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**Interest rate swaps: Firm characteristics, motivations and  
differential market reactions**

**Kim, Sungsoo, Ph.D.**

**City University of New York, 1993**

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**Interest Rate Swaps:  
Firm Characteristics, Motivations and  
Differential Market Reactions**

by

Sungsoo Kim

A dissertation submitted to the Graduate Faculty in Business  
in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy, The City University of New York.

1993

c 1993

SUNGSOO KIM

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This manuscript has been read and accepted for the Graduate Faculty in Business in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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## Abstract

### Interest Rate Swaps: Firm Characteristics, Motivation and Differential Market Reactions

by

Sungsoo Kim

Adviser: Professor Steven B. Lilien

Interest rate swaps are a logical response to the market interest rate fluctuations following the Federal Reserve's change in interest rate policy in 1979. Since then the swap market has grown to 3 trillion dollars in notional principal amounts in 1992. But no empirical study of interest rate swaps has been done in either accounting or finance literatures. Empirical investigation of this topic helps users of financial statements and investors to understand this major segment of the capital market and contributes to the literature in this field. The major goal of this study is to empirically explain the interest rate swap transactions from the perspective of users and link the theories with empirical evidence. This study investigates the motivation and characteristics of those companies involved in swap transactions. Differences in the earnings response coefficients for swappers versus non-swappers are also examined.

A search of the National Automated Accounting Research Systems (NAARS) database is performed to identify interest

rate swaps or interest rate exchange agreements from 1984 through 1989.

Empirical findings show that swappers are larger in size and have higher leverage than non-swappers. Within swappers, those that change their interest payment from variable to fixed (VF) have higher leverage than those that change from fixed to variable (FV). Empirical results support the hypothesis that firms with different credit ratings engage in swap transaction to take advantage of the arbitrage opportunity created by a bond market structure in which the premium charged to less credit worthy firms in the variable short-term debt market is less than the premium charged in the long-term fixed debt market. The study also finds that interest rate swaps serve as an effective hedging mechanism with nominal costs. Signalling theory advanced by the finance literature to explain swaps is not supported by the empirical findings based on this particular sample. A subset of FV firms was found to be engaged in structured swap transactions to relax their operating cash flow constraints. Differences in earnings quality before and after the swap transactions are not observed, possibly because of inconsistent and incomparable disclosure on swaps during the study period.

More sophisticated analyses of these relatively new transactions are warranted. However, the unavailability of swap gain or loss data leaves no choice but to wait for more systematic disclosures on the swaps under SFASs 105 and 107.

## Acknowledgments

I owe a great debt to several individuals for guidance and encouragement during the last five years of my doctoral study. Appreciation goes to the members of my dissertation committee. I owe special thanks to Dr. Steven Lilien for his guidance and support as faculty advisor and chairman of the dissertation committee. I also extend my sincere gratitude to Dr. Joseph Kerstein and Dr. Steve Im for their support and guidance during the preparation of this dissertation. I am greatly indebted to Dr. In-Mu Haw, Texas Christian University, who encouraged and supported me in my MBA and doctoral study.

I thank Steve Balsam for his candid criticism and his help. I have also benefited from the comments and criticism of one of my friends, Jane, who provided her expertise in writing and the structure of the dissertation.

I owe my greatest debt to my wife, Eunjee. Her patience, understanding and love made this dissertation possible. Finally, I dedicate this dissertation to my parents whose sacrifice and love never ended since my childhood.

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## **Chapter 1. Introduction**

### **1.1. History and Structure of the Swap Market**

Interest rate swaps are contracts between two parties whereby each party commits to make periodic payments to the other based on a predetermined amount of notional principal<sup>1</sup> for a predetermined life called maturity. Interest rate swaps were first introduced in 1981, and in the years since, they have grown dramatically in volume to 3 trillion dollars in 1992.<sup>2</sup>

Deregulation, foreign exchange and interest rate volatility, and tax law changes are major causes for the creation of this new financial instrument.<sup>3</sup> Some financial instruments have been developed to reduce an entity's interest rate risk resulting from volatile markets by transferring risk to other entities. Many innovative financial instruments are a result of the breaking apart or combining traditional instruments. In addition to the above economic reasons, some financial instruments are implemented because of their favorable accounting implications. The significant increase in the level and volatility of interest rates since the late 1970's resulted in higher interest rate risk faced by firms

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<sup>1</sup> The amount on which interest payments are calculated; usually the amount of the underlying liability.

<sup>2</sup> Market Survey Highlights for 1992 Swaps, International Swap Dealers Association

<sup>3</sup> SFAS 105, 1990, "Disclosures about Financial Instruments," Financial Accounting Standard Board, Stamford, CT.

and financial institutions.<sup>4</sup>

A significant implication is the effect swaps have on credit risk and corresponding overall enterprise risk. Credit risk may increase because the parties to a swap substitute their ability to pay a series of payments for another company's ability to make those payments. In effect, these companies swap credit ratings. The result may be that one company accepts another company's lower credit rating as equal to its own. The overall result is higher enterprise risk for one firm.

The Financial Accounting Standard Board (FASB) tried to develop standards to aid in resolving existing financial accounting and reporting issues and other issues that arise with various financial instruments, including interest rate swaps.<sup>5</sup> The issues include whether assets or liabilities should be recognized as a result of certain transactions

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<sup>4</sup> Intermediaries trading in the swap market include many of the largest commercial and investment banks. The largest traders tend to act as market makers in swap transactions, meaning they take market risk and credit exposure to their counterparties and stand ready to quote a two-way market for almost any structure desired. More minor players frequently act only as an agent or credit intermediary. Market-making principals in swaps maintain a "book", or inventory, of swaps.

<sup>5</sup> The FASB selected financial instruments as a topic for investigation in May 1986, and issued Exposure Drafts on financial instruments, including interest rate swaps, in November 1987 and July 1989. The FASB issued two statements on this project: 1) SFAS 105 "Disclosures of Information about Financial Instruments with Off-balance sheet Risk and Financial Instruments with concentration on Credit Risk, and 2) SFAS 107 "Disclosures about Fair Value of Financial Instruments".

involving financial instruments. While this issue was under consideration, the manner in which interest rate swaps transactions were recognized and disclosed in financial statements was decided by each individual firm. SFASs 105 and 107, passed in 1990 and 1992, respectively, currently cover disclosure, but to date no standard covers measurement and recognition.

### **1.2. Motivations of the Study**

Interest rate swaps market is now estimated at about 3 trillion dollars in notional principal amount outstanding<sup>6</sup> and thus represents one of the major segments of the capital market. The significance of this volume is perhaps best understood in the context of the fact that this market did not exist prior to 1981. Ever since its inception interest rate swaps have quickly gained its popularities among users partly because of its simple execution and attractiveness as an effective hedging mechanism.

The finance literature has attempted to explain the economic rationale for the existence and the evolution of the interest rate swap market [Bicksler and Chen(1986), Turnbull (1987)]. They have explored the rationale for the existence of swap markets, the principles of pricing swaps and the impact of interest rate and credit risk contracts on the structure and valuation. Whittaker (1987) explores the

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<sup>6</sup> Market Survey Highlights for 1992 Swaps, International Swap Dealers Association

regulatory framework for interest rate swap markets.

Thus in the 1980's attempts have been made to advance the theory of swap valuation. But to my knowledge no empirical study of interest rate swaps has been done in either accounting or finance literatures. Empirical investigation of this topic helps users of financial statements and investors to understand this major segment of capital market and contributes to the literature in this field. The major goal of this study is to empirically explain the interest rate swap transactions from the perspective of users and link the theories with empirical evidence.

### 1.3. Research Questions

The growing popularity of interest rate swaps is due, in part, to the fact that the technique is simple and easy to execute. Using interest rate swaps, market participants transform fixed cash flows to variable and variable to fixed. An interesting question is which type of firm will find it advantageous to change from fixed (variable) interest payments to variable (fixed). In order to answer this question this study empirically examines the characteristics of two group of firms, one of which switched from the fixed to variable interest payments (FV) and the other from variable to fixed(VF). Financial institutions are excluded from the sample because interest rate swaps is one of their product lines (see Footnote 3). Characteristics of swappers versus non-swappers, VF versus FV, VF versus non-swappers matched by

industry (VFM) and FV versus non-swappers matched by industry (FVM) will be examined by univariate t-tests as well as multivariate logit-models.

The second research question examines why firms swap interest rate payments and the impact of swap transactions on firms' financial variables. To answer those motivational aspects and effect of swap transactions, several hypotheses are proposed and tested. Hypotheses to be tested include economic efficiency, hedging, signalling and cash flow hypothesis. The economic efficiency hypothesis predicts that due to a comparative advantage in the bond market, higher-risk firms are expected to choose VF swap transactions to save interest expenses by taking advantage of comparative advantage in accessing to variable and fixed debt market. The hedging hypothesis predicts that swapper's post-swap earnings variances are lower than those of the pre-swap and those of the non-swappers. It further predicts that FV (VF) firms' operating cash flows are more(less) highly correlated with fluctuations in interest rates than VF (FV) firms in the period following (preceding) the swap. The signalling hypothesis predicts that VF firms signal the market that firm's credit ratings will go up after the swap, since VF firm's managers have inside information on favorable cash flows of the firms in the future. The cashflow hypothesis predicts that a subset of FV firms engage in swap transactions to mitigate their cash flow problems by receiving lump-sum

cash of present value of future interest payments at the inception of the swap contract.

To test these hypotheses, cross-sectional and inter-temporal method of analyses are employed. Cross-sectional analysis compares differences in the hypothesized variables between the VF and FV swap samples and their non-swap matched samples in the year of the swap transaction. It explains why some firms choose to engage in swap transaction, while others don't, and why firms choose one form of swap over the other. Time-series analysis is based on a trend over years prior to and in the year of swap.

