i(K'S_i)/[1-h_i(K'S_i)]\} * COV_{Lu} \quad (4\text{-}5d)$$

where COV's are covariances between the error term in equation (4-4) and the conditional error terms in equations

[26] The self-selection model is analogous to an endogenous switching regression with the switching point determined by the predicted value using the choice equation (4-4).

(4-5a) and (4-5b), respectively; f_i is the standard normal density function (i.e., standard normal z ranging from $-\infty$ to $+\infty$); and h_i is the cumulative distribution of the standard normal density function (i.e., the probability of adopting SFAS 87 early by firm i and ranging from 0 to 1).

The two terms $[-f_i(K'S_i)/h_i(K'S_i)]$ and $\{f_i(K'S_i)/[1-h_i(K'S_i)]\}$ are known as the inverse Mills ratios and are estimated from equation (4-4) using a probit model. However, COV_{Eu} and COV_{Lu} are not estimated directly from the variance-covariance matrix of (u_i, e_{Ei}, e_{Li}) because the covariance between e_{Ei} and e_{Li} is not in the likelihood function of the probit model (Maddala 1983). Instead, COV_{Eu} and COV_{Lu} are estimated as regression coefficients in the second stage by adding the estimates of $[-f_i(K'S_i)/h_i(K'S_i)]$ and $\{f_i(K'S_i)/[1-h_i(K'S_i)]\}$ to equations (4-5a & b). The two equations become:

$$CHSPD_{Ei} = B_E'X_{Ei} + COV_{Eu} * [-f_i(\hat{K}'S_i)/h_i(\hat{K}'S_i)] + w_{Ei} \qquad (4\text{-}6a)$$

$$CHSPD_{Li} = B_L'X_{Li} + COV_{Lu} * \{f_i(\hat{K}'S_i)/[1-h_i(\hat{K}'S_i)]\} + w_{Li} \qquad (4\text{-}6b)$$

where all variables are as defined earlier and w's are error terms with $E(w_{Ei})=E(w_{Li})=0$.[27]

The hypothesis testing procedures require that equations (4-6a & b) be combined and estimated in one model. Also, Maddala (1983) suggests that it is desirable to

---

[27] The notations for parameter vectors are changed from A_E and A_L to B_E and B_L to distinguish between parameters with and without correction for potential selection bias.

combine equations (4-6a & b) into one equation to be estimated using all observations from both groups. Equations (4-6a & b) may be combined into one equation as follows (Maddala 1983, 227):

$$CHSPD_i=(CHSPD_i|I_i=1)*P(I_i=1)+(CHSPD_i|I_i=0)*P(I_i=0)$$
$$=B_E'X_{Ei}h_i+B_L'X_{Li}(1-h_i)+(COV_{Lu}-COV_{Eu})f_i(\hat{K}'S)+w_i \qquad (4\text{-}7)$$

where $P(I_I=1)$ and $P(I_i=0)$ are the probability of early and late adoption of SFAS 87, respectively; w_i is the error term with $E(w_i)=0$ and is the sum of h_i*w_{Ei} and $(1-h_i)*w_{Li}$.

Furthermore, since variables in matrices X_{Ei} and X_{Li} are the same, it is possible to define $X_i=X_{Ei}=X_{Li}$. Equation (4-7) may be expressed as follows (Maddala 1983, 227):

$$CHSPD_i=B_L'X_{iy}+(B_E'-B_L')X_{iy}h_i+(COV_{Lu}-COV_{Eu})*f_i(\hat{K}'S)+w_i$$
$$=B_L'X_i+dB'X_ih_i+dCOV*f_i(\hat{K}'S)+w_i \qquad (4\text{-}8)$$

If the bid-ask spread behavior is independent of the choice of an adoption date for SFAS 87, there is no self-selection bias in the basic spread equations (4-5a & b). On the other hand, if the spread behavior is correlated with the factors influencing the adoption date choice for SFAS 87, a self-selection bias is present. The bias arises from the omission of the self-selection variable, $f_i(\hat{K}'S)$. If, in fact, there is a significant difference in the spread behavior due to a firm's self-selecting into either the early or late adopting group, $f_i(\hat{K}'S)$ in equation (4-8) should be significant. In other words, the coefficient of $f_i(\hat{K}'S)$, dCOV, will indicate the direction and magnitude of

the difference in the spread behavior between the two groups due to self-selection bias. If a significant difference exists, any analysis that ignores the self-selection process will generate misleading results (Maddala 1991).

Specification of the Self-Selection Model

This section discusses the definitions and measurements of variables included in the accounting choice and the spread regression equations.

The Accounting Choice Equation: The financial effects of adopting SFAS 87 include: (1) in general, a reduction in pension expenses, (2) the reporting of a minimum pension liability for underfunded pension plans, and (3) a potential increase in the volatility of pension assets and liabilities and related financial ratios (Gropper 1986; Liebtag 1986; Norton 1989). Also, projected benefit obligation (PBO) as well as accumulated benefit obligation (ABO) disclosed in the footnotes to financial statements may be valued by the capital markets as the sponsoring firm's liabilities (e.g., Barth 1991; Landsman 1986). Extant research (e.g., Ayres 1986) on accounting method choice suggests that the following variables may influence a firm's choice of adoption dates for new accounting standards:

1. Firm Size: Prior research (e.g., Lilien and Pastena 1982; Ayres 1986) suggests that larger firms are less likely to choose income-increasing accounting methods. Extant studies (e.g., Norton 1989) reported that the adoption of

SFAS 87 generally decreased periodic pension expense, and, thus, ceteris paribus, increased reported income. Thus, larger firms should be less likely to choose adopting SFAS 87 early than smaller firms.[28] Firm size (SIZE) is measured as the natural logarithm of total assets.

2. Financial Constraints: Restrictive debt covenants are written to limit the transfer of wealth from debt-holders to equity-holders. Common debt covenant constraints include generally accepted accounting principles-based constraints on (1) the long-term debt to assets (or equity) ratio, (2) the working capital requirement, (3) the interest coverage ratio, and (4) the dividend payout ratio.

The directional impact of adopting SFAS 87 on leverage ratios based on recognized liabilities and assets is ambiguous. Although the income effect is generally positive, the effect of adopting SFAS 87 on recognized liability and net assets depends on the magnitude of unfunded ABO and of pension liability recognized prior to SFAS 87 adoption. However, PBO and ABO disclosed in the footnote may be viewed by the capital markets as the sponsoring firm's liabilities (Barth 1991) and the size of ABO and PBO are generally greater than the reduction in pension expense due to adopting SFAS 87 (Stone and Ingram 1988). Thus, the

---

[28] Size may proxy for many omitted correlated variables (Leftwich and Holthausen 1983). However, to the extent that size reflects political visibility, a negative relation is expected.

probability of early adoption should be inversely related to leverage ratio (LEVER). LEVER is measured as the ratio of total long-term debt (after an adjustment for unfunded ABO) to stockholders' equity.

A common debt covenant is the maintenance of a minimum amount of working capital. Since the adoption of SFAS 87 generally reduced pension expense, a firm can reduce pension funding without increasing pension liability. Also, Berliner and Gerboth (BG) (1986) stated that companies have generally tried to keep pension funding equal to pension expense. Ghicas (1990) provided empirical support for BG's statement. He found that firms with lower current ratios (current assets to current liabilities) would choose an actuarial cost method to lower pension expense and funding. Thus, a firm's current ratio (CACL) should be negatively related to the probability of early adoption.

Because of the positive income effect of adopting SFAS 87, the interest coverage ratio (net income to interest expense) increases and, thus, become less restrictive. Prior studies (e.g., Bowen et al. 1981; Ayres 1986) suggest that lower interest coverage ratios (i.e., higher inverse interest coverage ratio) increase the likelihood of default on existing loans, make it more difficult for firms to issue additional debt, or may affect firms' debt ratings. Thus, firms with higher inverse interest coverage ratios (INTCOV) are more likely to elect early adoption. INTCOV is measured

as interest expense divided by net income (to avoid division by zero when a firm has no interest expense).

Dividends are often limited to available retained earnings. Adoption of SFAS 87 would increase retained earnings and lower dividend pay-out ratio. As a result, firms with higher pay-out ratios are more likely to choose early adoption (Ayres 1986). The dividend pay-out ratio (DIVPO) is measured as the ratio of total preferred and common dividends to retained earnings.

3. Earning Growth: Management bonuses or compensations are often based on some accounting measure of profitability. Prior studies (e.g., Bowen et al. 1981; Zmijewski and Hagerman 1981) have examined whether the existence of earnings-based bonus schemes affect management's accounting choice with mixed results. Based on the evidence in Healy (1985) and a survey by M. E. Segal & Company,[29] Ayres (1986) characterized management as striving to accomplish a certain earnings growth target. Managers of firms with a "poor" earnings performance may be motivated to adopt income increasing accounting policies in order to improve reported earnings. Ayres (1986), Trombley (1989), and Ghicas (1990) found evidence consistent with this hypothesis. Since the adoption of SFAS 87 would generally increase income, firms

---

[29] The survey found that a modest increase (1-5%) in earnings was associated with a large (36%) increase in bonuses, while earnings growth in excess of 10% led to only slight incremental increase in bonuses.

with a lower growth in reported income (NIGRODM) are more likely to adopt SFAS 87 early. NIGRODM is defined as 1 (or 0) if net income increased (or decreased) from last year.

4. Earnings and Pension Expense Volatility: SFAS 87 standardizes pension expense computation and ties the measurement of pension assets and liabilities to the market interest rate. Many have voiced concerns that these requirements would greatly increase the volatility of pension expense, pension assets and obligations, earnings, and related financial ratios (Gropper 1986; Liebtag 1986). Volatile accounting numbers increase potential debt contracting costs because the swings in accounting numbers will likely increase the possibility of violating debt covenants in some years (Lilien and Pastena 1982). Hence, firms with volatile earnings may be motivated to take action, including appropriate accounting policy choices, to reduce the volatility. Thus, to the extent that SFAS 87 would increase pension expense volatility, firms with more volatile pension expense (PENVAR) or earnings (NIVAR) in prior years are less likely to choose early adoption. PENVAR and NIVAR are measured, respectively, as the natural logarithm of the standard deviations of pension expense and of gross profits over the prior five years (Shehata 1991).

In addition, the higher a firm's pension expense relative to its income, the greater the financial impact (in terms of magnitude and volatility) SFAS 87 adoption can

bring; thus the firm would delay adoption of SFAS 87.[30] Pension expense materiality (PENMAT) is measured as the logarithm of the ratio of pension expense to net income.

5. Pension Funding Status: Prior market-based accounting studies (e.g., Landsman 1986; Maher 1987) suggest that pension assets (PA) and benefit obligations (PBO and ABO) disclosed in the footnotes are valued by the capital markets as the sponsoring firm's assets and liabilities and pension obligations may be valued more heavily than pension assets. Firms with unfunded pension benefit obligations may wish to avoid or delay the disclosure of their pension plan funding status (Norton 1987). Thus, firms with a less favorable funding status (FUND) are less likely to elect early adoption than firms with better funding status. FUND is measured as the natural logarithm of the ratio of PA to ABO as used in Ghicas (1990) and Norton (1989).

Exhibit 7 (p.133) summarizes the above variable definitions. The probit model in (4-4) can be specified as follows:

$$I_i=K_0+K_1SIZE_i+K_2LEVER_i+K_3CACL_i+K_4INTCOV_i+K_5DIVPO_i+$$
$$K_6NIGRODM_i+K_7PENVAR_i+K_8NIVAR_i+K_9PENMAT_i+K_{10}FUND_i-u_i \quad (4-9)$$

The Bid-Ask Spread Equation: As discussed earlier, the percentage spread of a stock due to inventory holding and

---

[30] This is consistent with the evidence in Shehata (1991). He found that firms with higher R&D expenditures relative to income are more likely to capitalize R&D expenditures to reduce earnings variability.

order processing costs is increasing in price (or return) variability and decreasing in price per share, and trading volume for the stock. Thus, equation (4-8) may be specified as follows to test hypotheses H_{A1} and H_{A2}:

$$CHSPD_{iy}=b_0+b_1CHPRC_{iy}+b_2CHVRT_{iy}+b_3CHVOL_{iy}+b_4FY86_{iy}+b_5FY87_{iy}+$$
$$b_6HFY85_{iy}+b_7HFY86_{iy}+b_8HFY87_{iy}+b_9Z_{iy}+w_{iy} \qquad (4\text{-}10a)$$

where all variables are as defined in Exhibit 6 (p.132).