Another research question is to investigate the impact of swaps on the informativeness of earnings announcements. By changing the interest rate payment from fixed(variable) to variable(fixed), uncertainty about future expected cash flow is expected to be increased (decreased) and so will the market's perceived risk of the future expected cash flow. It predicts that swappers' post-swap earnings response coefficients (ERCs) are greater than pre-swap ERCs.

The rest of the dissertation is organized as follows: The remaining part of Chapter 1 discusses the institutional and accounting backgrounds. It also provides discussions on disclosure and recognition issues and compares interest rate swap transactions with futures contract. Chapter 2 describes the experimental and control sample selection procedures. Univariate t-test and multivariate logit test are performed to

identify the characteristics of swap firms are presented. Chapter 3 discusses the motivational aspects of swap transactions and develops the testable hypotheses, methodology and test results. Chapter 4 discusses the differential market reaction to earnings announcements in the period surrounding swap. Finally, summary and conclusions are provided in Chapter 5.

#### 1.4. Institutional and Legal Background<sup>7</sup>

Firms swapping fixed rate obligations for variable ones received the fixed interest payments in exchange for making interest payments based on then-effective variable rates. Some FV firms structured swap transactions in such a way that they receive the whole lump-sum of present value of interest payments from their swap partners at the inception of the swap contract.

Prior to Internal Revenue Service(IRS) Notice 89-21<sup>8</sup> which became effective February 1 1989, some firms recognized the entire lump-sum payment received from FV transactions as income in order to utilize otherwise unavailable net operating loss carry-overs or foreign tax credits. Those firms argued that lump sum payments received in connection with an interest

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<sup>7</sup> Legal, institutional and accounting backgrounds(Section 2) are based on the discussions with J. Showers and A. Satrap of Solomon Brothers, K. Amburgey of ISDA, S. Sullivan of Lehman Brothers and the others.

<sup>8</sup> IRS Notice 89-21, Deferred Recognition of Income from Lump-sum payment in connection with Notional Principal Contracts

rate swap contract were fully includable in income when received, in reliance on a line of U.S. Supreme Court precedents involving prepaid service contracts.<sup>9</sup> IRS Notice 89-21 reduces this conceptual uncertainty by stipulating that any lump-sum payment received(or made) in one tax year under a swap contract that relates to payments to be made (or received) on the contract in other tax years must be recognized as income or expense over the life of the contract. Therefore, Notice 89-21 effectively eliminated the use of lump sum payments under swap contracts as an income acceleration technique.

In 1988, the Federal Financial Examinations Council (FFIEC) proposed interest rate swap reporting standards in an effort to address bank regulators' concerns over a perceived lack of consistent practices in the recognition of swap income for financial institutions. This proposal suggests that arrangement fees and spread income would not be recognizable at the inception of a swap, but rather such income would be recognized over the life of the swap. FFIEC also proposed that swaps meeting the detailed requirements of SFASs No.52 or 80 be permitted to be recorded as hedges. This would include only swaps which are specifically identified to a particular asset or liability, but would not include swaps which hedge other swaps.

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<sup>9</sup> Schlude v Commissioner, 372 US 128 (1963) and American Automobile Association v Commissioner, 367US687 (1961)

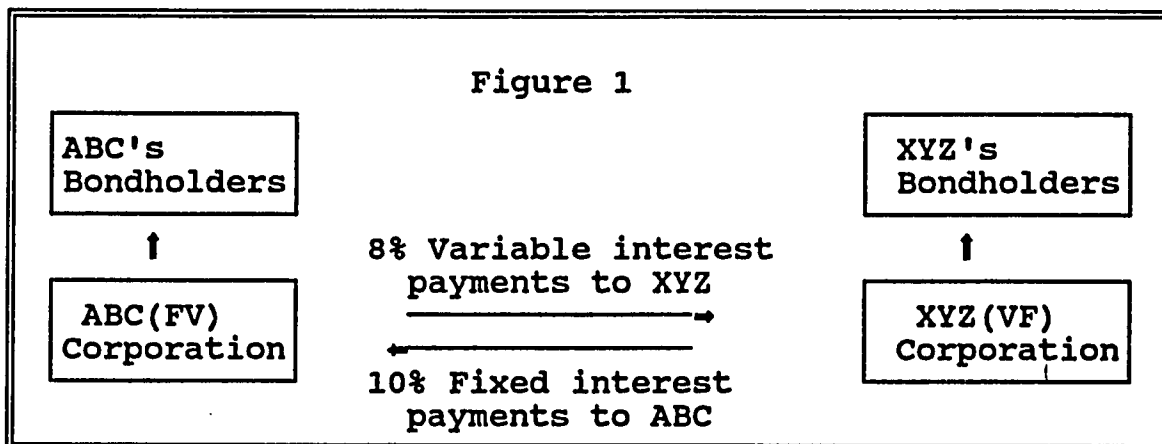
The FFIEC proposal deviates significantly from current practice, which increasingly is based on mark-to-market accounting and permits the recognition of certain up-front payments in the period of receipts. There is concern among swap dealers that the adoption of such standards by the FFIEC could put strong pressure on the FASB or the SEC to adopt similar standards for all entities.

#### 1.5. Accounting Background

Current accounting recognition of interest rate swaps involve changes in interest expenses as the market rate changes. The only other recognition usually given to "material" swaps is the disclosure that occurs in MDA (Management Discussion and Analysis) or footnotes section of the annual report. No accounting recognition is made at the inception of the swap agreement. The impact on net worth and overall enterprise risk is greater with swaps than with futures contracts.

This change in net worth occurs because the longer time period of the swap contract causes a larger change in market value with a given change in interest rates. However, in comparing the accounting for future contracts with swaps, it can be seen that accounting practice now provides investors and analysts with much less information than is provided about futures contracts. Nor is the information about swaps usually detailed enough to permit an evaluation of the financial consequences of the swap.

The following example presents several alternative methods of accounting for interest rate swaps. In Figure 1, ABC Corporation entered an interest rate swap on January 1, 1990 with XYZ Corporation. The swap is unmatched,<sup>10</sup> and ABC Corporation has exchanged fixed interest payments of \$10,000 (10 percent on a \$100,000 bond issue) for a three-year series of variable payments currently at 8 percent on an equal amount of debt. It is assumed that the swap contract is a separate legal contract from the bond indenture. The time value of money is a consideration in accounting for interest rate swaps, but this example does not incorporate



present value concepts for simplicity. In this example, a three-year time period is assumed for simplicity as actual swap agreements would extend beyond this time period. The following exhibit highlights the assumptions in this illustration.

#### A) Constant Interest Rate During the Period

<sup>10</sup> See page 20 for the explanation of matched and unmatched swap transactions.

At the inception of this transaction, ABC(FV) sets up two series of payments. One series is a receivable from the other party to the swap, and the other series is payable to the other party as described below.

Entry 1 at the Inception (January 1, 1990)

Swap Payment Receivable	30,000	
Swap Payment Payable		24,000
Deferred Gain		6,000

**Exhibit 1**

Description of Interest Rate Swap for ABC company

Amount of Debt	: \$100,000
Time Period	: 3 years
Type of Exchange:	Fixed Rate of 10% for Variable of 8%
Type of Swap	: Illustrations with both matched and unmatched

Here the amount of the Swap Payments Receivable is recognized for the total of the amount receivable of \$30,000. At the same time, the payable is recognized for the total that will be paid out over the three-year life of the swap of \$24,000. Therefore, both parties to a swap agreement establish a "Swap Payments Receivable" and "Swap Payments Payable" accounts. Although the variable interest rate change over the life of the swap and affect the amount payable by ABC Company, the initial liability is recognized for an amount based on the market rate at the inception of the swap. The difference between the amounts receivable and payable represents a deferred gain of \$6,000.

There are several methods of handling deferred gains and

losses recognized at the inception of the swap. They can be systematically written off over the life of the swap, or the gain can be systematically written off and the loss immediately recognized. Under the latter method, recoveries of any previously recognized losses are recorded up to the amount of the realized loss. Beyond this point, recoveries are recorded as deferred gains. Alternatively, both the gain or loss can be maintained in a deferred account until the swap agreement expires. At that time, the realized amount of the gain or loss is recognized. This deferred account is considered an adjustment to the stockholder's equity until expiration of the swap. A variation on the last alternative is to defer any gain as part of stockholders' equity but to recognize any loss as a realized loss in the current income statement. In this case, later gains from the changes in market interest rate are limited in the amounts recognized to the total of past realized losses. Beyond that point, gains are deferred until the expiration of the swap agreement.

Since this is an unmatched swap which causes overall enterprise risk to increase and because this type of swap can have significant financial effects on a corporation that need to be quickly recognized, the first method described is selected. With an unmatched swap, any gains are deferred and amortized to realized gain over the life of the swap; losses are immediately recognized. The deferred gain account is usually maintained as part of stockholders' equity.

Entry 2 at December 31, 1990

Interest Expense	10,000	
Interest Payable		10,000
Deferred Gain	2,000	
Realized Gain		2,000

Since I assume constant interest rate during the period, the above entry is made to record interest expense calculated by the initial rate. As the bond is considered separately from the swap, interest expense is recorded at the 10 percent rate originally fixed. The corporation remains legally responsible for this \$10,000 payment regardless of the terms of the swap. Also on the same date, one-third of the deferred gain is recognized as a realized gain. An entry on January 1, 1991 will record the payment of cash to reduce the Swap Payment Payable and Interest Payable as well as the receipt of cash from the swap.

**B) Interest Rate Increases(Decrease) during the Period**

The initial entry to record the swap agreement is unchanged from the constant rate case, and interest expense is still recorded at \$10,000 as a year-end adjustment. The significant change in entries occurs with the second entry on December 31. With interest rate of 14(6)%, the amount which is payable on a three-year, variable swap based on debt of \$100,000 is equal to \$42,000 (18,000). The previously recognized deferred gain is canceled, and a realized loss(gain) of \$12,000(12,000) is recognized. In addition the Swap Payable liability is increased (decreased) by \$18,000 (6,000). Therefore, any previous deferred gain is reduced to

zero, and the liability under the swap is increased(decreased) to \$42,000(6,000). The loss is equal to the difference between the swap receivable of \$30,000, which has not changed, and the adjusted swap payable of \$42,000. This loss is not deferred as the gain would be, and it is reported on the current year's income statement. If interest rates reverse in the future, a recovery of up to the amount of the loss should be recognized, but any gains beyond the realized loss should be deferred and amortized.

The above treatment uses the "mark-to-market" method to determine the gain and loss recognized in current year's income. This is similar to the method followed in FASB Statement 80 for unmatched hedges in futures contracts. Although this swap initially appeared to be a good decision, a market rate increase to 14 percent means that ABC Corporation pays a 4 percent higher interest rate than it would have without the swap. The actual consequences of this decision are recognized in the financial statements when the "mark-to-market" method is adopted. This swap was assumed to be unmatched, and it was not issued as part of the financing package of a new debt issuance.

#### **1.6. Disclosures for Interest Rate Swaps During the Study Period**

Some disclosures about financial instruments have been required by generally accepted accounting principles. Until 1990, firms disclose information about financial instruments

in their annual reports to shareholders or regulators either because of the requirements of the SEC or regulators of their particular industry or institution. Other firms disclose information because they believe the information is useful to investors, creditors, and others in better understanding of the financial instruments and their impacts on the entity. However, many financial instruments have been inadequately reported in financial statements.

Many financial instruments have been created as a response to market volatility, deregulation, tax law changes, and other stimuli.<sup>11</sup> The ever-changing state of financial markets suggests the need to develop broad, general disclosure requirements about financial instruments. Generally accepted accounting principles and regulatory accounting requirements related to financial instruments seem to have developed in an ad hoc fashion.

Because accounting procedures for interest rate swaps have not been established by the FASB (except the disclosure requirements of SFASs 105 and 107), there exists a great potential for diversity in recognizing of interest rate swaps. The SEC however, requires that information about material transactions such as swaps, be disclosed in Management's Discussion and Analysis section or footnotes of the annual report. Two examples of this type of disclosures follow:

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<sup>11</sup> SFAS 105, 1990, "Disclosure about Financial Instruments," Financial Accounting Standard Board, Stamford, CT.

Dun & Bradstreet Corp.

"... On December 1988, the Company entered into a two-year interest-rate swap transaction in which a cash payment of \$132 million was received in 1988 in exchange for semi-annual LIBOR-related floating rate payments to be made in 1989. This obligation is collateralized by \$167 million in cash and cash equivalents. Similar receipts and payments will be made in 1989 and 1990, respectively. In addition, the Company has entered into a second interest-rate swap transaction for similar amounts, exercised in January 1989. In this transaction expiring in 1990, the Company has committed to receive semi-annual LIBOR-related floating rate payments in exchange for semi-annual fixed interest rate payments".<sup>12</sup>

Owens and Minor

"..... During 1988, the Company entered into several interest rate swap agreements to reduce its exposure to rising interest rates. The agreements, which amount to \$15 million, expire in three years and require the Company to make fixed rate interest payments of 9.23% in exchange for a three-month LIBOR. The interest rate swap agreements did not have a material effect on the Company's results of operations in 1988."<sup>13</sup>

As the examples illustrate, the information disclosed varies from company to company. In general, companies make disclosures about the effective rate of interest on the total corporate debt, the effective rate of interest on the variable debt after the swap, the amount of principal related to the swap, and whether the swap is a matched swap. To some extent, financial statements and footnotes provide considerably descriptive information about financial instruments and the risks involved with them, in addition to the information

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<sup>12</sup> Long-term Debt Section of Footnote, 1988 Annual Report of Dun & Bradstreet Corporation

<sup>13</sup> Long-term Debt Section of Footnote, 1988 Annual Report of Owens and Minor Corporation

provided by recognition of many financial assets and liabilities in the statement of financial position. However, not all financial instruments are adequately disclosed, not all entities disclose adequate information, and not all disclosures are readily comparable.

There have not been enough information about the time period of the swap, the effective interest rates swapped in a complex financial package, and the present value of the payments traded. Any significant loss is recognized under FASB Statements No. 5 "Accounting for Contingencies." The method used to recognize any loss or revenue are not disclosed. When the amount of loss exposure is reduced by the guarantees of intermediaries in the swap, disclosures are not be made about how this loss exposure is reduced. A general description of the swap agreement and of the degree of risk involved are not also provided. All these disclosures are to be in the footnotes to the financial statements, and not part of management's discussion in the annual report.

Some entities have provided information not required by generally accepted accounting principles (GAAP) as voluntary disclosures or to comply with requirements of the SEC. Voluntary disclosures about off-balance-sheet items and additional information about recognized financial instruments differ from entity to entity. Disclosure requirements of regulators tend to produce comparability within an industry, but different requirements for similar but separately

regulated industries reduce comparability between entities in different industries. Comparability problems result from different time intervals in future cash flows and interest rate disclosures, different principles in dealing with optional features of particular financial instruments, different measurement approaches, and other causes.

#### **1.7. Financial Recognitions and Implications for Swaps**

Some swap transactions are simply recorded as increase or decreases in interest expense. For example, any change in market interest rates that causes the party accepting the variable rate to pay more or less in interest is simply recorded as a change in interest expense even if interest rate change substantially over the life of the swap agreement. Usually there is no disclosure whether any corresponding assets, liabilities, gains, or losses related to the transaction are recognized. The concept of basing accounting recognition for swaps through recording changes in interest expense is supported through a "linkage argument." Linkage occurs when management views the swap as a component of the related debt. Once this swap-debt link is made, no market rate adjustments from interest rate increases or decreases are made on the principal of the underlying debt or the related swap. Note that a swap agreement can be entered into when new debt is issued, but it can also be based on the previously existing debt. As these swaps are new financial management tool, it is assumed that most swaps relate to previously existing debt. In

either case, the relationship between the underlying debt and the swap should be considered.

When a swap is based on previously existing debt, it is important to consider whether the interest rate swap is established under a separate contract issued at a different time from the debt indenture. If this has occurred, it weakens the arguments that the swap and the debt are linked. Under these circumstances, it is possible for the debt to be retired while payments under the swap agreement continue. This swap agreement exists independently of underlying debt.

The execution of a swap agreement can result in various types of cash payments. For example, one party to the swap may make an initial cash payment to the second party in the swap. In this case, the negotiated payment is made in return for paying a lower interest rate than before the swap. The characteristics of underlying debt have no effect on the amount of these payments. Therefore, it is difficult to accept the idea of linkage between the previously-issued debt and a swap.

Despite these arguments against the concept of linkage, one case of genuine linkage does appear to exist. This occurs when an interest rate swap is an integral part of an overall financing package which involves the issuance of new debt. The financing arrangement may even be established so that the swap is terminated if the debt is extinguished. In this type of arrangement, linkage is justified.

If the swap is seen as a financial instrument separate from a debt agreement, it is necessary to assess the effect of market interest rate changes on the swap. It has been argued that swap agreements are linked to the debt agreement itself, and the amount of debt is not adjusted for market rate changes. Therefore, no adjustments are needed for the swap agreement. One possibility is that swaps may be used to circumvent restrictive covenants of a debt agreement. A creditor may have determined that a company has reached its maximum debt capacity. To prevent a company from reducing its ability to service its existing debt, the creditor may require a provision preventing the company from issuing additional debt or altering the terms of existing debt through refunding.

However, by swapping the fixed for variable payments, ABC Company may circumvent those provisions. In this unmatched swap<sup>14</sup> if variable interest rates move unfavorably, ABC Company may pay substantially higher interest. By changing to variable interest payments ABC Company is now facing the increased default risks. As a result, the company reduced its borrowing capacity and its ability to repay its existing debts. The intent of the protective covenants is to reduce

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<sup>14</sup> In an unmatched swap a company enters into an agreement with another party to pay a series of cash flows in exchange for receipt of another series of cash flows, but the company has no other asset or liability related to the swap transaction. However, a swap is matched when the company has an interest-bearing liability or asset with interest payment terms similar to those of the swap agreement. See pp.12-13 for an example of this swap transaction.

the possibility of default; yet a swap agreement allows the firm to circumvent these provisions. In effect, a company in an unmatched swap agreement may circumvent debt agreements with no obligation to disclose this information.

Although Figure 1 illustrates a swap agreement which is established directly between two firms, a bank commonly acts as an intermediary between the two firms, charging a fee for its services.<sup>15</sup> This fee may account for part of the differential in the swapped interest rates.

#### **1.8. Futures Contracts Versus Interest Rate Swaps**

A futures contract can be used as a hedge to counteract the effect of future price changes on a commodity or financial instrument. The accounting recognition for futures contracts is described in FASB Statement 80, and can either increase or decrease overall enterprise risk. If a futures contract reduces the "sensitivity of an enterprise's income for one or more future periods to changes in the market prices or yield of existing assets, liabilities, firm commitments, or anticipated transactions,"<sup>16</sup> the future contract is accounted for using a deferred method for market rate changes. When a future contract results in risk reduction, all gains and losses are deferred until the hedge is terminated. At

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<sup>15</sup> According to K.A. Amburgey, International Swap Dealers' Associations (ISDA), swap transactions involved with financial intermediaries are accounted for about 60% of the total swap amounts in 1990.

<sup>16</sup> SFAS 80, 1984, Accounting for Future Contracts, Financial Accounting Standard Board, Stamford, CT.

that time, an adjustment is made to the cost or price of the commodity or financial instrument involved in the hedge. This type of a futures contract is called a matched hedge.