Equation (4-10a) is estimated using 1985 to 1987 data for both groups. Hypothesis H_{A1} states that the spread ratio (used to measure the change in the spread) around the 1986 10-K release minus the spread ratio around the 1985 10-K release is smaller for the early adopter group than for the late adopter group. That is, hypothesis H_{A1} states that (b_7-b_6) in equation (4-10a) will be less than zero. Similarly, hypothesis H_{A2} states that the spread ratio around the 1987 10-K release minus the spread ratio around the 1986 10-K release is smaller for the late adopter group than for the early adopter group. That is, hypothesis H_{A2} states that (b_7-b_8) will be less than zero.[31] Also, if there is a

---

[31] Hypothesis H_{A1} states that the coefficient of dummy variable for year 1986 minus the coefficient of variable for year 1985, i.e., $(b_0+b_4+b_7)-(b_0+b_6)$, should be smaller for early adopters than for late adopters, i.e., $(b_0+b_4)-b_0$. That is, $[(b_0+b_4+b_7)-(b_0+b_6)] - [(b_4+b_0)-b_0] = (b_7-b_6) < 0$ in equation (4-10a). Similarly, hypothesis H_{A2} states that the coefficient of variable for year 1987 minus the coefficient of variable for year 1986 for late adopters, i.e., $(b_0+b_5)-(b_0+b_4)$, should be smaller than for early adopters, i.e., $(b_0+b_5+b_8)-(b_0+b_4+b_7)$. That is, $[(b_0+b_5)-(b_0+b_4)] - [(b_0+b_5+b_8)-(b_0+b_4+b_7)] = (b_7-b_8) < 0$ in equation (4-10a).

significant difference in the spread behavior due to self-selection bias, b_9 in equation (4-10a) should be significantly different from zero.

A regression model similar to equation (4-10a) is used to test the negative relationship between the spread ratio (CHSPD) and the two measures (CHPEXP and POEQ) of new SFAS 87 information as stated in hypothesis H_{A3}. The model is expressed as follows:

$$CHSPD_{iy}=b_0+b_1CHPRC_{iy}+b_2CHVRT_{iy}+b_3CHVOL_{iy}+b_4CHPEXP_{iy}+$$
$$b_5POEQ_{iy}+b_6HCHPEXP_{iy}+b_7HPOEQ_{iy}+b_8Z_{iy}+w_{iy} \qquad (4\text{-}10b)$$

where all variables are as defined in Exhibit 6.

Equation (4-10b) is estimated using 1986 data for early adopters and 1987 data for late adopters, i.e., the year when SFAS 87 pension data first became publicly available for each group. Hypothesis H_{A3} states that there is a significant negative relationship between the spread ratio and the magnitude of CHPEXP and POEQ. That is, b_4 and b_5 (for the late adopting group) and (b_4+b_6) and (b_5+b_7) (for the early adopting group) in equation (4-10b) are less than zero. Also, if there is a significant difference in the spread behavior due to self-selection bias, b_8 in equation (4-10b) should be significantly different from zero.

CHAPTER V

EMPIRICAL RESULTS

This chapter discusses the empirical results. Descriptive statistics for the CRSP data on the bid-ask spread, stock price, return variance and trading volume, and financial statement data for the sample firms are presented first. Results of testing each hypothesis using the basic regression model are discussed, followed by discussions on results of testing the same hypotheses using the self-selection model.

Table 1 (p.134) reports descriptive statistics for the CRSP data. The percentage spread on average declined slightly (i.e., the spread ratio is less than 1) subsequent to the release of the first 10-K to contain SFAS 87 data for both the early adopter (1986) and late adopter (1987) groups. In contrast, the percentage spread exhibited on average a marginal increase around the release of 10-Ks for other years. However, as discussed earlier, these changes in the percentage spread could potentially be attributable to concurrent changes in stock price per share, return variance, and trading volume.

In Table 1, trading volume and return variance increased substantially for both groups, while stock price increased

only slightly. The regression models used in this study control for changes in trading volume, stock price, and return variance in examining the effect of SFAS 87 disclosures on the bid-ask spread. Note that the increase in return variance or trading volume could itself represents the effect of an information event (Beaver 1968). By controlling for changes in return variance and trading volume, regression tests used in this study are conservative in that part of the informed trading cost is likely to be subsumed in the change in return variability or trading volume. Hence, the possibility of wrongfully rejecting the null hypothesis of no significant decline in the spread is likely to be small (Raman and Tripathy 1993).

Table 2 (p.136) presents descriptive statistics for financial statement data. These statistics suggest some systematic differences in financial characteristics between early and late adopters. The more noticeable are the differences in pension funding status (FUND), inverse interest coverage ratio (INTCOV), and pension expense variability (PENVAR). First, pension plans of early adopters were much better funded than those of late adopters for years 1985 through 1987. About 29%, 21%, and 23% (for 1985, 1986, and 1987, respectively) of late adopters' pension plans had unfunded accumulated benefit obligations (i.e., FUND is negative) as compared to about 7%, 5%, and 7% of early adopters' pension plans. These findings are consistent

with the findings in prior studies on financial statement effects of SFAS 87 adoption (e.g., Norton 1989; Senteney and Strawser 1990). Second, early adopters on average had higher inverse interest coverage ratio (i.e., lower interest coverage ratio) than late adopters. Finally, early adopters had much higher pension expense variability (PENVAR) than late adopters. Also, SFAS 87 adoption did not appear to significantly increase pension expense variability of either group. The descriptive statistics for PENVAR do not appear to support the claims of greater variability in pension variables due to SFAS 87 adoption by opponents of SFAS 87 (e.g., Liebtag 1986).

The results of the multivariate probit model, presented in Table 7 (p.142) and discussed later, also support the existence of some systematic differences in financial characteristics between the two groups. Whether or not these differences would affect the spread behavior around the 10-K releases for 1985 to 1987 is discussed later in the section on self-selection regression results.

Results of the Basic Regression Models

Pearson correlation coefficients for variables included in basic regression models (4-3a) and (4-3b) are reported in Table 3 (p.138). Tables 4 (p.139) and 5 (p.140) present the results of the two basic regression models for testing hypotheses H_{A1} and H_{A2} and hypothesis H_{A3}, respectively.

An examination of the correlation coefficients in Table 3 reveals that although some coefficients are significant, they are considerably less than the 0.8 suggested by Judge et al. (1980) as indicative of a serious collinearity problem. Collinearity may potentially result in inflated standard errors and lower significance levels for the regression coefficients of explanatory variables, although the estimated regression coefficients are still unbiased. A heuristic test known as the variance inflation factor (VIF) is also used to detect any serious collinearity problem. An examination of the VIFs in Tables 4 and 5 reveals the highest VIF to be only 2.03, far below the level of 10 normally considered as indicative of a serious collinearity problem (Mendenhall and Sinich 1986). Tables 4 and 5 also provide results of heteroscedasticity test for both models (4-3a) and (4-3b). The null hypothesis of no significant heteroscedasticity is not rejected for either model. Thus, collinearity or heteroscedasticity does not appear to be a serious problem in interpreting the regression results reported in Tables 4 and 5. Both the usual t-test and White's (1980) t-test, which corrects for heteroscedasticity if any, are provided for comparative purpose.

Results of Testing Hypothesis 1: The basic regression model (4-3a) developed in chapter IV is used to test hypotheses H_{A1} and H_{A2}. The model is repeated below for convenience:

$$CHSPD_{iy}=a_0+a_1CHPRC_{iy}+a_2CHVRT_{iy}+a_3CHVOL_{iy}+a_4FY86_{iy}+ a_5FY87_{iy}+a_6CFY85_{iy}+a_7CFY86_{iy}+a_8CFY87_{iy}+e_{iy} \quad (4\text{-}3a)$$

where all variables are as defined in Exhibit 6 (p.132).

Results of estimating model (4-3a) are presented in Table 4. All control variables from the finance literature (finance control variables) are significantly associated with changes in the percentage bid-ask spread with expected signs. The changes in stock price per share and trading volume (CHPRC and CHVOL) are negatively related to changes in the spread (CHSPD), while the change in return variance (CHVRT) is positively associated with changes in the spread. These results are consistent with prior theoretical and empirical research on the determinants of the bid-ask spread (e.g., Branch and Freed 1977; Stoll 1978a, 1978b).

The primary question of interest is whether or not the change (decline) in the bid-ask spread (CHSPD) around the release of the first 10-Ks to contain new SFAS 87 disclosures is greater than the spread change around the release of other 10-Ks. The spread change is measured as the ratio of post-event (post 10-K release) average percentage spread to pre-event average percentage spread during the 20-day period around the 10-K release. A decrease in the post-event average spread means that the spread ratio is less than one. If the public disclosure of SFAS 87 data reduces information asymmetry in the capital markets, the spread ratio will be less than one.

Specifically, if the first-time disclosure of SFAS 87 data by early adopters in their 1986 10-Ks reduces information asymmetry, ceteris paribus, the spread ratio around the 1986 10-K release minus the spread ratio around the 1985 10-K release is expected to be smaller for early adopters than for late adopters as stated in hypothesis H_{A1}. In other words, H_{A1} states that (a_7-a_6) in equation (4-3a) is negative. The result of testing H_{A1} reported in Table 4 indicates that the first-time disclosure of SFAS 87 data by early adopters in their 1986 10-K was associated with significantly greater reduction in the percentage spread, i.e., (a_7-a_6) is significantly less than zero. This result suggests that, for early adopters, the disclosure of SFAS 87 data in the 1986 10-K significantly reduced information asymmetry, as compared to information asymmetry after the 1985 10-K release for early adopters and after the 1985 and 1986 10-K releases for late adopters.

Results of Testing Hypothesis 2: Similarly, hypothesis H_{A2} states that, ceteris paribus, the spread ratio around the 1987 10-K release minus the spread ratio around the 1986 10-K release will be smaller for late adopters than for early adopters. In other words, H_{A2} states that (a_7-a_8) in equation (4-3a) is negative. The result of testing H_{A2} reported in Table 4 indicates that the first-time disclosure of SFAS 87 data by late adopters in their 1987 10-K was associated with significantly greater reduction in the

percentage spread, i.e., (a_7-a_8) is significantly less than zero. This result suggests that, for late adopters, the disclosure of SFAS 87 in the 1987 10-Ks significantly reduced information asymmetry, as compared to information asymmetry after the 1986 10-K release for late adopters and after the 1987 and 1986 10-K releases for early adopters.

Results of Testing Hypothesis 3: To further test the relationship between the spread behavior and SFAS 87 pension disclosures, this study examines whether the cross-sectional differences in changes in the spread around the 10-K release can be explained by the magnitude of new pension information required by SFAS 87. Two pension variables are used to measure the magnitude of new SFAS 87 information: (1) CHPEXP -- the absolute change in the ratio of periodic pension expense to net income, and (2) POEQ -- the absolute value of the ratio of the excess of PBO over ABO to common stockholders' equity. Hypothesis H_{A3} states that changes in the spread are expected to be negatively associated with the magnitude of CHPEXP and POEQ. Regression model (4-3b) specified in chapter IV is used to test H_{A3}. The model is repeated below for convenience:

$$CHSPD_{iy}=a_0+a_1CHPRC_{iy}+a_2CHVRT_{iy}+a_3CHVOL_{iy}+a_4CHPEXP_{iy}+ a_5POEQ_{iy}+a_6CCHPEXP_{iy}+a_7CPOEQ_{iy}+e_{iy} \quad (4\text{-}3b)$$

where all variables are as defined in Exhibit 6.

The results of estimating model (4-3b) are reported in Table 5. All the finance control variables again are

significantly associated with changes in the percentage spread with expected signs. The changes in stock price per share and trading volume (CHPRC and CHVOL) are negatively related to changes in the spread (CHSPD), while the change in return variance (CHVRT) is positively associated with changes in the spread. These results are consistent with prior theoretical and empirical research on the determinants of bid-ask spreads (e.g., Stoll 1978a, 1978b).

The main question of interest is whether or not the spread ratio used to measure changes in the spread (CHSPD) around the release of the first 10-Ks to contain new SFAS 87 data is negatively associated with the magnitude of the two pension variables (CHPEXP and POEQ). Hypothesis H_{A3} states that in equation (4-3b), a_4 and a_5 for late adopters and (a_4+a_6) and (a_5+a_7) for early adopters are negative. The results reported in Table 5 indicate that the magnitude of absolute change in the ratio of pension expense to net income for early adopters is significantly associated with changes in the spread with an expected negative sign, i.e., (a_4+a_6) is significantly less than zero. Also, the absolute value of the ratio of the excess of PBO over ABO to common equity for late adopters is associated with the spread change with an expected negative sign, i.e., a_5 is significantly less than zero. However, neither the absolute change in the ratio of pension expense to net income for late adopters nor the absolute value of the ratio of the

excess of PBO over ABO to equity for early adopters exhibits significant negative association with the spread changes. These results are consistent with prior research evidence (Norton 1989; Senteney and Strawser 1990) that SFAS 87 adoption had greater impact on pension expense of early adopters and on pension obligations of late adopters whose pension plans were more often underfunded. The overall results of testing H_{A3} suggest that there is a significant association between the magnitude of SFAS 87 pension disclosures in the 10-Ks and the reduction in information asymmetry after the 10-K release.