If the company is initially in an exposed position and the risk from the exposed position is not reduced by the futures contract, any gain or loss from market changes would be recognized in the period when changes in market prices occur. In this case, no risk reduction occurs due to the relationship between two financial instruments. This is an unmatched hedge. In comparing an interest swap with a futures contract, many similarities and differences become apparent. The two are similar because in both cases the net worth of the company changes when market interest rates change. For example, a futures contract can cause an increase in the amount due to or from a broker based on changes in market rates. The effect is an immediate change in the net worth. This immediate change also occurs with swaps when variable interest rates change. The amount of each payment made under the swap agreement immediately increases or decreases due to change in market rates, and net worth is affected.

Another similarity is that both swaps and futures contracts can change from matched to unmatched positions over a period of time. It cannot be assumed that all swaps beginning as matched swaps will maintain this position over the entire life of the agreement. FASB Statement 80 recognizes unmatched positions change over time, and if this

switch occurs, changes in the accounting for the futures contracts are required.

One important difference between swaps and futures contracts is the length of the contract. Six months is a long time for closing out a hedged futures position, but interest rate swaps typically involve several years.<sup>17</sup> The time period in a swap agreement requires that the time value of interest payments be taken into account when market rates change. This is not an important consideration with futures contracts. Another difference is that swap transactions tend to be more difficult to terminate than futures contracts.

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<sup>17</sup> For the 201 sample firms used in this study, median swap period is 5 years for FV and VF group.

## **Chapter 2. Firm Characteristics**

### **2.1. Sample Selection**

#### **2.1.1. Experimental Samples**

A search of the National Automated Accounting Research Systems (NAARS) database is performed to identify interest rate swaps or interest rate exchange agreements from 1984 through 1989.<sup>18</sup> NAARS is a computerized file which includes texts of the annual reports of about 4,000 firms traded on the NYSE, AMEX, or OTC. The sample obtained over this six-year search period provides the basis for this part as well as for the rest of the dissertation.

Additional sample selection criteria are:

1. Firms must be listed on NYSE, AMEX or OTC during their swap years.
2. For 1984-1989, firms' financial data must be available from either the 1992 Compustat Annual Industrial Tape or the 1992 Compustat Research Industrial Tape or the 1992 Compustat OTC Tape and the 1992 Compustat Quarterly Tape.
3. Annual reports or Form 10-Ks must explicitly report the amount of the swap, the swap period and the direction of swap.
4. For the tests of earnings informativeness in Chapter 4 the firm's common stock must be listed on the CRSP daily return tapes on and around the time of earnings release following the swap transaction. Firms must also be listed on the IBES History tapes.

#### **2.1.2. Control Sample**

To analyze the motivation behind interest rate swaps, firm characteristics of swappers are compared with a control sample

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<sup>18</sup> The specific key words used are; DB/S = ALL AND (INTEREST W/2 RATE W/8 SWAP OR EXCHANGE) NOT W/5((SECURITY W/3 COMMISSION) OR SEC OR FOREIGN CURRENCY). The foreign currency restriction is included to eliminate currency swaps.

(non-swappers) which did not undertake interest rate swaps during the search period.

7 The control firms are industry matched with the sample observations. The firms are not matched by firm size, but firm size is used as an explanatory variable to control for a possible size effect. This study uses an industry match for the control sample mainly because of the industry clustering problems.<sup>19</sup> To minimize the time period effects, the study introduces a matching procedure that provides a representative distribution across calendar years.

Zmijewski (1984) provides a methodological critique of the bankruptcy prediction literature focusing specifically on three issues: 1) the effects of using non-random state-based samples for model estimation; 2) the choice between various statistical specifications of the bankruptcy probability model; 3) the problem of incomplete data availability for some members of the population. Palepu (1986) reports two other issues: 1) the bias introduced by the use of state-based samples in prediction tests, 2) the problems of using an arbitrary cutoff probability in prediction tests.

Two different control samples are collected to analyze swap firms relative to non-swap firms. The first control sample (VFM) consisted of firms matched with VF firms by 3 digit SIC industry code (4 digit SIC Code if available) and

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<sup>19</sup> If experimental samples are disproportionately drawn across the industry, industry matched samples are theoretically representing the control group.

calendar year. The second control sample (FVM) is created by following the same procedures for the FV sample. These control samples for each test group are selected from the population of firms on the 1992 Compustat<sup>20</sup> tape. Panel A of Table 1 shows sample firms (VF and FV) by industry membership. VF firms are evenly distributed, representing 44 different industries. Twenty-eight (18%) out of a total 155 VF firms come from the regulated industries including railroads, airlines, telephone and utilities. The VF sample also includes 13 (8.4%) firms from the chemical industry. A total of 46 FV firms represent 23 different industries. The chemical industry turns out to be a heavy user of FV swaps as well, accounting for 15% of the total sample. Panel B of Table 1 shows the distribution of sample firms by industry and calendar year. By far the largest number of swaps occurs in 1988, with 29 VF and 14 FV swaps.

Descriptive statistics are presented in Table 2 for each swap group. Overall, interest rate swaps turn out to have significant implication for the financial statements in terms of transaction size and volume.<sup>21</sup>

Mean and median SWAPRAT (swap amount/long-term debt) are

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<sup>20</sup> Combined list of 1992 Industrial, Research and OTC Compustat Tape

<sup>21</sup> For a hypothetical firm with notional swap amount of \$100 millions, one percent increase in market interest rate above fixed rate would cost the firm an additional \$1 million interest charge against income. The company understate the liability if it does not disclose the swap payable under swap contracts.

about 29 percent and 18 percent respectively for VF and FV swappers. If a firm changes the nature of its long term debt by about 30 percent, that level of change is expected to have significant impact on the right-hand-side of the balance sheets. However, the swap has not been accounted for on the balance sheet during the study period.

Median swap amounts for VF(FV) firms are about \$75(\$100) million. Mean swap amount for the entire sample is \$120 million. With this level of notional principal amount of swap, the fluctuation of market interest rate will have a significant impact on financial statements, especially for FV firms. For some of the sample firms swaps were more than 1 billion dollars.

Mean and median swap period are 5 years for both FV and VF. Swap periods of more than 10 years are not unusual for some of the sample firms. Unlike futures contracts which usually last about 6 months, swap contracts have long-term implications. Depending upon how market interest rates fluctuate, swap transactions have significant implication on the financial statements. The amount of swap, the swap ratio and the swap period all suggest that swap transactions have significant long-term implications for the firms' financial statements.

**Table 1 Industry Membership**  
**Panel A: By SIC Code**

IND	Description	VF	%	FV	%
10	Metal Mining	.	.	1	2.2
12	Coal Mining	3	1.9		
13	Oil and Gas	4	2.6	1	2.2
15	Building Construction	1	0.6	.	.
16	Heavy Construction	1	0.6	.	.
17	Electrical Work	1	0.6	.	.
20	Foods and Kindred	5	3.2	4	8.7
21	Tobacco, Cigarettes	1	0.6	.	.
22	Textiles	2	1.3	.	.
23	Apparel	2	1.3	1	2.2
24	Lumber and Woods	3	1.9	.	.
25	Furniture	1	0.6	.	.
26	Paper and Allied Products	7	4.5	4	8.7
27	Newspaper and Periodicals	6	3.9	.	.
28	Chemicals	13	8.4	7	15.2
29	Petroleum and Refining	3	1.9	1	2.2
30	Tires and Tubes	1	0.6	1	2.2
32	Glasses and Cements	2	1.3	.	.
33	Furnaces and Steels	6	3.9	2	4.3
34	Metals and Tools	4	2.6	2	4.3
35	Engines and Turbines	2	1.3	.	.
36	Elect. Appliances	2	1.3	4	8.7
37	Motor Vehicles	6	3.9	1	2.2
38	Navigation and Aeronautics	7	4.5	2	4.3
39	Jewelry, Silverware	1	0.6	.	.
40	Railroads	3	1.9	.	.
42	Trucking	1	0.6	.	.
45	Air Transportation	2	1.3	.	.
48	Telephone Communications	6	3.9	1	2.2
49	Utilities	16	10.3	4	8.7
50	Machines and Appliances	6	3.9	2	4.3
51	Groceries and Apparel	3	1.9	.	.
52	Building Material, Lumber	2	1.3	.	.
53	Department Stores	6	3.9	.	.
54	Food, Groceries	1	0.6	.	.
56	Apparels, Clothes, Shoes	1	0.6	1	2.2
57	Radio, TV	2	1.3	.	.
58	Restaurants	1	0.6	1	2.2
59	Retail Stores	4	2.6	.	.
70	Hotel and Lodging	3	1.9	2	4.3
73	Advertising	5	3.2	1	2.5
75	Auto Repair, Service, Rent	1	0.6	.	.
78	Motion Pictures	3	1.9	1	2.2
80	Health Service	3	1.9	1	2.2
87	Engineering Service	2	1.3	1	2.2
Total		155	100 %	46	10%

Panel B. Across the Calendar Year by SIC

SIC	84		85		86		87		88		89		Total
	VF	FV	VF	FV	VF	FV	VF	FV	VF	FV	VF	FV	
10	.	.	.	.	.	.	.	.	.	.	.	1	1
11	.	.	.	.	1	.	1	.	.	.	1	.	3
13	1	.	2	.	.	.	.	1	.	.	1	.	5
15	1	.	.	.	.	.	.	.	.	.	.	.	1
16	.	.	.	.	.	.	.	.	.	.	1	.	1
17	.	.	.	.	1	.	.	.	.	.	.	.	1
20	.	.	1	2	2	.	1	2	.	.	1	.	9
21	.	.	.	.	.	.	.	.	.	.	1	.	1
22	.	.	.	.	1	.	.	.	.	.	1	.	2
23	.	.	.	.	.	.	1	.	.	1	1	.	3
24	1	.	.	.	1	.	.	.	1	.	.	.	3
25	.	.	.	.	1	.	.	.	.	.	.	.	1
26	.	1	1	.	2	1	2	1	1	.	1	1	12
27	1	.	1	.	.	.	2	.	1	.	1	.	6
28	2	.	1	.	2	1	2	2	3	2	3	2	20
29	.	.	.	.	1	.	1	.	.	.	1	1	4
30	.	.	1	.	.	.	.	1	.	.	.	.	2
32	.	.	1	.	.	.	.	.	.	.	1	.	2
33	2	.	.	.	1	.	.	2	1	1	1	.	8
34	1	.	2	.	1	.	.	.	.	2	.	.	6
35	.	.	1	.	.	.	.	.	.	.	1	.	2
36	.	.	.	.	.	1	2	1	.	2	.	.	6
37	.	.	1	.	2	.	.	.	3	.	.	1	7
38	.	.	.	.	3	.	.	.	2	1	2	1	9
39	.	.	.	.	.	.	1	.	.	.	.	.	1
40	1	.	.	.	1	.	1	.	.	.	.	.	3
42	.	.	1	.	.	.	.	.	.	.	.	.	1
45	.	.	.	.	.	.	1	.	.	.	1	.	2
48	2	.	1	.	.	.	1	.	1	1	1	.	7
49	4	1	1	1	2	.	3	.	4	1	2	1	20
50	1	.	1	.	.	1	.	1	3	.	1	.	8
51	1	.	1	.	.	.	.	.	.	.	1	.	3
52	1	.	.	.	.	.	.	.	1	.	.	.	2
53	.	.	.	.	3	.	.	.	1	.	2	.	6
54	1	.	.	.	.	.	.	.	.	.	.	.	1
56	1	.	.	.	.	1	.	.	.	.	.	.	2
57	.	.	.	.	.	.	.	.	2	.	.	.	2
58	.	.	.	.	.	.	.	.	1	1	.	.	2
59	2	.	.	.	1	.	.	.	1	.	.	.	4
70	1	.	1	.	.	1	.	.	1	1	.	.	6
73	.	.	.	.	3	.	2	.	.	.	.	1	5
75	.	.	.	.	.	.	.	.	1	.	.	.	1
78	1	.	.	.	.	1	1	.	.	.	1	.	4
80	.	.	.	1	.	.	.	.	1	.	2	.	4
87	.	.	.	.	.	.	2	.	.	1	.	.	3
total	25	2	18	4	29	7	24	11	29	14	29	9	201

VF: Changed from variable to Fixed FV: Fixed to Variable

Table 2 Descriptive Statistics for Swaps

		Mean	Median	Minimum	Maximum
SWAPRAT	All (n=201)	.287	.180	.009	1.000
	VF (n=155)	.282	.179	.028	0.973
	FV (n=46)	.321	.224	.009	1.000
SPERIOD	All	4.83	5	1	16
	VF	4.92	5	1	16
	FV	4.77	5	1	10
SAMOUNT	All	120	52	5	1700
	VF	100	50	5	910
	FV	181	100	20	1700
SLUMP	FV (n=12)	70.85	50	35	132

SWAPRAT = Swap Amount/Long-term Debt  
 SPERIOD = Number of Years Interest Payments swapped  
 SAMOUNT = Swap Amounts in Millions of Dollars  
 SLUMP = Swap lump-sum Payments in Millions of Dollars for the Subset of FV firms which received the present value of the entire fixed interest payments at the inception of the contract in return for making variable payments in the future.

## 2.2. Firm Characteristics

Interest rate swaps involve only interest payments; no principal amounts change hands. Firms with little or relatively lower level of long-term debt have less incentive or basis for the swaps. On average, the larger the firm is, the higher level of absolute long-term debt it is expected to carry (Ben-Zion and Shalit, 1975). Therefore, larger firms with a relatively higher level of long-term debt are expected to engage in this transaction.

Ben-Zion and Shalit argue that larger firms have lower probabilities of failure, more diversified investments and economies of scale. These three factors tend to lower the

probability of bankruptcy and make it more likely that large firms will take on relatively more debt. Therefore, swappers are expected to have higher leverage than nonswappers. This is especially true for firms switching their interest payments from variable to fixed (VF); their objective is to hedge their higher level of long-term debt against the fluctuation of future market interest rate risk and, therefore to prevent them from paying higher interest payments. The magnitude of debt is expected to be an increasing function of size (Ben-Zion and Shalit, 1975). Therefore, swappers, collectively as well as categorically (VF and FV), are larger in size than non-swappers (VFM and FVM). Collins, Rozeff and Dhaliwal(1981), among others, suggest that size is a comprehensive variable that proxies for leverage and public debt. Size is used in previous accounting literature because large firms and small firms differ in many respects.

Therefore, predicted directions are:

Size	:	Swappers	>	Non-swappers
		FV	>	FVM
		VF	>	VFM
Leverage	:	Swappers	>	Non-swappers
		VF	>	FV
		FV	>	FVM
		VF	>	VFM

### 2.3. Univariate Tests

To test whether VF characteristics are different from those of the FV swappers, a two-sample mean difference t-test

is applied to the selected variables as described above. The appropriate statistics are:

$$t = \frac{X_{exp} - X_{con}}{\sqrt{S^2 \left( \frac{1}{N_{exp}} + \frac{1}{N_{con}} \right)}}$$

where  $x$  = variables being examined

$$s^2 = ((n_{exp} - 1)s_{exp}^2 + (n_{con} - 1)s_{con}^2) / (n_{exp} + n_{con} - 2),$$

$s_{exp}^2$  = sample variance of experimental samples

$s_{con}^2$  = sample variance of control samples

$n_{exp}$  = number of experimental samples

$n_{con}$  = number of control samples

#### 2.4. Univariate Analysis Results

Tables 3 through 6 show time series trends of total assets, long-term debt, log of sales (LSALE) and net income for the experimental and control samples for the 3 years before and after the swap. Panel A of each table contains descriptive statistics; mean difference t-test results are provided in Panel B of each table. Table 3 compares these variables between swappers and non-swappers. Over the 7-year period swappers consistently have higher level of long term debts than those of non-swappers, except for the third years preceding and following the swap year. Size is also statistically different from the observation of total assets and LSALE, consistent with the Ben-Zion and Salit (1975). Swappers' net income during the period is higher than that of non-swappers at a statistically significant level (p-value,

0.02) over the period, except for the two years following the swap year.

Table 4 shows that VF firms are larger in size, measured by LSALE, than those of its matching firms (VFM) except for the third year preceding and following the swap year. However, mean differences in total assets between matched pair are not statistically significant over the entire period. Differences in mean of long-term debt are statistically significant only for the two years following the swap year, although VF's level of long-term debt is higher than that of VFM over the 7-year period. Mean differences of net income between the two groups are not observed over the period.

Size and long-term debt differences are most noticeable between FV and FVM. Table 5 shows the remarkable difference between these two groups for the all variables. FV's total assets and LSALE are consistently higher than those of FVM over the period, except for the third year following the swap year. Except for the third years preceding and following the swap year, long-term debt differences between this pair are statistically significant. It is interesting to note that FV firms' median level of long-term debt increases by about 50 percent (from \$686 million to \$954 million) at the swap year. Differences in net income between the two groups are also statistically significant, except for the third year following the swap.

Table 6 shows the comparisons between two experimental

samples, FV and VF firms. Mean differences in total assets and LSALE between two groups are statistically significant over the entire period. Consistent with the size results, long term debt differences between two test samples are evident except for the third year following the swap year. Mean differences in net income are also statistically significant over the entire period.

Panel A of Table 7 summarizes the univariate analyses for swapper-nonswapper pairs for other selected variables. Swappers have higher leverage than non-swappers with statistical significance (p-value, 0.00) over the 7-year period, but results are largely driven by VF firms' higher leverage as shown in Panel B of Table 7. It is interesting to note that the difference becomes more significant around the swap year. As expected, swappers with higher leverage have lower interest coverage ratio (INTCOV) than non-swappers at swap year, but the mean differences in INTCOV become statistically insignificant after the swap. Average INTCOV over the 7-year period becomes marginally significant. Analysis of a performance variable (ROE) between this pair reveals that this variable is only statistically significant for the two years preceding the swap year. However, average ROE between the two is not statistically different. Mean difference t-test results for price earnings multiple (PE ratio), capital market's perception of the firm, shows that the difference-in-mean of this variable between the pairs is

statistically different with the p-value of 0.00 over the 7-year period. Difference in Altman's ZSCORE<sup>22</sup> between these two groups is not statistically significant across the period, except for the swap year when the difference is statistically significant (p-value, 0.03).

Panel B of Table 7 examines the differences in these variables for the VF-VFM pair. Except for the third year preceding the swap year, VF's leverages are higher than those of VFM with statistical significance level of 0.00. Seven-year average difference is also statistically significant at 0.00. As expected, VF firms with higher leverage have lower interest coverage ratio than its matching sample at the swap year. However, the difference is marginally significant on the average. The performance variable (ROE) becomes statistical insignificant across the 7-year period except for the second year preceding the swap. Mean difference in PE ratio is statistically significant up to the swap year, but become insignificant after the swap. However, mean difference of 7-year average PE ratio is statistically significant at the p-value of 0.00. Altman's ZSCORE is statistically significant only at the swap year when VF's ZSCORE is close to the critical value of 2.65. The fact over the period that VF's ZSCORE is the lowest in the swap year over the period implies that these firms engage in swap transactions when they are in

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<sup>22</sup> Altman's bankruptcy prediction model (1968). Z-score has critical value of 2.65. See Footnote 23 for the detail calculation of this score.

financial difficulties as measured by ZSCORE.

Panel C of Table 7 shows the differences in these variables for FV-FVM pairs. Leverage and interest coverage ratios are not statistically significant in any year during the period. This result suggests that FV firm's motivation for the swap is not related to the leverage issue, but to an economic efficiency consideration as will be hypothesized and tested in Chapter 3. There are no differences in ROE, PE and ZSCORE over the period for this pair group. In other words, FV firms are not different from the matching sample with respect to the selected variables.