The basic regression results reported here, taken together, suggest that the disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry (or economic inequity) in the stock market by reducing the informed trading cost component of the bid-ask spread after the 10-K release.

Results of the Self-Selection Models

Prior research (e.g., Ayres 1986; Trombley 1989) suggests that there may be systematic differences in financial characteristics between early adopters and late adopters of a particular accounting standard. The summary statistics presented in Table 2 also suggest some differences in financial characteristics between the two sample groups. These differences conceivably may affect the spread behavior around the 10-K release. The potential self-

selection bias needs to be controlled for in examining the effect of new SFAS 87 information on the spread changes. The two-stage Heckman-Lee self-selection models (4-10a) and (4-10b) are used to test and control for any potentially contaminating effect on the spread due to self-selection bias.

Results of the Probit Model:

The Pearson correlation coefficients for the probit model variables are presented in Table 6 (p.141). Although some of the correlation coefficients are significant, most correlation coefficients are considerably less than the 0.8 suggested by Judge et al. (1980) as indicative of a serious collinearity problem. Collinearity may potentially result in inflated standard errors of the estimated probit model coefficients and lower significance levels for the explanatory variables, although the estimated coefficients are still unbiased. Moreover, an examination of the VIFs in Table 7 (p.142) reveals the highest VIF to be 5.57, well below the level of 10 normally considered as indicative of a serious collinearity problem (Mendenhall and Sinich 1986). Thus, collinearity does not appear to be a serious problem in interpreting the probit model results.

The results of accounting choice reported in Table 7 indicate that the probit model has good overall explanatory power and classificatory ability. About 67% of early adopters (which account for 34% of the sample) are correctly

classified, while about 87% of late adopters (which account for the remaining 66% of the sample) are correctly classified. Overall, about 80% of sample firms are correctly classified, representing a 14% improvement over chance prediction. Five of the ten explanatory variables are significant with expected signs; however, pension expense variability is significant with an unexpected sign.[32] These findings are consistent with prior studies on adoption date choice (Ayres 1986; Trombley 1989) and comparable to the probit model results reported in prior studies using self-selection regression models (e.g., Abdel-Khalik 1990b).

Results of the Self-Selection Regression:

Table 8 (p.143) reports the correlation coefficients for variables included in self-selection regression models (4-10a) and (4-10b). Although some correlation coefficients are significant, most correlation coefficients are considerably less (and none is greater) than the 0.8 suggested by Judge et al. (1980) as indicative of a serious collinearity problem. Furthermore, an examination of the VIFs in Tables 9

---

[32] Whether the adoption of SFAS 87 would increase the volatility of pension and related financial ratios is essentially an empirical question. The concern has been that SFAS 87 would increase the volatility because the discount rate used must be "tied to the market". However, Norton (1989) found no narrowing of the discount rates used by companies. In addition, SFAS 87 allows many smoothing options. As a result, SFAS 87 adoption may not increase the volatility of pension and related accounting data as suggested by the opponents of SFAS 87. The descriptive statistics presented in Table 2 and discussed earlier did not support the claim of increased pension volatility due to SFAS 87 adoption.

and 10 (p.144-145) reveals that most VIFs are well below (and none is greater than) the level of 10 normally considered as indicative of a serious collinearity problem (Mendenhall and Sinich 1986). Tables 9 and 10 also provide the results of heteroscedasticity test for both models (4-10a) and (4-10b). The test results fail to reject the null hypothesis of no significant heteroscedasticity. Thus, collinearity or heteroscedasticity does not appear to be a serious problem in interpreting the self-selection regression results reported in Tables 9 and 10. Both the usual t-test and White's (1980) t-test, which corrects for heteroscedasticity if any, are provided for comparative purpose.

Results of Testing Hypothesis 1: Self-selection regression model (4-10a) specified in chapter IV is used to test hypotheses H_{A1} and H_{A2}. The model is repeated below for convenience:

$$CHSPD_{iy}=b_0+b_1CHPRC_{iy}+b_2CHVRT_{iy}+b_3CHVOL_{iy}+b_4FY86_{iy}+b_5FY87_{iy}+b_6HFY85_{iy}+b_7HFY86_{iy}+b_8HFY87_{iy}+b_9Z_{iy}+w_{iy} \qquad (4\text{-}10a)$$

where all variables are as defined in Exhibit 6.

Results of estimating model (4-10a) are presented in Table 9. First, the results again show significant association between the finance control variables and changes in the percentage spread with expected signs. The changes in stock price per share and trading volume (CHPRC and CHVOL) are negatively related to changes in the spread

(CHSPD), while the change in return variance (CHVRT) is positively associated with changes in the spread. These results are consistent with prior theoretical and empirical research on the determinants of bid-ask spreads (e.g., Branch and Freed 1977; Stoll 1978a, 1978b) and the basic regression results discussed earlier.

Second, the results presented in Table 9 do not suggest a significant self-selection bias. The selectivity variable Z, which is estimated using the probit model for accounting choice, is not significant. Hence, the differences in financial characteristics between early and late adopters do not appear to be associated with the spread changes. This finding is consistent with the empirical evidence of no significant self-selection bias in the accounting literature thus far (Maddala 1991).

The primary question of interest is whether or not the change (decline) in the bid-ask spread (CHSPD) around the release of the first 10-Ks to contain new SFAS 87 disclosures is greater than the change in the spread around the release of other 10-Ks. The change in the spread is measured as the ratio of post-event average percentage spread to pre-event average percentage spread during the 20-day period around the 10-K release. A decrease in the post-event average spread means that the spread ratio is less than one. If the disclosure of SFAS 87 data in the 10-K

reduces information asymmetry in the stock market, the spread ratio will be less than one.

Specifically, hypothesis H_{A1} states that, ceteris paribus, the spread ratio around the 1986 10-K release minus the spread ratio around the 1985 10-K release will be smaller for early adopters than for late adopters. In other words, H_{A1} states that (b_7-b_6) in equation (4-10a) is negative. The results of testing H_{A1} (reported in Table 9) are inconsistent with the basic regression results discussed earlier; they indicate that the first-time public disclosure of SFAS 87 data by early adopters in their 1986 10-Ks is not associated with significantly greater reduction in the percentage spread, i.e., $(b_7 - b_6)$ is not significantly less than zero. Thus, for early adopters, the disclosure of SFAS 87 data in the 1986 10-Ks did not appear to significantly reduce information asymmetry, as compared to information asymmetry after the 1985 10-K release for early adopters and after 1985 and 1986 10-K releases for late adopters.

Results of Testing Hypothesis 2: Similarly, hypothesis H_{A2} states that the spread ratio around the 1987 10-K release minus the spread ratio around the 1986 10-K release is smaller for late adopters than for early adopters. In other words, H_{A2} states that (b_7-b_8) in equation (4-10a) is negative. The results of testing H_{A2} (reported in Table 9) are consistent with the basic regression results discussed earlier; they indicate that the first-time disclosure of

SFAS 87 data by late adopters in their 1987 10-Ks is associated with significantly greater reduction in the percentage spread, i.e., (b_7 - b_8) is significantly less than zero. This result suggests that, for late adopters, the disclosure of SFAS 87 data in the 1987 10-Ks significantly reduced information asymmetry, as compared to information asymmetry after the 1986 10-K release for late adopters and after 1987 and 1986 10-K releases for the early adopters.

Results of Testing Hypothesis 3: To further test the relationship between the spread behavior and new SFAS 87 pension information, this study also examines whether or not the cross-sectional differences in the spread changes around the 10-K release can be explained by the magnitude of the two pension variables (CHPEXP and POEQ). Hypothesis H_{A3} states that changes in the bid-ask spread are expected to be negatively associated with the magnitude of CHPEXP and POEQ. Self-selection regression model (4-10b) specified in chapter IV is used to test hypothesis H_{A3}. The model is repeated below for convenience:

$$CHSPD_{iy}=b_0+b_1CHPRC_{iy}+b_2CHVRT_{iy}+b_3CHVOL_{iy}+b_4CHPEXP_{iy}+$$
$$b_5POEQ_{iy}+b_6HCHPEXP_{iy}+b_7HPOEQ_{iy}+b_8Z_{iy}+w_{iy} \qquad (4\text{-}10b)$$

where all variables are as defined in Exhibit 6.

Results of estimating model (4-10b) are presented in Table 10. First, the results again show a significant association between the finance control variables and changes in the percentage bid-ask spread with expected

signs. The changes in stock price per share and trading volume (CHPRC and CHVOL) are negatively related to changes in the spread (CHSPD), while the change in return variance (CHVRT) is positively associated with changes in the spread. These results are consistent with prior theoretical and empirical research on the determinants of bid-ask spreads (e.g., Branch and Freed 1977; Stoll 1978a,1978b) and the findings of this study discussed earlier.

Second, the results presented in Table 10 again do not suggest a significant self-selection bias. The selectivity variable Z, which is estimated using the probit model, is not significant. Hence, the differences in financial characteristics between early and late adopters do not appear to be associated with changes in the spread. This finding is consistent with the empirical evidence of no significant self-selection bias in the accounting literature thus far (Maddala 1991).

The main question of interest is whether or not the spread ratio used to measure changes in the bid-ask spread (CHSPD) around the release of the <u>first</u> 10-Ks to contain the new SFAS 87 data is associated with the magnitude of the two pension variables (CHPEXP and POEQ). Hypothesis H_{A3} states that, in equation (4-10b), b_4 and b_5 for the late adopting group and (b_4+b_6) and (b_5+b_7) for the early adopting group are negative. The self-selection regression results reported in Table 10 indicate that the absolute value of the ratio of

the excess of PBO over ABO to common equity (POEQ) is negatively associated with the spread ratio for late adopters as hypothesized, i.e., b_5 is significantly less than zero. However, for early adopters, the ratio of the excess of PBO over ABO to common equity has no significant negative relationship with the spread ratio, i.e., (b_5+b_7) is not significantly less than zero. Also, for both groups, there is no significant negative association between the magnitude of the absolute change in the ratio of pension expense to net income and the spread ratio, i.e., (b_4+b_6) for early adopters and b_4 for late adopters are not significantly less than zero.

The above results are consistent with prior research evidence (Norton 1989; Senteney and Strawser 1990) that (1) the adoption of SFAS 87 had greater impact on pension obligations of late adopters whose pension plans were more often underfunded, and (2) the effect of SFAS 87 adoption on pension obligations was greater than the effect on pension expense. The above findings are also consistent with the self-selection regression results reported earlier that the decrease in the bid-ask spread around the first-time disclosure of SFAS 87 data by late (early) adopters in their 1987 (1986) 10-Ks was significant (not significant). The overall results of testing H_{A3} suggest that there is an association between the magnitude of SFAS 87 pension

disclosures in the 10-Ks and the reduction in information asymmetry after the 10-K release.

Taken together, the self-selection regression results reported here, although not as strong as the basic regression results, suggest that the disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry (economic inequity) in the capital markets by reducing the informed trading cost component of the bid-ask spread.

One possible explanation for the weaker self-selection regression results is that the adoption date choice for SFAS 87 is treated as being probabilistic, rather than being dichotomous, in the self-selection models. In other words, the SFAS 87 adoption date choice is defined as a continuous variable in the self-selection models rather than as a dummy variable in the basic regression models. The difference in results of the two types of regression models may possibly be attributable to this difference in variable definition of adoption date choice for SFAS 87. Another possibility is the lower classification accuracy of the probit model for early adopters than for late adopters (67% versus 87%).

Overall, the results reported in this study suggest that the disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry (or economic inequity) in the capital markets by reducing the informed trading cost component of the bid-ask spread. These results are also consistent with the evidence reported in prior studies (which took the

perspective of information efficiency) on the usefulness of SFAS 87 data in the valuation of firms sponsoring defined-benefit pension plans (e.g., Barth 1991).

CHAPTER VI

SUMMARY AND CONCLUSIONS

The issuance of SFAS 87: Employers' Accounting for Pensions in 1985 by the FASB was one of more important accounting developments in many years. The FASB contended that the SFAS 87 disclosures would provide information useful for making economic decisions. However, decision usefulness is a necessary but not a sufficient condition for mandatory accounting disclosures (Lev 1988). Instead, disclosure regulation is motivated by the need to preserve public confidence in the integrity of the capital markets by reducing information asymmetry between informed and uninformed market participants (Lev 1988).