Panel D of Table 7 shows comparison between two experimental samples, FV and VF swappers. VF's leverage is higher than that of FV over the period, except for the two years following the swap. In other words, those firms which change from variable interest payments to fixed have an incentive to lock in their interest payments possibly because they want to hedge their higher level of long-term debt against the fluctuation of market interest rate. ROE difference between the two test samples is observed at the swap year with a statistical significance of 0.06. Except for the swap year and the second year following the swap, ROE is not statistically different between the pairs. FV's level of PE is higher than that of VF, but statistically significant only at swap year and the second year following the swap. Taken as a group, this ratio is marginally significant over

the period. ZSCORE differences around the swap year are statistically significant. FV's ZSCORES are higher than VF's over the period, but the differences are not statistically significant in the third years preceding and following the swap year. Marginal significance is observed for the 7-year average of this variable.

## **2.5. Multivariate Analysis**

### **2.5.1. Methodology**

A multivariate logit analysis investigates the effects of each variable controlling for the other variables and also measuring the joint ability of independent variables to explain firm behavior. One advantage of logit analysis over multiple discriminant analysis is that it provides significance tests for the individual independent variables as well as for the overall classification. Another advantage of the logit analysis is found when there is disproportionate sampling from two populations (as is the case with swappers and non-swappers) occurs. Zmijewski (1984) explores sampling and methodological issues related to the discrete prediction model which has dichotomous alternatives (i.e., bankruptcy /non-bankruptcy, swapper/non-swapper) as a dependent variable. He examined estimation biases which can result when the models are estimated on non-random samples. Maddala (1983) shows that disproportionate sampling affects only the constant term of the logit model and all the other logit coefficients are consistent.

The model used in the logit analysis is

$$Y_j = b_0 + b_1 LEV_j + b_2 LSALE_j + b_3 ROE_j + b_4 ZSCORE_j + e_j \quad (1)$$

where; j is the firm-year index.  
 $Y_j$  is 1 if test samples (VF, VF, FV or Swappers)  
 is 0 if control samples (VFM, FV, FVM or  
 Nonswappers).  
 $Lev_j$  is measured by dividing long-term debt by  
 total assets.  
 $LSALE_j$  is the size variable measured by natural  
 log of sales  
 $ROE_j$  is the performance variable computed by  
 dividing net income by market value of equity.  
 $ZSCORE_j$ <sup>23</sup> is Altman's ZSCORE.  
 $b_{0-4}$  regression coefficient  
 $e_j$  is an error term.

The model includes leverage, size, performance and financial distress variables to investigate each variable for each different group in a multivariate setting. This logit model, together with univariate analysis, captures the firm characteristics of each group. Size, measured by log of sales, is included in the model because size may proxy for unexplained differences between small and large firms [Atiase(1985)].

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<sup>23</sup> Altman's Z-score was developed by Altman [1968] to predict bankruptcy as follows:  

$$ZSCORE_j = 1.2 X1_j + 1.4 X2_j + 3.3 X3_j + 0.6 X4_j + 0.99 X5_j + E_j$$

where:

j is the firm-year index,  
 $X1_j$  is the ratio of net working capital to total assets,  
 $X2_j$  is the ratio of retained earnings to total assets,  
 $X3_j$  is the ratio of earnings before interest and tax to  
 total assets,  
 $X4_j$  is the ratio of market value of equity to book value  
 of total debt,  
 $X5_j$  is the ratio of sales to total assets, and  
 $E_j$  is an error term

### 2.5.2. Results of Multivariate Analysis

Table 8 shows the results of the multivariate logit analyses for each pair group. Three independent variables (LEV, LSALE and ROA) are included in two different logit models one with Altman's ZSCORE (Model 2) and one without (Model 1).

For VF-VFM pair analysis in Model 1, VF firms have higher leverage than the control firms (significant with the p-value of 0.00), controlling for size and performance variable. VF firms are also larger in size at a statistically significant level (p-value, 0.02). However, ROE is insignificant between these two groups. When the logit model includes Altman's ZSCORE (Model 2), leverage and size are still statistically significant, while ROE and ZSCORE are not statistically significant.

For VF-FV pair analysis, VF firms have higher leverage than FV firms at a statistical significance level (p-value, 0.01) and FV firms are larger than VF firms in Model 1 (ZSCORE omitted), controlling for leverage and ROE. However, ROE between VF and FV becomes statistically insignificant in a multivariate setting. Leverage difference becomes marginally significant (p-value, 0.15), although size is still statistically different (p-value, 0.00) when the logit model includes ZSCORE as an additional independent variable.

For FV-FVM pair analysis, only the size variable is statistically different, with the p-value of 0.00 level in

Model 1. Results of Model 2 is similar to that of Model 1 in that only the size variable are statistically significant. This finding is consistent with the univariate test results for this paired group.

Swapper-nonswapper pair analysis shows both size and leverage variables are statistically significant as expected. ROE and ZSCORE become statistically insignificant in both models. The fact that results for leverage and size still hold in a multivariate setting suggests that swappers are larger and more highly levered than non-swappers. Overall, ROE and ZSCORE are statistically insignificant across the pairs and across the models. However, leverage and size differences are robust across the pairs and models. The results of multivariate logit analyses are generally consistent with those of univariate analysis.

## 2.6. Summary

Ever since their inception in the early 1980's, interest rate swaps have been used as a hedging mechanism by the firms, as confirmed by its notional principal volume. Using this creative financial instrument, firms can convert their fixed rate interest payments into variable payments and vice versa. This Chapter explores the question of which types of firms change their interest rate payments.

Firms which change the configuration of their interest rate payments from variable to fixed (VF) have higher leverage and are larger in size than matching non-swap firms (VFM).

Firms which change their interest payments from fixed to variable (FV) have lower leverage than VF firms, but are larger in size than their matching firms (FVM). Taken as a group, swappers (both VF and FV combined) are larger in size and have higher leverage than matched non-swappers (both VFM and FVM combined). These results are generally robust in both univariate and multivariate setting.

These findings imply that VF firms, with their higher leverage, engage in this transaction to hedge their long-term debt against the fluctuation of the market interest rate. FV firms' motivations seem to be different from those of VF firms as will be discussed and analyzed in Chapter 3.

**Table 3 Statistics for Swappers versus Non-swappers****Panel A: Descriptive Statistics**

(Unit: million dollars except LSALE)

<b>Swappers(n=201)</b>		<b>t-3</b>	<b>t-2</b>	<b>t-1</b>	<b>t</b>	<b>t+1</b>	<b>t+2</b>	<b>t+3</b>
<b>Total</b>	<b>Mean</b>	2,957	3,274	3,649	4,780	5,742	6,339	3,885
<b>Assets</b>	<b>Median</b>	1,126	1,119	1,323	1,426	1,361	1,320	1,248
	<b><math>\sigma</math></b>	5,378	6,035	6,437	11,864	14,636	17,948	6,897
<b>Long-term</b>	<b>Mean</b>	590	696	826	1,071	1,349	1,468	1,133
<b>Debt</b>	<b>Median</b>	183	187	272	318	292	256	323
	<b><math>\sigma</math></b>	1,117	1,308	1,362	2,049	2,858	3,223	2,403
<b>LSALE</b>	<b>Mean</b>	6.94	7.02	7.12	7.27	7.31	7.36	7.24
	<b>Median</b>	7.06	7.12	7.14	7.19	7.21	7.14	7.19
	<b><math>\sigma</math></b>	1.56	1.51	1.48	1.48	1.52	1.49	1.43
<b>Net</b>	<b>Mean</b>	160	192	226	236	274	258	231
<b>Income</b>	<b>Median</b>	59	69	70	73	64	70	88
	<b><math>\sigma</math></b>	302	349	427	464	589	646	485
<b>Non- (n=201) Swappers</b>		<b>t-3</b>	<b>t-2</b>	<b>t-1</b>	<b>t</b>	<b>t+1</b>	<b>t+2</b>	<b>t+3</b>
<b>Total</b>	<b>Mean</b>	1,968	2,026	2,221	2,280	2,248	2,611	3,087
<b>Assets</b>	<b>Median</b>	508	541	569	599	704	868	1,072
	<b><math>\sigma</math></b>	5,016	5,092	5,382	5,416	5,069	5,087	5,946
<b>Long-term</b>	<b>Mean</b>	434	428	456	456	429	474	660
<b>Debt</b>	<b>Median</b>	80	77	75	95	115	118	202
	<b><math>\sigma</math></b>	1,211	1,131	1,175	1,142	928	939	1,233
<b>LSALE</b>	<b>Mean</b>	6.36	6.36	6.39	6.42	6.48	6.66	6.73
	<b>Median</b>	6.52	6.55	6.59	6.56	6.54	6.80	7.26
	<b><math>\sigma</math></b>	1.67	1.69	1.72	1.74	1.69	1.69	1.81
<b>Net</b>	<b>Mean</b>	99	105	123	135	140	162	185
<b>Income</b>	<b>Median</b>	31	35	42	42	47	47	56
	<b><math>\sigma</math></b>	216	207	249	270	347	341	352

t indicates the swap year.

 $\sigma$  indicates standard deviation.

LSALE: Log of Sale

Swappers: both VF and FV combined

VF(FV) firms are the ones which changed from variable(fixed) interest payment to fixed(variable).

Non-swappers: both VFM and FVM combined

VFM firms are VF's industry matched control sample

FVM firms are FV's industry matched control sample

**Table 3 Statistics for Swappers versus Non-swappers (continued)**

**Panel B: T-test Results for Swappers versus Non-swappers**

**Total Assets**

	t-3	t-2	t-1	t	t+1	t+2	t+3
Swappers	2,957	3,274	3,649	4,780	5,742	6,339	3,885
Non-swappers	1,918	2,026	2,221	2,280	2,248	2,611	3,087
t-value	1.45	1.75	1.91	2.29	2.69	2.21	0.75
p-value	0.14	0.08	0.05	0.02	0.00	0.02	0.45

**Long-term Debt**

	t-3	t-2	t-1	t	t+1	t+2	t+3
Swappers	590	696	826	1,071	1,349	1,468	1,133
Non-swappers	434	428	456	456	429	474	660
t-value	1.02	1.71	2.31	3.10	3.65	3.33	1.57
p-value	0.30	0.08	0.02	0.00	0.00	0.00	0.11

**Log of Sale**

	t-3	t-2	t-1	t	t+1	t+2	t+3
Swappers	6.94	7.12	7.12	7.27	7.31	7.36	7.24
Non-swappers	6.36	6.36	6.39	6.42	6.48	6.66	6.73
t-value	2.76	3.20	3.63	4.21	4.04	3.52	1.91
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.05

**Net Income**

	t-3	t-2	t-1	t	t+1	t+2	t+3
Swappers	160	192	226	236	274	258	231
Non-swappers	99	105	123	135	140	162	185
t-value	1.81	2.40	2.40	2.21	2.25	1.42	0.66
p-value	0.07	0.01	0.01	0.02	0.02	0.15	0.50

t indicates the swap year.

LSALE: Log of Sale

Swappers: both VF and FV combined

VF(FV) firms are the ones which changed from variable (fixed) interest payment to fixed(variable).

Non-swappers: both VFM and FVM combined

VFM firms are VF's industry matched control sample

FVM firms are FV's industry matched control sample

**Table 4 Statistics for VF versus VFM****Panel A: Descriptive Statistics**

(Unit: million dollars except LSALE)

VF	(n=155)	t-3	t-2	t-1	t	t+1	t+2	t+3
Total	Mean	1,420	1,572	1,875	2,151	2,186	2,434	2,786
Assets	Median	688	799	952	1,021	962	995	1,018
	$\sigma$	1,976	2,320	2,664	3,032	3,156	3,668	4,226
Long-term	Mean	347	381	517	602	626	715	815
Debt	Median	145	153	234	271	226	234	290
	$\sigma$	627	689	844	929	1,076	1,307	1,556
LSALE	Mean	6.52	6.62	6.73	6.89	6.87	6.94	6.94
	Median	6.45	6.44	6.56	6.81	6.70	6.82	6.99
	$\sigma$	1.38	1.32	1.30	1.30	1.30	1.29	1.34
Net	Mean	79	97	104	111	100	74	129
Income	Median	39	40	47	48	36	42	51
	$\sigma$	117	147	153	178	224	250	179
VFM	(n=155)	t-3	t-2	t-1	t	t+1	t+2	t+3
Total	Mean	1,636	1,722	2,010	2,013	1,957	2,272	2,395
Assets	Median	378	405	449	450	560	641	860
	$\sigma$	3,940	4,169	4,907	4,880	4,544	5,384	4,648
Long-term	Mean	348	354	413	411	376	406	562
Debt	Median	54	64	56	90	75	104	84
	$\sigma$	767	861	1,082	1,092	841	886	1,262
LSALE	Mean	6.16	6.16	6.22	6.23	6.30	6.43	6.44
	Median	6.34	6.34	6.34	6.25	6.33	6.48	6.45
	$\sigma$	1.67	1.70	1.73	1.76	1.70	1.69	1.77
Net	Mean	81	91	109	118	113	126	119
Income	Median	25	29	33	34	30	28	40
	$\sigma$	202	201	238	266	326	310	250

t indicates the swap year.

 $\sigma$  indicates standard deviation.

LSALE: log of sales

VF firms are the one which changed from variable debt payments to fixed.

VFM: VF's industry matched control sample

**Table 4 Statistics for VF versus VFM (continued)****Panel B: T-test Results for VF versus VFM****Total Assets**

	t-3	t-2	t-1	t	t+1	t+2	t+3
VF	1,420	1,572	1,875	2,151	2,186	2,434	2,786
VFM	1,636	1,722	2,010	2,013	1,957	2,272	2,395
t-value	-0.43	-0.28	-0.21	-0.24	-0.40	-0.20	-0.45
p-value	0.63	0.77	0.82	0.80	0.68	0.83	0.65

**Long-term Debt**

	t-3	t-2	t-1	t	t+1	t+2	t+3
VF	347	381	517	602	626	715	815
VFM	348	354	413	411	376	406	562
t-value	-0.09	0.23	0.71	1.32	1.75	1.78	1.17
p-value	0.92	0.81	0.47	0.18	0.08	0.07	0.24

**LSALE**

	t-3	t-2	t-1	t	t+1	t+2	t+3
VF	6.52	6.62	6.73	6.89	6.87	6.94	6.94
VFM	6.16	6.16	6.22	6.23	6.30	6.43	6.44
t-value	1.35	1.80	2.06	2.85	2.46	2.08	1.60
p-value	0.17	0.07	0.04	0.00	0.01	0.03	0.11

**Net Income**

	t-3	t-2	t-1	t	t+1	t+2	t+3
VF	79	97	104	111	100	74	129
VFM	81	91	109	118	113	126	119
t-value	-0.15	0.15	-0.27	-0.24	-0.33	-1.20	0.17
p-value	0.87	0.87	0.78	0.80	0.75	0.23	0.85

t indicates the swap year.

LSALE: Log of Sale

VF firms are the ones which changed from variable debt payments to fixed.

VFM: VF's industry matched control sample

**Table 5 Statistics for FV versus FVM**

Panel A: Descriptive Statistics  
(Unit: million dollars except LSALE)

FV (n=46)		t-3	t-2	t-1	t	t+1	t+2	t+3
Total	Mean	6,594	7,282	7,833	11,298	13,581	15,236	7,365
Asset	Median	3,430	3,423	4,210	4,868	5,106	5,156	4,599
	$\sigma$	8,328	9,310	9,872	20,212	24,021	30,278	11,040
Long-term	Mean	1,130	1,419	1,531	2,199	2,898	3,125	1,818
Debt	Median	452	668	686	954	976	624	499
	$\sigma$	1,692	1,968	1,961	3,270	4,492	5,128	3,899
LSALE	Mean	7.99	7.99	8.08	8.21	8.32	8.37	8.19
	Median	7.42	7.47	7.18	7.37	7.38	7.42	7.84
	$\sigma$	1.48	1.47	1.47	1.46	1.49	1.44	1.30
Net	Mean	362	425	524	553	668	689	558
Income	Median	233	256	222	251	429	401	339
	$\sigma$	471	535	662	730	888	986	849
FVM (n=46)		t-3	t-2	t-1	t	t+1	t+2	t+3
Total	Mean	3,021	2,973	2,878	3,160	3,131	3,655	5,045
Asset	Median	1,632	1,518	1,411	1,666	1,380	1,584	3,417
	$\sigma$	7,480	7,252	6,663	6,868	6,352	6,885	8,461
Long-term	Mean	707	661	592	605	595	687	940
Debt	Median	182	178	214	294	236	338	431
	$\sigma$	2,078	1,721	1,430	1,291	1,143	1,062	1,127
LSALE	Mean	6.91	6.90	6.81	7.00	7.04	7.11	7.46
	Median	8.28	8.30	8.41	8.50	8.61	8.64	8.65
	$\sigma$	1.50	1.50	1.53	1.48	1.46	1.55	1.68
Net	Mean	150	144	156	185	220	268	358
Income	Median	96	85	78	124	113	140	229
	$\sigma$	238	206	263	256	383	400	505

t indicates the swap year.

$\sigma$  indicates standard deviation.

LSALE : Log of Sales

FV firms are the ones which changed from fixed debt payments to variable.

FVM: FV's industry matched control samples

**Table 5 Statistics for FV versus FVM (continued)****Panel B: T-test Results for FV versus FVM****Total Assets**

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	6,594	7,282	7,833	11,298	13,581	15,236	7,365
FVM	3,021	2,973	2,878	3,160	3,131	3,655	5,045
t-value	1.77	2.09	2.41	2.25	2.55	2.10	0.74
p-value	0.08	0.04	0.01	0.02	0.01	0.03	0.46

**Long-term Debt**

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	1,130	1,419	1,531	2,199	2,898	3,125	1,818
FVM	707	661	592	605	595	687	940
t-value	0.88	1.66	2.24	2.67	3.01	2.63	1.03
p-value	0.38	0.10	0.02	0.00	0.00	0.01	0.31

**LSALE**

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	7.99	7.99	8.08	8.21	8.92	8.37	8.19
FVM	6.91	6.90	6.81	7.00	7.04	7.11	7.46
t-value	2.85	2.95	3.47	3.42	3.59	3.23	1.52
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.13

**Net Income**

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	362	425	524	553	668	689	558
FVM	150	144	156	185	220	268	358
t-value	2.25	2.80	3.00	2.80	2.78	2.21	0.92
p-value	0.02	0.00	0.00	0.00	0.00	0.03	0.36

t indicates the swap year.

LSALE: Log of Sale

FV firms are the ones which changed from fixed debt payments to variable.