This study extends prior research on the effects of accounting regulation by examining the effectiveness of the pension disclosures mandated by SFAS 87 in reducing information asymmetry in the capital markets. This information asymmetry analysis is therefore different from, yet complementary to, prior research (which took the perspective of information efficiency) on the usefulness of pension disclosures. This study presents evidence that the disclosure of SFAS 87 data in the 10-Ks reduces information asymmetry in the capital markets by reducing the informed

trading cost component of the bid-ask spread (both with and without correction for self-selection bias). The decrease in spread is greater around the release of the first 10-Ks to contain SFAS 87 data (i.e., the 1986 10-Ks for early adopters and the 1987 10-Ks for late adopters) than the decrease around the release of other 10-Ks. Furthermore, the magnitude of SFAS 87 pension disclosures in the 10-Ks is associated (with an expected negative sign) with the decline in the bid-ask spread after the 10-K release. These findings appear to support the mandatory nature of pension disclosures by the FASB.

Since the SFAS 87 data appear to reduce information asymmetry, the postponement of their disclosure by the late adopters (due to the long transition period allowed by SFAS 87) could have deprived capital market participants of timely, relevant information. In addition, the probit model results suggest some systematic differences in financial characteristics between early and late adopters of SFAS 87. This finding is consistent with those reported in prior research on adoption date choice (e.g., Ayres 1986). It is also consistent with prior studies suggesting that the adoption of SFAS 87 had substantial and differential effects on net income and pension obligations of early and late adopters (Norton 1989; Senteney and Strawser 1990). The substantial and differential financial impact of SFAS 87 adoption and the long transition period allowed may have had

an adverse impact on the comparability of financial statements of the two groups. Moreover, the change in the bid-ask spread is associated with the magnitude of the absolute change in the ratio of pension expense to net income for early adopters and with the absolute value of the ratio of the excess of projected pension obligation over accumulated pension obligation to common equity for late adopters. The FASB has indicated that "transition to new accounting standards is a practical matter and that the objective of transition is to minimize the cost and to mitigate the disruption involved, without unduly compromising the objective of enhancing the ability of financial statements to provide useful information" (FASB 1985, para. 256). The evidence reported here suggests that the FASB has a number of practical issues (such as cost-benefits of mandatory accounting disclosure and the comparability of financial statements) to address as it considers the promulgation of and flexible transition periods for new financial accounting standards in the future (Norton 1989).

This study has several limitations. First, this study represents an economic analysis of accounting regulatory consequences. However, the issues regarding accounting regulation are complex and involve more than economics. As Cooper and Keim (1983) point out, the extant structure of accounting regulation is a mosaic of political and social as

well as economic influences and outcomes. Thus, although an economic analysis is relevant, social and political factors must also be addressed before any definitive overall conclusions can be reached regarding the necessity and effects of accounting regulation.

Another limitation is the use of a quasi-experimental design with a non-equivalent control group. However, the use of a true experimental design with a random sample is not possible in an event-type market-based study. Also, consistent with prior studies (e.g., Swaminathan 1991), an important assumption is that there are no significant, systematic differences in the amount of new information (other than SFAS 87 data) released in the 10-Ks between years for the same firm or between two firms for the same year. To the extent that such differences exist and are not controlled for by the research design used in this study, the results should be interpreted with caution.

Finally, the self-selection model is based on the idea that a firm chooses to be an early or a late adopter of SFAS 87 on the basis of expected direct benefits from belonging to the two groups. Since the bid-ask spread does not have "the interpretation of benefit" to the sample firms, changes in the spread due to SFAS 87 adoption cannot be the basis on which the sample firms self-select into either the early or late adopting group (Maddala 1991, 800). Therefore, one assumption here is that the accounting choice equation

captures the determinants of a firm's preference for early adoption of SFAS 87 (Maddala 1991).[33]

The equity issues in accounting regulation remain a relatively unexplored area. More research seems warranted to examine the effects on economic inequity (information asymmetry) in the capital markets of other mandatory accounting disclosures. This study represents one of few applications of the self-selection model to accounting research. Additional research is needed to apply the model to different accounting choice issues to assess its validity in accounting research. Another possible extension is to modify the analysis of dichotomous choice described here to polychotomous accounting choice such as alternative accounting methods for depreciation and inventory valuation.

[33] This is also an implicit assumption in Shehata (1991) and Abdel-Khalik (1990a).

Appendix A

Background on Pension Accounting

BACKGROUND ON PENSION ACCOUNTING

Public concerns about pension plans date back several decades. One concern is about the security of pension assets and benefits, which represent a substantial part of the U.S. economy. For example, prior to the new requirements under SFAS 87, the ratios of pension expenses to pre-tax profits and to payroll costs for major U. S. firms averaged 9.6% and 4.8%, respectively (Johnson & Higgins 1985, cited in Norton 1988, 47). Also, Barth (1991) reported that, under SFAS 87 requirements, the ratio of pension assets to market value of common equity on average varied between 26% and 33% during 1985-1987, while the ratio of accumulated (projected) pension benefit obligation to common equity on average ranged from 18% (22%) to 28% (33%) for the same period. These ratios no doubt are important in security valuation. Empirical findings (e.g., Barth 1991; Daley 1984; Landsman 1986) support their importance.

Another concern focuses on the potential for the "mispricing" of corporate securities because of inadequate, and often non-comparable, pension disclosures (e.g., Daley 1984; Landsman 1986). These concerns have led to the issuance of many accounting standards. As early as 1948, the Committee on Accounting Procedures (CAP) considered

accounting standards for pension plans. Next, the Accounting Principles Board (APB) reviewed accounting for pensions and finally issued APB Opinion No. 8 in 1966. However, the APB viewed pension accounting as being in a "transitional stage". The APB decided that it would be premature to eliminate the diversity that then characterized pension accounting before settling controversies such as reporting pension asset or liability (other than prepaid or accrued pension expense) on the balance sheet.

The Financial Accounting Standard Board (FASB) continued the efforts by adding the first pension project to its agenda in 1974 and addressed pension accounting on a piecemeal approach. The FASB first expanded pension disclosures in the footnotes to financial statements by issuing SFAS 35 and SFAS 36 in 1980. Subsequent changes in legal and economic environments and the recognition of non-comparability of pension accounting data between companies prompted the FASB to reconsider the entire pension accounting issue. On December 26, 1985, the controversy on pension accounting came to an end, at least temporarily, when the FASB issued SFAS 87, "Employers' Accounting for Pensions".

SFAS 87 substantially changes the accounting and reporting requirements for defined-benefit pension plans. Among the more important changes required by SFAS 87 are: (1) more standardized computations of pension expense, (2)

the disclosure of pension expense components, (3) the disclosure of projected benefit obligations (PBO) in addition to accumulated benefit obligations (ABO) previously required, (4) the recognition of a minimum liability for underfunded pension plans, and (5) other important footnote disclosures. These changes are discussed below. Exhibit 5 (p.130) summarizes the major differences between APB 8 (as amended by SFAS 35 and SFAS 36) and SFAS 87.

Computation of Pension Expense

Much of management's discretion in pension expense computation is eliminated or restricted. Prior to SFAS 87, companies could use any "reasonable" actuarial cost methods to determine the service cost component. SFAS 87 now requires all companies to use the "unit credit" attribution method, which assigns to each period the cost of benefits to be paid to employees for service provided during that period according to the plan's stated or implied benefit formula. Secondly, prior to SFAS 87, a company could use any discount rate for computing present value of future benefit payments and interest costs. This choice is now restricted to a rate at which its pension benefits can be effectively settled. The settlement rate should be an external, market-determined rate such as the rate implicit in current prices of annuity contracts. In addition, the methods and periods for amortizing prior service costs and gains and losses are

either restricted or determined by specific formula provided in SFAS 87.

New Balance Sheet Requirements

Until now, pension information has been confined to the footnotes to financial statements except for a small amount of prepaid or accrued pension cost (which represents the difference between cumulative funding and cumulative pension expense). Under SFAS 87, companies have to recognize an additional liability to adjust pension liability to the excess of accumulated benefit obligation (ABO) over the fair market value of pension assets. This provision was effective for fiscal years beginning after December 15, 1988.

More Pension Disclosures

Pension information has been required in the footnotes to financial statements for years. However, many accountants argued that disclosures under previous standards did not enable users of financial statements to understand how pension expense was determined, whether accounting methods used were appropriate, or what the funding status of pension plans was (e.g., SFAS 87, para. 105-106; White 1987). SFAS 87 adds substantially to existing disclosure requirements. Below are the major new disclosure requirements.

First, components of net periodic pension expense must be disclosed so that users of financial statements can understand how the expense is determined. Second, SFAS 87 requires that each actuarial assumption be realistic and

requires separate disclosure of (a) the discount rate used to compute the interest component of pension expense and the projected and accumulated benefit obligations (PBO and ABO), (b) the expected rate of return on pension assets, and (c) the expected rate of salary progression for determining PBO if applicable. Third, SFAS 87 increases information available for assessing the funding status of pension plans by requiring (a) the disclosure of PBO in addition to ABO and vested benefit obligations as required by prior standards, and (b) separate disclosures of asset and benefit obligation for each individual overfunded or underfunded pension plan in stead of for all plans combined. Finally, SFAS 87 requires new disclosures on market-related value of pension assets, actual and expected returns on pension assets, and the types of assets held.

Effects of Adopting SFAS 87

The potential impacts of adopting SFAS 87 on a firm's financial statements include, in general, a reduction in pension expense, the reporting of additional pension liability for underfunded pension plans, and a potential increase in the volatility of pension expense, pension assets and liabilities and related financial ratios (Gropper 1986; Liebtag 1986; Norton 1988, 1989). Also, PBO and ABO disclosed in the footnotes to financial statements may be valued by the capital markets as the sponsoring firm's liabilities (Barth 1991).

A number of studies have examined the effects on financial statements of adopting SFAS 87 (e.g., Jarnagin et al. 1987; Norton 1988; Stone and Ingram 1988; Norton 1989; Senteney and Strawser 1990), while others have examined the security valuation implications of new disclosures required by SFAS 87 (e.g., Barth 1991). The financial statement effect studies suggest that SFAS 87 generally has had a favorable impact on pension expense and income for most companies. The income effect was greater and more favorable for early adopters than for late adopters. Many companies even reported a pension income (i.e., negative pension expense). In addition, the reduction in pension expense occurred in both the year of adoption and subsequent years. The reduction in pension expense may be a result of the good performance of the capital markets in the 1980s, since the actual return on pension assets (which reduces pension expense) is on average the largest component of pension expense. Also, this finding is consistent with the argument that the required "unit credit" method recognizes less expense in the earlier years and more in the later years (Liebtag 1986; Gropper 1986). The small amount of service cost component reported in prior studies (e.g., Norton 1989; Senteney and Strawser 1990), relative to other pension expense components, further supports this argument.

The effect of transition to SFAS 87 on the balance sheet was minimal for most companies examined in prior

studies (Norton 1989; Senteney and Strawser 1990); in fact, few companies reported additional pension liability on their balance sheets. There are several reasons for this. First, the reporting of additional pension liability on the balance sheet was not required until 1989. Also the result may be due to the generally good performance of the stock market during years 1985 to 1987 being examined; and, as a result, most pension plans were well funded. However, the situation could change dramatically if the stock market takes a downturn. A market downturn will reduce the market value of pension assets and, thus, increase the possibility of reporting additional pension liability. The possibility of reporting additional pension liability is especially high for late adopters, who very often have underfunded pension plans. Finally, although most pension plans, especially those of early adopters, were well funded, there were substantial differences in the pension funding status between early and late adopting firms. In general, the funding status of early adopters was much better than that of late adopters (Norton 1989; Senteney and Strawser 1990).

APPENDIX B

EXHIBITS AND TABLES

Exhibit 1

Summary of Findings of Market Studies on Pension Data

Study/Topic	Methodology	Results
Daley (1984) Examines how various measures of pension cost are related to stock prices.	Adds pension measures to an equity valuation model. Pension cost measures included: PENEXP, UVB, & PSC.	PENEXP is the most consistent measure of pension costs impounded in stock prices.
Dhaliwal (1986) Examines whether UVB viewed as a firm's debt.	Adds UVB to a model of beta on operating risk, tax rate, and financial risk.	Inclusion of UVB significantly increase the model's explanatory power. UVB viewed as a firm's debt.
Landsman (1986) Examines the property ownership of PA & PL.	Add PA & ABO to an equity valuation model.	PA & ABO viewed in the same way as a firm's other assets and liabilities.
Maher (1987) Examines if measures of net PA (or PL) used in bond rating decisions.	Adds measures of net PA (or PL) to a probit model of bond ratings.	Net PA (or PL) using a common discount rate of 3% significant in explaining bond ratings.
Landsman & Ohlson (1990). Examine if stock prices fully reflected pension obligations	Use unfunded ABO to construct portfolios to see if UR can be earned.	Significant UR can be earned even after adjusting for firm size, risk, & industry effect.
Barth (1991) Examines how various PA & PL are valued by the markets.	Adds various measures of PA and PL to an equity valuation model and examines the magnitude of measurement errors.	PBO (or ABO) and FMV of PA under SFAS 87 have the lowest measurement errors and thus most closely reflect market assessment of PA & PL.
Barth et al. (1993) Examines the market valuation implications of pension expense components required under SFAS 87	Includes pension and non-pension components in a cross-sectional equity valuation model.	Pension expense components, except amortization of transition amount, are impounded in stock price. Also, their coefficients differ significantly.

Abbreviations:
ABO: accumulated pension benefit obligations.
FMV: fair market value.
PA: pension plan assets.
PBO: projected pension benefit obligations.
PENEXP: periodic pension expenses.
PL: pension plan liabilities (i.e. obligations).
PSC: past service pension costs.
UR: unexpected returns.
UVB: unfunded vested pension benefits.

Exhibit 2

Summary of the Results of Accounting Choice Studies

Study	Topic[b]	Significance Levels of Variables Used[a]						
		LEVER	INCOV	DIVPO	SIZE	NIVAR	BONUS	NIGRO
H & Z (79)	Depreciation	NA	NA	NA	0.022	NA	0.04	NA
	Inventory	NA	NA	NA	0.137	NA	0.46	NA
	Investment Tax Cr.	NA	NA	NA	0.048	NA	0.09	NA
	Pension	NA	NA	NA	0.151	NA	0.01	NA
B N & L (81)	Interest	0.09	0.09	0.02	0.94	NA	0.89	NA
Z & H (81)	Combined Methods	0.025	NA	NA	0.04	NA	0.03	NA
D S & S (82)	Depreciation	0.01	NA	NA	0.15	NA	NA	NA
L & P (82)	Oil & Gas	0.04	NA	NA	0.02	0.02	NA	NA
D & V (83)	R & D	0.02	0.33	0.34	0.02	NA	NA	NA
L & H (85)	Inventory	0.148	NA	NA	0.65	0.03	NA	NA
Ayres (86)	Adoption Date	NA	0.12	0.01	0.04	NA	NA	0.001
Zimmer (86)	Interest Cost	0.174	NA	NA	0.01	NA	NA	NA
V & D (88)	Pension	0.001	0.02	NA	NA	NA	NA	NA
Trombley (89)	Adoption Date	0.001	NA	NA	0.023	NA	NA	0.03
Malmquist(90)	Oil & Gas	0.002	NA	NA	0.002	0.002	NA	NA
Ghicas (90)	Pension	0.10	NA	NA	0.11	NA	NA	0.30
Shehata (91)	R & D	0.0001	NA	NA	0.001	0.0006	NA	NA

Notes:

a: LEVER:Leverage ratio. INCOV: Interest coverage.
DIVPO:Dividend pay-out ratio. SIZE: Size of the firm .
NIVAR:Net income variability. NIGRO: Net income growth.
BONUS:The existence of earnings-based bonus plans.
NA: The variable is not tested.

b: H & Z: Hagerman and Zmijewski (1979). Also tested industry concentration ratio (p=0.177, 0.045, 0.0325, & 0.134), beta (p=0.0065, 0.0584, 0.17 & 0.157), and capital intensity (p=0.029, 0.037, 0.335 & 0.386). Also used total assets to measure size with similar results.

B N & L: Bowen, Noreen and Lacey (1981). SIZE has an unexpected sign.

Z & H: Zmijewski and Hagerman (1981). Also tested industry concentration ratio (p=0.025), beta (p=0.68), and capital intensity (p=0.82).

D S & S: Dhaliwal, Salamon, and Smith (1982). Also tested ownership structure (management versus owner control) (p=0.03).

L & P: Lilien & Pastena (1982). Also tested the age of firms (p=0.04).

D & V: Daley and Vigeland (1983). SIZE has an unexpected sign.

L & H: Lee and Hsieh (1985). Also tested inventory price variability (p=0.001), industry concentration (p=0.058), and inventory turnover (p=0.01).

Exhibit 2 - continued

Summary of the Results of Accounting Choice Studies

Ayres (1986): Examined the choice of adoption date for SFAS 52. Also tested stock ownership of managers and directors (p=0.02).

Zimmer (1986): Also tested if project specific financing was used (p=0.09).

V & J: VanDerhei & Joanette (1988). Also tested if the use of trust funds to meet pension obligations (p=0.0021), discount rates used (p=0.041), and vested benefits to measure importance of pension plans (p=0.259).

Trombley (1989): Also tested percentage of stocks owned by managers and directors (p=0.09).

Ghicas (1990): Also tested current ratio (p=0.03), rate of new investment to total assets (p=0.01), effective tax rate (p=0.18), funds from operations (p=0.37), and pension funding status (p=0.06).

Shehata (1991): Also tested R & D (research and development) expenditure variability (p=0.0001) and materiality of R & D expenditures (p=0.01).

Exhibit 3

Summary of Empirical Studies of Spread Determinants

STUDY	PRICE	#SH	VOL	INST	DEAL	MKTS	VAR	SYS	UNSY	R-Square
DEMSETZ (1968)[a]	+++	---	---			NS				.58/.54
TINIC (1972)[d]	+++		---[c]	--		++[b]	NS			.85
TINIC & WEST (1972)	++		-			NS	NS			.81
BENSTON & HAGERMAN (1974)[f]	+++	---			---			NS	+++	.75/.78
BRANCH & FREED (1977)[g]	+++[m]		--			NS	+++			.49
HAMILTON (1976)[i]	+++/ +++			--/ --	---/ ---					.59/ .61
HAMILTON (1978)[j]	+++/ +++[k]	--/ --		--/ --	---/ ---		+++/ +++			.73/ .66
STOLL [g,l] (1978b)	---		---		---		+++	++	+++	.82
TRIPATHY & PETERSON (1989)[g,n]	---		---		---			NS	+++	.86

Notes:
#SH: No of shareholders. VOL: Trading volume
INST:Institutional investors. DEAL:No. of competing dealers.
MKTS:No.of markets traded. VAR: Price variance.
SYS: Systematic risk. UNSY:Unsystematic risk.
R-Square: Adjusted R square.
+++/++/+ (---/--/-): Significantly positive (or negative) at .01, .05, and .1 levels.
NS: Not significant at .1 level.
a: #SH and VOL were tested in separate equations.
b: Herfindahl's Index of Competition was used. Lower index value means higher competition.
c: The percentage of days with trading during the sample period, measuring trading continuity, was tested (---).
d: Included No. of stocks handled by the dealer (++) and dealer capital divided by No. of transactions (NS).
e: Measured as (high price - low price) / average price.
f: SYS and UNSY were tested in separate equations.
g: Percentage spread (= spread / price) used.
h: Risk measure from Financial World ratings.
i: Also tested VOL / outstanding shares (+++) and dealer's wealth measured by daily inventory change (---). VAR tested separately for SYS and UNSY.
j: Also tested No. of shares closely held (--).
k: Results were for two different years.
l: Used market and modal spreads in separate equations. Also tested average shares per shareholder (--) and average shares per institutional investor (NS).
m: Used inverse of price per share.
n: Also included the ratio of daily trading volume to shares outstanding to measure insider trading risk (+++).

Exhibit 4

Summary of Findings of Empirical Studies
of Information Effects on Spreads

Study	Topic and Results
Stoll (1976)	Dealer's inventory increases (decreases) prior to stock price declines (increases), suggesting the existence of informed trading. There is no control for changes in IHC & OPC.
Morse & Ushman (1983)	SPD increases significantly prior to large stock price changes but not around the releases of quarterly earnings. There is no control for changes in IHC and OPC.
Venkatesh & Chiang (1986)	SPD increases significantly prior to the later of earnings or dividends releases if separated by 10-30 days but not for joint releases or if separated by less than 10 days or more than 30 days.
Rao et al. (1991)	SPD declines significantly after, compared to before, option listings, suggesting reduced informed trading risks to dealers.
Tripathy & Rao (1992)	SPD decreases significantly around the announcement of OTC seasoned equity offerings, suggesting reduced adverse information risk to dealers as a results of information gathering efforts during the underwriting process.
Raman & Tripathy (1993)	Public disclosure of oil & gas reserve data is associated with declines in SPD, suggesting that reserve-based disclosure reduces information asymmetry in securities markets.
Greenstein & Sami (1994)	The disclosure of segment data reduces the SPD and the spread decline is associated with the number of segments. The findings suggest that the disclosure of segment data reduces information asymmetry.

Notes: SPD = the bid-ask spread.
IHC = inventory holding cost component of spread.
OPC = order processing cost component of spread.

Exhibit 5

Major Differences Between APB 8 and SFAS 87

Attribution Method:
- APB 8: Any "acceptable" actuarial cost method.
- SFAS 87: Unit credit method.

Discount Rate:
- APB 8: Any "reasonable" rate.
- SFAS 87: External, market-determined settlement rate.

Amortization of unrecognized prior service cost:
- APB 8: Any systematic and rational method; in practice, interest method predominates; amortized from 10 to 40 years.
- SFAS 87: Equal amortization over the average service life of active employees on the date of amendment or initiation; specific formula provided; Allows alternatives that amortize no less rapidly.

Amortization of unrecognized gains and losses:
- APB 8: Various methods allowed; amortized from 10 to 20 years.
- SFAS 87: Minimum rate equal to 1 divided by average remaining employee service life applied to amount outside a prescribed range. Alternatives that amortizes no less rapidly allowed.

Actual Return on Pension Assets:
- APB 8: Calculated by applying the discount rate to a smoothed actuarial value of pension plan assets.
- SFAS 87: Computed as the difference between ending and beginning fair market values of plan assets after adjustments for contributions and benefit payments.

New Disclosure Requirements under SFAS 87:
a. Components of net periodic pension expense.
b. Discount rate for computing interest cost and present values of ABO and PBO; expected rate of increase in salaries.
c. PBO as well as ABO and VBO for each plan; separate disclosure of plan assets and benefit obligations for each overfunded and underfunded plan.
d. Market value of pension assets and their actual and expected returns and the type of assets held.

Note: ABO: Accumulated Benefit Obligations.
PBO: Projected Benefit Obligations.
VBO: Vested Benefit Obligations.

Exhibit 6

Variable Definitions in the Spread Regression Models

Variable	Definition of Variable
$CHSPD_{iy}$	The change in spread measured by the ratio of the average percentage spread of the 10-day period after to the aveage before the release of 10-K of firm i for fiscal year y (the dependent variable).
$CHPRC_{iy}$	The ratio of the average price per share for the 10-day period after to the average before the release of 10-K of firm i for fiscal year y.
$CHVRT_{iy}$	The ratio of the variance of the daily returns for the 10-day period after to that before the release of 10-K.
$CHVOL_{iy}$	The ratio of the average number of shares traded for the 10-day period after over that before the release of 10-K.
$CHPEXP_{iy}$	The absolute change in the ratio of pension expense to net income between years y and y-1; one measure of new pension information required by SFAS 87.
$POEQ_{iy}$	The ratio of the excess of PBO over ABO to common equity; another measure of new pension information required by SFAS 87.
FY85	1 if the fiscal year is 1985; 0 otherwise.
FY86	1 if the fiscal year is 1986; 0 otherwise.
FY87	1 if the fiscal year is 1987; 0 otherwise.
C_i	1 if firm i is an early adopter; 0 otherwise.
CFYxx	The interaction variable between FYxx and C.
HCHPEXP	The interaction variable between CHPEXP and C.
CPOEQ	The interaction variable between POEQ and C.
Z_i	The standard normal z estimated from the accounting choice model, i.e., $f_i(K'S)$; f(.) = the standard normal density function.
H_i	The probability of early adoption by firm i estimated from the accounting choice model, i.e., $h_i(K'S)$; $h_i(.)$ = the cumulative distribution of the standard normal density function.
HFYxx	The interaction variable between FYxx and H_i.
HCHPEXP	The interaction variable between CHPEXP and H_i.
HPOEQ	The interaction variable between POEQ and H_i.
e_{iy} & w_{iy}	The regression error terms with $E(e_{iy})=E(w_{iy})=0$.

Exhibit 7

Variable Definitions in the Accounting Choice Equation

Variable	Definition and Measurement
I	I_i=1 if firm i is an early adopter; 0 otherwise. (the dependent variable).
SIZE	Firm size measured by the logarithm of total assets.
LEVER	The leverage ratio measured as the logarithm of long term debt to equity, adjusted for pension asset and liability.
CACL	Working capital requirement measured as the ratio current assets to current liabilities.
INTCOV	Inverse of interest coverage ratio measured as the ratio of interest expense to net income.
DIVPO	Dividend payout ratio defined as the ratio of total preferred and common dividends over retained earnings as used in Ayres (1986).
NIGRODM	1 if net income increased from last year; 0 otherwise.
PENVAR	Logarithm of the standard deviation of pension expenses over a five-year period before SFAS 87 adoption.
NIVAR	Logarithm of the standard deviation of gross profit over a five-year period. The reason for using gross profit rather than net income is to capture the volatility in earnings before smoothing, if any, takes place (Shehata 1991).
PENMAT	The materiality of pension expense measured as the logarithm of the ratio of pension expense to net income.
FUND	The funding status of a firm's pension plans measured as the logarithm of the ratio of pension assets to ABO.

Table 1

Descriptive Statistics for CRSP Data

Panel A: Early Adopters:

	1985		1986		1987	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
No. of Observations	n=41		n=41		n=42	
Percentage Spread-Before	2.59	1.93	3.08	2.44	3.59	2.71
Percentage spread-After	2.55	1.76	2.89	1.99	3.71	2.74
Stock Price-Before	55.85	75.42	50.89	77.36	41.58	82.14
Stock Price-After	55.85	74.18	51.12	78.45	41.35	79.40
Return Variance-Before	0.0006	0.0007	0.0007	0.0009	0.0007	0.0009
Return Variance-After	0.0005	0.0006	0.0008	0.0012	0.0010	0.0009
Trading Volume-Before	627.89	2,439.53	949.48	3,714.09	472.76	1,453.03
Trading Volume-After	608.46	2,270.91	669.40	2,154.88	813.27	3,322.05
Percentage Spread Ratio	1.034	0.181	0.991	0.186	1.037	0.245
Stock Price Ratio	1.010	0.055	1.009	0.070	1.010	0.065
Return Variance Ratio	1.306	1.289	1.772	2.337	1.449	1.036
Trading Volume Ratio	1.247	1.101	2.038	3.095	1.800	1.531

Table 1 - continued

Descriptive Statistics for CRSP Stock Data

Panel B: Late Adopters:

	1985		1986		1987	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
No. of Observations	n=81		n=79		n=81	
Percentage Spread-Before	3.29	2.91	3.12	2.56	3.39	2.03
Percentage spread-After	3.35	3.33	3.13	2.46	3.23	1.88
Stock Price-Before	67.59	80.35	72.69	89.36	64.54	86.47
Stock Price-After	69.45	83.45	73.12	90.32	64.71	85.49
Return Variance-Before	0.0007	0.0009	0.0008	0.0009	0.0007	0.0008
Return Variance-After	0.0008	0.0013	0.0008	0.0009	0.0007	0.0007
Trading Volume-Before	107.15	175.64	176.67	586.83	157.32	404.44
Trading Volume-After	95.10	130.45	155.44	539.58	164.98	460.49
Percentage Spread Ratio	1.004	0.204	1.041	0.225	0.992	0.203
Stock Price Ratio	1.017	0.066	1.005	0.081	1.015	0.088
Return Variance Ratio	2.042	4.353	2.159	4.234	1.493	1.488
Trading Volume Ratio	1.207	0.905	1.339	1.887	1.243	0.971

Notes:
1. "Before" represents the 10-day period ending five trading days prior to the 10-K release date (t_{-14} through t_{-5}).
2. "After" represents the 10-day period following the 10-K release date (t_{+1} through t_{+10}).
3. The four ratios are measured as the ratios of After-event average to Before-event average for spread, return variance, and volume, respectively.

Table 2

Descriptive Statistics for Financial Statement Data

Panel A: Early Adopters

	1985		1986		1987	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
No. of Observation	n=41		n=41		n=42	
SIZE (log)	5.010	1.195	5.005	1.224	5.115	1.237
LEVER	0.435	0.365	0.475	0.432	0.453	0.364
CACL	2.372	0.985	2.322	0.917	2.302	0.926
INTCOV	0.201	0.243	0.330	0.795	0.624	2.526
DIVPO	0.038	0.030	0.038	0.028	0.038	0.029
NIGRODM (dummy)	0.512	0.506	0.415	0.499	0.548	0.504
PENVAR (log)	-1.153	1.296	-0.810	1.212	-0.801	1.213
NIVAR (log)	2.318	1.114	2.344	1.139	2.429	1.151
PENMAT (log)	-2.120	1.102	-2.559	1.554	-2.396	1.863
FUND (log)	0.436	0.327	0.494	0.400	0.454	0.338
CHPEXP	N/A		0.180	0.325	N/A	
POEQ	N/A		0.056	0.035	N/A	

Table 2 - continued

Descriptive Statistics for Financial Statement Data

Panel B: Late Adopters

	1985		1986		1987	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
No. of Observations	n=81		n=79		n=81	
SIZE (log)	4.591	1.151	4.741	1.154	4.839	1.113
LEVER	0.490	0.451	0.623	0.994	0.525	0.548
CACL	2.886	2.048	2.878	2.291	3.091	3.259
INTCOV	0.029	2.032	0.131	0.536	0.140	0.828
DIVPO	0.054	0.126	0.041	0.058	0.044	1.172
NIGRODM (dummy)	0.605	0.492	0.582	0.496	0.716	0.454
PENVAR (log)	-1.923	1.364	-1.776	1.249	-1.426	1.262
NIVAR (log)	1.835	1.256	1.961	1.243	2.076	1.254
PENMAT (log)	-2.195	1.371	-2.115	1.310	-2.463	1.553
FUND (log)	0.182	0.411	0.282	0.350	0.244	0.324
CHPEXP	N/A		N/A		0.368	1.069
POEQ	N/A		N/A		0.036	0.032

Table 3

Pearson Correlation Coefficients for the Basic Models

Panel A: Correlations for Model (4-3a)

Variable	CHPRC	CHVRT	CHVOL	FY86	FY87	CFY85	CFY86
CHVRT	-0.05						
CHVOL	0.05	0.17***					
FY86	-0.05	0.060	0.07				
FY87	0.02	-0.07	0.010	-0.50***			
CFY85	-0.01	-0.05	-0.04	-0.25***	-0.25***		
CFY86	-0.01	0.00	0.14***	0.51***	-0.25***	-0.13**	
CFY87	0.04	-0.04	0.09	-0.25***	0.51***	-0.13**	-0.13**

Panel B: Correlations for Model (4-3b)

VARIABLE	CHPRC	CHVRT	CHVOL	CHPEXP	POEQ	CCHPEXP
CHVRT	0.08					
CHVOL	0.02	0.28***				
CHPEXP	0.07	-0.01	-0.08			
POEQ	-0.02	-0.10	-0.02	-0.03		
CCHPEXP	-0.06	-0.07	0.05	0.15	0.12	
CPOEQ	-0.10	0.03	0.13	-0.08	0.58***	0.33***

Note:
*** / ** /* : Significant at .01 / .05 / .10 levels (two-tailed)

Table 4

Results of Basic Model (4-3a) for Hypotheses 1 and 2

Variable	Exp. Sign	Coefficient (a_i)	t statistic	White's t	VIF
Intercept	?	1.5007 (a_0)	10.012 ***	9.950 ***	0.00
CHPRC	-	- 0.4952 (a_1)	- 3.404 ***	- 3.348 ***	1.01
CHVRT	+	0.0102 (a_2)	2.888 ***	2.617 ***	1.05
CHVOL	-	- 0.0142 (a_3)	- 2.108 **	- 2.004 **	1.01
FY86	?	0.0350 (a_4)	1.083	1.061	2.03
FY87	-	- 0.0040 (a_5)	- 0.1237	- 0.131	2.03
CFY85	?	0.0380 (a_6)	0.9704	1.062	1.35
CFY86	-	- 0.0342 (a_7)	- 0.8665	- 0.935	1.37
CFY87	?	0.0512 (a_8)	1.316	1.200	1.36

Adjusted R square: 0.0536 Model F value: 3.570 ***

Test for Heteroscedasticity:
X^2 = 34.55 with 29 degrees of freedom (significance: 0.3455).

Hypothesis Testing:

H_{A1}: $(a_7 - a_8) < 0$
$(a_7 - a_8)$: - 0.0722
t statistic: - 1.302 *
White's t: - 1.417 *

H_{A2}: $(a_7 - a_8) < 0$
$(a_7 - a_8)$: - 0.0854
t statistic: - 1.550 *
White's t: - 1.517 *

Notes:
1. *** / ** / * : Significant at .01 / .05 / .10 levels (one-tailed except two-tailed for variables with an unspecified sign "?").
2. White's t is computed using White's (1980) asymptotically consistent variance-covariance matrix, which corrects for heteroscedasticity, if any.

Table 5

Results of Basic Model (4-3b) for Hypothesis 3

Variable	Exp. Sign	Coefficient (a_i)	t statistic	White's t	VIF
Intercept	?	1.7944 (a_0)	8.898 ***	8.040 ***	0.00
CHPRC	-	- 0.7848 (a_1)	- 3.963 ***	- 3.690 ***	1.02
CHVRT	+	0.2822 (a_2)	3.007 ***	2.845 ***	1.19
CHVOL	-	- 0.0247 (a_3)	- 2.886 ***	- 4.755 ***	1.19
CHPEXP	-	0.0049 (a_4)	0.268	0.365	1.06
POEQ	-	- 0.7789 (a_5)	- 1.314 *	- 1.308 *	1.58
CCHPEXP	?	- 0.1422 (a_6)	- 1.669 *	- 2.719 ***	1.19
CPOEQ	?	1.3291 (a_7)	2.061 **	2.101 **	1.80

Adjusted R square: 0.1899 Model F value: 5.053 ***

Test for Heteroscedasticity:
X^2 = 29.16 with 31 degrees of freedom (significance: 0.5611).

Hypothesis Testing:

H_{A3}-Part a: For Early Adopters: $(a_4 + a_6) < 0$
For Late Adopters: $a_4 < 0$

For Early Adopters:	For Late Adopters:
$(a_4 + a_6)$: - 0.1373	a_4 : 0.0049
t statistic: - 1.641 **	t statistic: 0.268
White's t: - 2.689 ***	White's t: 0.365

H_{A3}-Part b: For Early Adopters: $(a_5 + a_7) < 0$
For Late Adopters: $a_5 < 0$

For Early Adopters:	For Late Adopters:
$(a_5 + a_7)$: 0.5501	a_5 : - 0.7789
t statistic: 0.573	t statistic: - 1.314 *
White's t: 0.931	White's t: - 1.308 *

Note:
1. *** / ** / * : Significant at .01 / .05 / .10 levels (one-tailed except two-tailed for variables with an unspecified sign "?").

Table 6

Pearson Correlation Coefficients for Probit Model Variables

Variable	SIZE	LEVER	CACL	DIVPO	INTCOV	NIGRODM	NIVAR	PENVAR	PENMAT
LEVER	0.26***								
CACL	-0.26***	-0.22***							
DIVPO	0.29***	-0.05	-0.22**						
INTCOV	-0.07	-0.30***	-0.16*	0.07					
NIGRODM	0.06	0.03	-0.08	0.13	-0.17*				
NIVAR	0.84***	0.12	-0.17*	0.16*	-0.07	0.19**			
PENVAR	0.73***	0.16*	-0.16*	0.17*	0.02	-0.09	0.65***		
PENMAT	-0.09	-0.02	0.05	-0.09	0.20**	-0.34***	-0.18**	0.13	
FUND	-0.09	0.20**	-0.01	0.09	-0.12	0.22**	-0.04	0.03	0.29***

Note:
*** / ** / * : Significant at .01 / .05 / .10 levels (two-tailed).

Table 7

Results of the Probit Model for Accounting Choice

Variable	Exp. Sign	Coefficient	Chi Square	VIF
Intercept	?	3.5585	5.682 **	0.00
SIZE	-	- 0.6834	4.886 **	5.72
LEVER	-	- 0.3166	0.785	1.46
CACL	-	- 0.2496	3.502 **	1.35
INTCOV	+	0.3105	0.711	1.27
DIVPO	+	- 4.0220	1.187	1.33
NIGRODM	-	- 0.7678	5.842 ***	1.26
PENVAR	-	0.8347	16.066 ***	2.61
NIVAR	-	0.2044	0.600	4.43
PENMAT	-	- 0.4146	9.558 ***	1.38
FUND	+	0.7206	3.360 **	1.31

Log-Likelihood: - 54.60

Classification Accuracy:
Early Adopters: 67%
Late Adopters: 87%
Overall: 80%

Sample Proportion:
Early Adopters: 34%
Late Adopters: 66%

Chance Prediction: 66%

Note:
a. *** / ** / * : Significant at .01 / .05 / .10 levels (one-tailed except two-tailed for the intercept).

Table 8

Pearson Correlation Coefficients for the Self-Selection Models

Panel A: Correlations for Model (4-10a)

Variable	CHPRC	CHVRT	CHVOL	FY86	FY87	HFY85	HFY86	HFY87
CHVRT	-0.05							
CHVOL	0.05	0.17***						
FY86	-0.05	0.06	0.07					
FY87	0.02	-0.07	0.01	-0.50***				
HFY85	0.02	0.14***	-0.05	-0.32***	-0.32***			
HFY86	0.02	-0.03	0.04	0.69***	-0.35***	-0.22***		
HFY87	0.09*	-0.04	0.09*	-0.35***	0.70***	-0.23***	-0.24***	
Z	0.07	0.01	0.04	0.04	0.44***	0.31	0.44***	0.44***

Penal B: Correlations for Model (4-10b)

Variable	CHPRC	CHVRT	CHVOL	CHPEXP	POEQ	HCHPEXP	HPOEQ
CHVRT	0.08						
CHVOL	0.02	0.28***					
CHPEXP	0.07	-0.01	-0.08				
POEQ	-0.02	-0.10	-0.02	-0.03			
HCHPEXP	0.16*	-0.09	-0.03	0.46***	0.08		
HPOEQ	0.08	-0.09	0.04	0.02	0.76***	0.25***	
Z	0.12	-0.05	0.07	-0.35***	0.21**	0.32***	0.61***

Note:
*** / ** /* : Significant at .01 / .05 / .10 levels (two-tailed)

Table 9

Results of Self-Selection Model (4-10a)
for Hypotheses 1 and 2

Variable	Exp. Sign	Coefficient (b_i)	t statistic	White's t	VIF
Intercept	?	1.5921 (b_0)	9.773 ***	10.508 ***	0.00
CHPRC	-	- 0.5985 (b_1)	- 4.061 ***	- 4.549 ***	1.01
CHVRT	+	0.0095 (b_2)	2.672 ***	2.329 ***	1.10
CHVOL	-	- 0.0170 (b_3)	- 2.568 **	- 2.481 **	1.05
FY86	?	0.0402 (b_4)	1.028	0.944	3.06
FY87	-	- 0.0367 (b_5)	- 0.937	- 1.029	3.08
HFY85	?	0.0832 (b_6)	0.604	0.582	9.49
HFY86	-	- 0.0086 (b_7)	- 0.067	- 0.066	6.23
HFY87	?	0.1830 (b_8)	1.485	1.408	7.73
Z	?	- 0.0081 (b_9)	- 0.277	- 0.281	7.33

Adjusted R square: 0.0751 Model F value: 4.174 ***

Test for Heteroscedasticity:
X^2 = 39.12 with 42 degrees of freedom (significance: 0.5979).

Hypothesis Testing:

H_{A1}: $(b_7 - b_6) < 0$
$(b_7 - b_6)$: - 0.0918
t statistic: - 0.932
White's t: - 0.844

H_{A2}: $(b_7 - b_8) < 0$
$(b_7 - b_8)$: - 0.1916
t statistic: - 2.098 **
White's t: - 2.006 **

Notes:
1. *** / ** / * : Significant at .01 / .05 / .10 levels (one-tailed except two-tailed for variables with an unspecified sign "?").
2. Z: The variable to test and control for self-selection bias, if any.

Table 10

Results of Self-Selection Model (4-10b) for Hypothesis 3

Variable	Exp. Sign	Coefficient (b_i)	t statistic	White's t	VIF
Intercept	?	2.0156 (b_0)	9.629 ***	11.439 ***	0.00
CHPRC	-	- 0.9877 (b_1)	- 4.886 ***	- 5.895 ***	1.03
CHVRT	+	0.0302 (b_2)	3.312 ***	3.419 ***	1.12
CHVOL	-	- 0.0233 (b_3)	- 2.818 ***	- 4.932 ***	1.10
CHPEXP	-	0.0214 (b_4)	0.947	1.144	1.37
POEQ	-	- 1.1865 (b_5)	- 1.426 *	- 1.551 *	3.25
HCHPEXP	?	- 0.0749 (b_6)	- 0.573 *	- 0.804	1.28
HPOEQ	?	1.6884 (b_7)	1.023	0.952	5.05
Z	?	0.0292 (b_8)	1.227	1.237	2.82

Adjusted R square: 0.2235 Model F value: 5.246 ***

Test for Heteroscedasticity:
X^2 = 36.49 with 43 degrees of freedom (significance: 0.7477).

Hypothesis Testing:

H_{A3}-Part a : For Early Adopters: $(b_4 + b_6) < 0$
For Late Adopters: $b_4 < 0$

For Early Adopters:		For Late Adopters:	
$(b_4 + b_6)$	: - 0.0535	b_4	: 0.0214
t statistic:	- 0.429	t statistic:	0.947
White's t	: - 0.601	White's t	: 1.144

H_{A3}-Part b: For Early Adopters: $(b_5 + b_7) < 0$
For Late Adopters: $b_5 < 0$

For Early Adopters:		For Late Adopters:	
$(b_5 + b_7)$	: 0.5019	b_5	: - 1.1865
t statistic:	0.466	t statistic:	- 1.426 *
White's t	: 0.381	White's t	: - 1.551 *

Notes:
1. *** / ** / * : Significant at .01 / .05 / .10 levels (one-tailed except two-tailed for variables with an unspecified sign "?").
2. Z: The variable to test and control for self-selection bias, if any.

REFERENCES

Abdel-Khalik, R. A. 1990a. Specification problems with information content of earnings: Revisions and rationality of expectations and self-selection bias. Contemporary Accounting Research 7 (Fall): 142-172.

_____. 1990b. The jointness of audit fees and demand for MAS: A self-selection analysis. Contemporary Accounting Research 7 (Spring): 295-322.

Accounting Principles Board (APB). 1966. APB Opinion No. 8: Accounting for the Costs of Pension Plans. New York: American Institute of Certified Public Accountants.

Aharony, J. and I. Swary. 1980. Quarterly dividends and earnings announcements and stockholders' returns: An empirical analysis. Journal of Finance 35 (March): 1-12.

Akerlof, G. A. 1970. The market for 'lemons': Quality uncertainty and the market mechanism. Quarterly Journal of Economics 84 (August): 488-500.

Amihud, Y., and H. Mendelson. 1980. Dealership market: Market making with inventory. Journal of Financial Economics 8 (March): 31-53.

Ayres, F. L. 1986. Characteristics of firms electing early adoption of SFAS 52. Journal of Accounting and Economics 8 (June): 143-158.

Bagehot, W. 1971. The only game in town. Financial Analysts Journal 27 (March/April): 12-14, 22.

Ball, R., and P. Brown. 1968. An empirical evaluation of accounting income numbers. Journal of Accounting Research 8 (Autumn): 159-178.

Barth, M. E. 1991. Relative measurement errors among alternative pension assets and liability measures. The Accounting Review 66 (July): 433-463.

_____, W. H. Beaver, W. R. Landsman. 1993. A structural analysis of pension disclosures under SFAS 87 and their relation to share prices. Financial Analysts Journal 49 (January/February): 18-26.

Baumol, W. J. 1965. The Stock Market and Economic Efficiency. New York: Fordham University Press.

_____. 1982. Applied fairness theory and rationing policy. The American Economic Review 72 (September):639-651.

Beaver, W. H. 1981. Financial Reporting: An Accounting Revolution. Englewood Cliffs, N. J.: Prentice-Hall.

_____, R. Clark, and W. Wright. 1979. The association between unsystematic security returns and the magnitude of earnings forecast errors. Journal of Accounting Research 17 (Autumn): 316-340.

_____., and W. R. Landsman. 1983. Incremental information content of statement 33 disclosures. Stamford, CT.: FASB.

Benston, G. J. 1973. Required disclosure and the stock market: An evaluation of the Securities Exchange Act of 1934. American Economic Review 63 (March): 132-155.

_____, and R. L. Hagerman. 1974. Determinants of bid-asked spreads in the over-the-counter market. Journal of Financial Economics 2 (No. 1): 353-364.

Berliner, R. W., and D. L. Gerboth. 1986. Accounting for pensions- new FASB statements. The CPA Journal 56 (April): 12, 14, 16-23.

Bernard, V. L. 1989. Capital market research in accounting during the 1980's: A critical review. Proceedings of the University of Illinois Golden Jubilee Symposium (June): 72-120.

Berry, W. D. 1982. Theories of regulatory impact: the roles of the regulator, the regulated, and the public. Policy Studies Review: 436-441.

Bowen, R. M., E. W. Noreen, and J. M. Lacey. 1981. Determinants of the corporate decision to capitalize interest. Journal of Accounting and Economics 3 (August): 151-179.

Branch B., and W. Freed. 1977. Bid-asked spreads on the AMEX and the big board. The Journal of Finance 32 (March): 159-163.

Brownlee, II, E. R., and S. D. Young. 1986. Financial disclosure regulation and its critique. Journal of Accounting Education 4 (Spring): 113-126.

Christie, A. A. 1990. Aggregation of test statistics: An evaluation of the evidence on contracting and size hypotheses. Journal of Accounting and Economics 12 (January): 15-36.

Coffee, Jr., J. C. 1984. Market failure and the economic case for a mandatory disclosure system. Virginia Law Review 70 (May): 717-753.

Cohen, K. J., S. F. Maier, R. A. Schwartz, and D. K. Whitcomb. 1978. The returns generation process, returns variance, and the effect of thinness in securities markets. The Journal of Finance 33 (March): 149-167.

_____. 1979. Market makers and the market spread: A review of recent literature. Journal of Financial and Quantitative Analysis 14 (November): 813-835.

Cook, T. D., and D. T. Campbell. 1979. Quasi-experimentation: Design and analysis issues for field settings. Boston, MA.: Houghton Mifflin Co.

Cooper, K., and G. D. Keim. 1983. The economic rationale for the nature and extent of corporate financial disclosure regulation: A critical assessment. Journal of Accounting and Public Policy 2 (Fall):189-205.

_____, and M. J. Sherer. 1984. The value of corporate accounting reports: Arguments for a political economy of accounting. Accounting Organizations and Society 9 (No. 2): 207-232.

Copeland, T. E., and D. Galai. 1983. Information effect on the bid-ask spread. The Journal of Finance 38 (December): 1457-1469.

Cready, W. M., and P. G. Mynatt. 1991. The information content of annual reports: A price and trading response analysis. The Accounting Review 66 (April): 291-312.

Daley, L. A. 1984. The valuation of reported pension measures for firms sponsoring defined benefit plan. The Accounting Review 59 (April); 177-198.

_____, and R. L. Vigeland. 1983. The effect of debt covenants and political costs on the choice of accounting methods: The case of accounting for R & D costs. Journal of Accounting and Economics 5 (December): 195-211.

Demsetz, H. 1968. The cost of transacting. Quarterly Journal of Economics 82 (February): 33-53.

Dhaliwal, D. S. 1980. The effect of the firm's capital structure on the choice of accounting methods. The Accounting Review 55 (January): 78-84.

_____, G. L. Salamon, and E. D. Smith. 1982. The effect of owner versus management control on the choice of accounting methods. Journal of Accounting and Economics 4 (July): 41-53.

Easley, D., and M. O'Hara. 1987. Price, trade size, and information in securities markets. Journal of Financial Economics 19 (September): 69-90.

Financial Accounting Standards Board (FASB). 1980. Statement of Financial Accounting Standard No. 35: Accounting and Reporting by Defined Benefit Pension Plans. Stamford, CT.: FASB.

_____. 1980. Statement of Financial Accounting Standard No. 36: Disclosure of Pension Information -- An amendment of APB Opinion No. 8. Stamford, CT.: FASB.

_____. 1985. Statement of Financial Accounting Standard No. 87: Employers' Accounting for Pensions. Stamford, CT.: FASB.

Foster, G. 1980. Accounting policy decisions and capital market research. Journal of Accounting and Economics 2 (March): 29-62.

Francis, J. R. 1987. Lobbying against proposed accounting standards: The case of employees' pension accounting. Journal of Accounting and Public Policy 6 (Spring): 35-57.

_____, and S. A. Reiter. 1987. Determinants of corporate pension funding strategy. Journal of Accounting and Economics 9 (April): 35-59.

Gaa, J. C. 1988. Methodological foundations of Standardsetting for Corporate Financial Reporting. Sarasota, FL.: American Accounting Association.

Garman, M. B. 1976. Market microstructure. Journal of Financial Economics 3 (June): 257-275.

Ghicas, D. C. 1990. Determinants of actuarial cost method changes for pension accounting and funding. The Accounting Review 65 (April): 384-405.

Glosten, L. R. 1987. Components of the bid-ask spread and the statistical properties of transaction prices. The Journal of Finance 42 (December): 1293-1307.

_____, and L. E. Harris. 1988. Estimating the components of the bid/ask spread. Journal of Financial Economics 21 (May): 123-142.

_____, and P. R. Milgrom. 1985. Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. Journal of Financial Economics 14 (March): 71-100.

Gonedes, N. J. 1975. Information production and capital market equilibrium. The Journal of Finance 30 (June): 841-864.

Greenstein, M. M., and H. Sami. 1994. The impact of the SEC's segment disclosure requirement on bid-ask spreads. The Accounting Review 69 (January): 179-199.

Gropper, D. H. 1986. How damaging will the new accounting laws be? Institutional Investor (April): 131-2, 137, 139, 142.

Hagerman, R. L., and M. E. Zmijewski. 1979. Some economic determinants of accounting policy choice. Journal of Accounting and Economics 1 (August): 141-161.

Hakansson, N. H. 1991. Why is financial reporting so inefficient? Journal of Accounting, Auditing and Finance (January): 33-53.

Hamilton, J. L. 1976. Competition, scale economy and transaction cost in stock market. Journal of Financial and Quantitative Analysis 11 (December): 779-802.

_____. 1978. Marketplace organization and marketability: NASDAQ, the stock exchange, and the national market system. The Journal of Finance 33 (May): 487-503.

Healy, P. M. 1985. The effect of bonus scheme on accounting decisions. Journal of Accounting and Economics 7 (April): 85-107.

Hirfindahl, O. C. 1950. Concentration in steel industry. Ph.D. Dissertation, Columbia University.

Hirshleifer, J. 1971. The private and social value of information and the reward to inventive activity. The American Economic Review 61 (September): 561-574.

Ho, T., and H. R. Stoll. 1980. On dealer markets under competition. The Journal of Finance 35 (May): 259-268.

_____, and _____. 1981. Optimal dealer pricing under transactions and return uncertainty. Journal of Financial Economics 9 (March): 47-73.

_____, and _____. 1983. The dynamics of dealer market under competition. The Journal of Finance 38 (September): 1053-1075.

Holthausen, R. W., and R. W. Leftwich. 1983. The economic consequences of accounting choices: Implications of costly contracting and monitoring. Journal of Accounting and Economics 5 (August): 77-117.

Jaffe, J. F., and L. Winkler. 1971. Optimal speculation against an efficient market. The Journal of Finance 26 (March): 49-61.

Jarnagin, B. D., D. Hudson, and B. Askren. 1987. Impact of the new pension pronouncements on the petroleum industry. Journal of Petroleum Accounting 6 (Fall/Winter): 63-77.

Judge, G., W. Griffith, R. Hill, and T. Lee. 1980. The Theory and Practice of Econometrics. New York: John Wiley and Sons.

Karpoff, J. M. 1986. A theory of trading volume. The Journal of Finance 41 (December): 1069-1087.

_____. 1987. The relation between price changes and trading volume: A survey. Journal of Financial and Quantitative Analysis 22 (March): 109-126.

Landsman, W. 1986. An empirical investigation of pension fund property rights. The Accounting Review 61 (October): 662-691.

_____, and J. A. Ohlson. 1990. Evaluation of market efficiency for supplementary accounting disclosures: The case of pension assets and liabilities. Contemporary Accounting Research 7 (Fall): 185-198.

Lee, J. C., and D. A. Hsieh. 1985. Choice of inventory accounting methods: comparative analyses of alternative hypotheses. Journal of Accounting Research 23 (Autumn): 468-485.

Leftwich, R. 1980. Market failure fallacies and accounting information. Journal of Accounting and Economics 2 (July): 193-211.

Lev, B. 1988. Toward a theory of equitable and efficient accounting policy. The Accounting Review.(January): 1-22.

_____, and J. A. Ohlson. 1982. Market-based empirical research in accounting: A review, interpretation, and extension. Journal of Accounting Research 20 (Supplement): 249-322.

Liebtag, B. 1986. Adverse effects expected from new pension rules; greater role seen for CPAs. The Journal of Accountancy 161 (April): 53-57.

Lilien, S., and V. Pastena. 1982. Determinants of intra-method choice in the oil and gas industry. Journal of Accounting and Economics 4 (December): 145-170.

Louge, D. E. 1975. Market making and the assessment of market efficiency. The Journal of Finance 30 (March): 115-123.

Maddala, G. S. 1983. Limited-dependent and qualitative variables in econometrics. Cambridge, U.K.: Cambridge University Press.

_____. 1991. A perspective on the use of limited-dependent and qualitative variables models in accounting research. The Accounting Review 66 (October): 788-808.

Maher, J. J. 1987. Pension obligations and the bond credit market: An empirical analysis of accounting numbers. The Accounting Review 62 (October): 785-798.

Malmquist, D. H. 1990. Efficient contracting and the choice of accounting method in the oil and gas industry. Journal of Accounting and Economics 12 (January): 173-295.

Manne, H. G. 1974. Economic aspects of required disclosure under federal securities laws. Wall Street in Transition, edited by H. G. Manne and E. Solomon. New York: New York University Press.

May, R. G., and G. L. Sundem. 1976. Research for accounting policy: An overview. The Accounting Review 51 (October): 747-763.

Mendelson, H. 1985. Random competitive exchange: Price distributions and gains from trade. Journal of Economic Theory 37 (December): 254-280.

Mendenhall, W., and T. Sincich. 1986. A Second Course in Business Statistics: Regression Analysis, 2nd edition. San Francisco, CA.: Dellen Publishing Co.

Merino, B. D., and M. D. Neimark. 1982. Disclosure regulation and public policy: A sociohistorical reappraisal. Journal of Accounting and Public Policy 1 (Fall): 33-55.

Milgrom, P. R., and N. Stockey. 1982. Information, trade and common knowledge. Journal of Economic Theory 26 (February): 17-27.

Morse, D. 1980. Asymmetrical information in securities markets and trading volume. Journal of Financial and Quantitative Analysis 15 (December): 1129-1148.

_____, and N. Ushman. 1983. The effect of Information announcements on the market microstructure. The Accounting Review 58 (April):247-258.

Noreen, E. 1988. An empirical comparison of probit and OLS regression hypothesis tests. Journal of Accounting Research 26 (Spring): 119-133.

Norton, C. L. 1988. Pension accounting: Effects of early adoption. The CPA Journal 58 (March): 46-51.

_____. 1989. Transition to new accounting rules: The case of FAS 87. Accounting Horizons 3 (December): 40-48.

O'Hara, M., and G. S. Oldfield. 1986. The microeconomics of market making. Journal of Financial and Quantitative Analysis 21 (December): 361-376.

Ohlson, J. A., and A. G. Buckman. 1980. Toward a theory of financial accounting. The Journal of Finance 35 (May): 537-547.

_____, and _____. 1981. Toward a theory of financial accounting: Welfare and public information. Journal of Accounting Research 19 (Autumn): 399-433.

Okun, A. M. 1975. Equity and efficiency: The big tradeoff. Washington, DC: The Brookings Institution.

Parkinson, M. 1980. The extreme value method for estimating the variance of the rate of return. Journal of Business 53 (January): 61-65.

Pastena, V. 1990. Discussion of "Evaluation of market efficiency for supplementary accounting disclosures: The case of pension assets and liabilities." Contemporary Accounting Research 7 (Fall): 199-202.

Raman, K. K., and N. Tripathy. 1993. The effect of supplemental reserve-based accounting data on the market microstructure. Journal of Accounting and Public Policy 12 (Summer): 113-133.

Rao, R. P., N. Tripathy, and W. P. Dukes. 1991. Dealer bid-ask spreads and options trading on OTC stocks. The Journal of Financial Research 14 (Winter): 317-325.

Roll, R. 1984. A simple implicit measure of the effective bid-ask spread in an efficient market. The Journal of Finance 39 (September): 1127-1139.

Ross, S. A. 1979. Disclosure regulation in financial markets: Implications of modern finance theory and signaling theory. Issues in financial regulation. edited by F. R. Edwards, 177-208. New York: McGraw-Hill Book.

Scott, D. R. 1973. The Cultural Significance of Accounts. Columbia, MO.: Lucas Brothers Publishers.

Securities and Exchange Commission (SEC). 1977. The nature of mandated disclosures. chapter 20. Report of the SEC Advisory Committee on Corporate Disclosure. (November): 618-656. Washington, D. C.: U. S. Government Printing Office.

Selto, F. H., and B. R. Neumann. 1981. A further guide to research on the economic consequences of accounting information. Accounting and Business Research 11 (Autumn): 317-322.

Senteney D. L., and J. R. Strawser. 1990. The impact of financial statement effects on adoption of accounting pronouncements: The case of SFAS 87. Advances in Accounting 6: 37-60.

Shehata, M. 1991. Self-selection bias and the economic consequences of accounting regulation: An application of two-stage switching regression to SFAS No. 2. The Accounting Review 66 (October): 768-787.

Smidt, S. 1971. Which road to an efficient stock market: Free competition versus regulated monopoly. Financial Analysts Journal 27 (September/October): 18-20, 64-69.

_____. 1979. Continuous versus intermittent trading on auction markets. Journal of Financial and Quantitative Analysis 14 (November): 837-872.

Solomons, D. 1983. The political implications of accounting and accounting standard setting. Accounting and Business Research 13 (Spring): 107-118.

Stigler, G. J. 1964. Public regulation of the securities markets. Journal of Business 37 (April): 117-134.

Stoll, H. R. 1976. Dealer inventory behavior: An empirical investigation of NASDAQ stocks. Journal of Financial and Quantitative Analysis 11 (September): 359-380.

_____. 1978a. The supply of dealer services in securities markets. The Journal of Finance 33 (September): 1133-1151.

_____. 1978b. The pricing of security dealer services: An empirical study of NASDAQ stocks. The Journal of Finance 33 (September): 1153-1172.

_____. 1989. Inferring the components of the bid-ask spread: Theory and empirical tests. The Journal of Finance 44 (March): 115-134.

Stone, M. and R. W. Ingram. 1988. The effect of Statement No. 87 on the financial reports of early adopters. Accounting Horizons 2 (September): 48-61.

_____, and J. Rasp. 1991. Tradeoffs in the choice between logit and OLS for accounting choice studies. The Accounting Review 66 (January): 170-187.

Swaminathan, S. 1991. The impact of SEC mandated segment data on price variability and divergence of beliefs. The Accounting Review 66 (January): 23-41.

Thomas, J. K. 1988. Corporate taxes and defined benefit pension plans. Journal of Accounting and Economics 10 (July): 199-237.

Tinic, S. M. 1972. The economics of liquidity services. Quarterly Journal of Economics 86 (February): 79-93.

_____, and R. R. West. 1972. Competition and pricing of dealer service in the OTC markets. Journal of Financial and Quantitative Analysis 7 (June): 1707-1727.

Tinker, A. M. 1980. Towards a political economy of accounting: An empirical illustration of the Cambridge controversies. Accounting Organizations and Society 5 (No. 2): 147-160.

_____, B. D. Merino, and M. D. Neimark. 1982. The normative origins of positive theories: Ideology and accounting thought. Accounting Organizations and Society 7 (No. 2): 167-200.

Tripathy, N., and R. L. Peterson. 1991. Portfolio risk, adjustment costs and security dealer's bid/ask spreads. Journal of Financial Services Research 5: 131-142.

_____, and R. P. Rao. 1992. Adverse selection, spread behavior, and OTC seasoned equity offerings. The Journal of Financial Research 15 (Spring): 39-56.

Trombley, M. A. 1989. Accounting method choice in the software industry: characteristics of firms electing early adoption of SFAS No. 86. The Accounting Review 64 (July): 529-538.

VanDerhei, J. L., and F. P. Joanette. 1988. Economic determinants for the choice of actuarial cost methods. The Journal of Risk and Insurance 52 (March): 59-74.

Varian, H. R. 1974. Equity, envy, and efficiency. Journal of Economic Theory 9 (September): 63-91.

_____. 1975. Distributive justice, welfare economics, and the theory of fairness. Philosophy and Public Affairs 5 (Spring): 223-247.

Venkatesh, P. C. and R. Chiang. 1986. Information asymmetry and the dealer's bid-ask spread: A case study of earnings and dividend announcements. The Journal of Finance 41 (December): 1089-1102.

Watts, R. L., and J. L. Zimmerman. 1978. Towards a positive theory of the determination of accounting standards. The Accounting Review 53 (January): 112-134.

_____, and _____. 1986. Positive Accounting Theory. N. Y.: Prentice-Hall.

_____, and _____. 1990. Positive accounting theory: A ten year perspective. The Accounting Review 65 (January): 131-156.

Weisbrod, B. A. 1978. Public Interest Law: An Economic and Institutional Analysis. Berkeley, Ca.: University of California Press.

White, G. I. 1987. Is FAS87 workable? Yes. Financial Executive 43 (September/October): 19, 22-24.

White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for the heteroskedasticity. Econometrica 48 (May): 817-838.

Williams, P. F. 1987. The legitimate concern with fairness. Accounting Organizations and Society 12 (No. 2):169-189.

Wolf, Jr., C. 1988. Market and non-market failures Comparison and assessment. Journal of Public Policy 7 (No. 1): 43-70.

Zabel, E. 1981. Competitive price adjustment without market clearing. Econometrica 49 (September): 1201-1221.

Zimmer, I. 1986. Accounting for interest by real estate developers. Journal of Accounting and Economics 8(March): 37-51.

Zmijewski, M. E., and R. L. Hagerman. 1981. An income strategy approach to the positive theory of accounting standard setting/choice. Journal of Accounting and Economics (August): 129-149.