FVM: FV's industry matched control sample

**Table 6 Descriptive Statistics of FV versus VF**  
(Unit: million dollars except for LSALE)

FV (n=46)		t-3	t-2	t-1	t	t+1	t+2	t+3
Total	Mean	6,594	7,282	7,833	11,298	13,581	15,236	7,365
Asset	Median	3,430	3,423	4,210	4,868	5,106	5,156	4,599
	$\sigma$	8,328	9,310	9,872	20,212	24,021	30,278	11,040
Long-term	Mean	1,130	1,419	1,531	2,199	2,898	3,125	1,818
Debt	Median	452	668	686	954	976	624	499
	$\sigma$	1,692	1,968	1,961	3,270	4,492	5,128	3,899
LSALE	Mean	7.99	7.99	8.08	8.21	8.32	8.37	8.19
	Median	7.42	7.47	7.18	7.37	7.38	7.42	7.84
	$\sigma$	1.48	1.47	1.47	1.46	1.49	1.44	1.30
Net	Mean	362	425	524	553	668	689	558
Income	Median	233	256	222	251	429	401	339
	$\sigma$	471	535	662	730	888	986	849
VF (n=155)		t-3	t-2	t-1	t	t+1	t+2	t+3
Total	Mean	1,420	1,572	1,875	2,151	2,186	2,434	2,786
Assets	Median	688	799	952	1,021	962	995	1,018
	$\sigma$	1,976	2,320	2,664	3,032	3,156	3,668	4,226
Long-term	Mean	347	381	517	602	626	715	815
Debt	Median	145	153	234	271	226	234	290
	$\sigma$	627	689	844	929	1,076	1,307	1,556
LSALE	Mean	6.52	6.62	6.73	6.89	6.87	6.94	6.94
	Median	6.45	6.44	6.56	6.81	6.70	6.82	6.99
	$\sigma$	1.38	1.32	1.30	1.30	1.30	1.29	1.34
Net	Mean	79	97	104	111	100	74	129
Income	Median	39	40	47	48	36	42	51
	$\sigma$	117	147	153	178	224	250	179

t indicates the swap year.

$\sigma$  indicates standard deviation.

LSALE: Log of Sale

VF(FV) firms are the ones which changed from variable (fixed) debt payments to fixed (variable).

Table 6 Descriptive Statistics of FV versus VF (continued)

## Panel B: T-test Results for FV versus VF

## Total Assets

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	6,594	7,282	7,833	11,298	13,581	15,236	7,365
VF	1,420	1,572	1,875	2,151	2,186	2,434	2,786
t-value	4.93	4.92	4.77	3.89	3.82	3.18	2.21
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.03

## Long-term Debt

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	1,130	1,419	1,531	2,199	2,898	3,125	1,818
VF	347	381	517	602	626	715	815
t-value	3.34	3.98	3.67	3.91	3.89	3.34	1.26
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.21

## LSALE

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	7.99	7.99	8.08	8.21	8.92	8.37	8.19
VF	6.20	6.62	6.73	6.89	6.87	6.94	6.94
t-value	4.92	4.81	4.74	4.67	4.95	4.60	3.26
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## Net Income

	t-3	t-2	t-1	t	t+1	t+2	t+3
FV	362	425	524	553	668	689	558
VF	79	97	104	111	100	74	129
t-value	4.74	4.83	5.11	4.93	4.90	4.44	3.09
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

t indicates the swap year.

LSALE: Log of Sale

VF(FV) firms are the ones which changed from variable(fixed) debt payments to fixed(variable).

**Table 7 Mean Difference T-test Results for Selected Variables  
Panel A: Swappers versus Non-swappers**

**LEV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
Swapper	0.215	0.224	0.242	0.258	0.254	0.254	0.282	0.247
Non-swapper	0.199	0.205	0.192	0.199	0.196	0.197	0.213	0.206
t-value	0.94	1.09	3.04	3.55	3.65	3.38	0.41	2.83
p-value	0.35	0.27	0.00	0.00	0.00	0.00	0.68	0.00

**INTCOV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
Swapper	3.626	3.391	3.414	3.535	4.150	4.333	4.158	3.796
Non-swapper	3.819	4.262	4.798	4.362	4.036	3.875	4.362	.245
t-value	-0.41	-2.22	-3.21	-2.22	0.28	1.14	-0.52	-1.52
p-value	0.68	0.02	0.00	0.02	0.77	0.25	0.60	0.12

**ROE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
Swappers	0.059	0.063	0.061	0.055	0.048	0.052	0.056	0.056
Non-swapper	0.057	0.044	0.041	0.058	0.048	0.062	0.029	0.052
t-value	0.37	2.09	1.86	-0.29	0.04	-0.78	1.63	0.59
p-value	0.71	0.04	0.06	0.76	0.96	0.37	0.10	0.55

**PE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
Swapper	11.19	11.63	11.66	11.56	10.66	11.13	11.78	11.42
Non-swapper	10.39	9.57	9.32	10.20	10.27	10.42	9.70	9.86
t-value	1.15	2.78	3.33	2.06	0.51	0.92	2.29	3.52
p-value	0.25	0.00	0.00	0.04	0.61	0.35	0.02	0.00

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7-year period

LEV : Long-term Debt/Total Assets

INTCOV: Operating Income/Interest Expenses

ROE : Net Income/Market Value of Equity

PE : Market Price per Share/Primary Earnings Per Share

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

**Panel A: Swappers versus Non-swappers**

**ZSCORE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
Swapper	3.488	3.431	3.271	3.012	3.413	3.826	4.526	3.386
Non-swapper	3.368	3.389	3.330	3.492	3.576	3.749	3.760	3.466
t-value	0.51	0.18	-0.26	-2.16	-0.57	0.25	1.58	-0.36
p-value	0.61	0.85	0.79	0.03	0.58	0.80	0.11	0.72

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7- year period

Swappers: both VF and FV combined

VF (FV) firms are the ones which changed from variable (fixed) to fixed(variable).

Non-swappers: both VFM and FVM combined

VFM firms are VF's industry matched control sample

FVM firms are FV's industry matched control sample

ZSCORE: 1.2\* working capital + 1.4(Retained Earnings/Total assets) + 3.3(Operating Income) + 0.6(Market Value of Equity + preferred stock) + 0.99(sales/total assets)

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

**Panel B: VF-VFM**

**LEV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
VF	0.229	0.236	0.260	0.275	0.267	0.263	0.293	0.260
VFM	0.205	0.202	0.196	0.207	0.198	0.190	0.200	0.209
t-value	1.22	1.76	3.32	3.57	3.79	3.87	2.93	3.22
p-value	0.22	0.08	0.00	0.00	0.00	0.00	0.00	0.00

**INTCOV**

	-3	t-2	t-1	t	t+1	t+2	t+3	AVG
VF	3.484	3.111	3.321	3.304	3.949	4.218	4.090	3.652
VFM	3.757	4.094	4.785	4.365	4.099	3.975	4.322	4.211
t-value	-0.50	-2.19	-3.02	-2.53	-0.32	0.54	-0.51	-1.67
p-value	0.62	0.03	0.00	0.01	0.74	0.58	0.60	0.09

**ROE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
VF	0.059	0.062	0.059	0.051	0.045	0.047	0.055	0.054
VFM	0.055	0.040	0.039	0.050	0.040	0.060	0.016	0.047
t-value	0.43	1.96	1.53	0.11	0.26	-0.91	1.87	0.86
p-value	0.66	0.05	0.12	0.91	0.80	0.36	0.07	0.39

**PE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
VF	11.21	11.60	11.56	11.11	10.32	10.57	11.49	11.18
VFM	10.00	9.31	8.59	9.73	9.89	10.25	8.92	9.43
t-value	1.61	2.90	3.88	1.70	0.50	0.34	2.26	3.40
p-value	0.06	0.00	0.00	0.09	0.61	0.72	0.02	0.00

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7-year period

LEV : Long-term Debt/Total Assets

INTCOV : Operating Income/Interest Expenses

ROE : Net Income/Market Value of Equity

PE : Market Price per Share/Primary Earnings Per Share

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

Panel B: VF versus VFM

	ZSCORE							
	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
VF	3.372	3.292	3.111	2.868	3.121	3.542	4.454	3.243
VFM	3.353	3.373	3.297	3.431	3.371	3.690	3.611	3.371
t-value	0.07	-0.31	-0.74	-2.21	-0.80	-0.41	1.44	-0.50
p-value	0.94	0.75	0.46	0.02	0.42	0.67	0.15	0.61

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7-year period

VF firms are the ones which changed from variable debt payments to fixed.

VFM : VF's industry matched control sample

ZSCORE :  $1.2 * \text{working capital} + 1.4(\text{Retained Earnings/Total assets}) + 3.3(\text{Operating Income}) + 0.6(\text{Market Value of Equity} + \text{preferred stock}) + 0.99(\text{sales/total assets})$

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

**Panel C: FV Versus FVM**

**LEV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
FV	0.175	0.190	0.190	0.206	0.216	0.220	0.226	0.204
FVM	0.174	0.214	0.174	0.174	0.192	0.223	0.253	0.199
t-value	0.02	-0.60	0.53	1.07	0.74	-0.09	-0.46	0.18
p-value	0.98	0.55	0.59	0.29	0.46	0.93	0.64	0.86

**INTCOV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
FV	4.316	4.173	3.852	4.329	4.829	4.734	4.392	4.306
FVM	4.003	4.754	4.792	4.331	3.819	3.570	4.570	4.355
t-value	0.34	-0.78	-1.07	-0.01	1.37	1.33	-0.23	-0.08
p-value	0.73	0.43	0.28	0.99	0.17	0.18	0.81	0.93

**ROE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
FV	0.063	0.067	0.070	0.066	0.056	0.065	0.063	0.064
FVM	0.063	0.058	0.051	0.084	0.075	0.068	0.069	0.069
t-value	0.05	0.58	1.28	-0.77	-1.36	-0.24	-0.42	-0.55
p-value	0.95	0.39	0.20	0.44	0.17	0.80	0.66	0.58

**PE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
FV	11.24	11.84	12.02	12.64	11.47	12.59	12.94	12.09
FVM	11.73	10.55	11.85	11.78	11.52	10.95	11.97	11.41
t-value	-0.31	0.75	0.12	0.88	-0.03	1.21	0.88	0.89
p-value	0.75	0.45	0.91	0.38	0.96	0.23	0.38	0.37

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7- year period

LEV : Long-term Debt/Total Assets

INTCOV : Operating Income/Interest Expenses

ROE : Net Income/Market Value of Equity

PE : Market Price per Share/Primary Earnings Per Share

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

Panel C: FV versus FVM (Continued)

	ZSCORE							
	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
FV	3.830	3.866	3.763	3.411	4.196	4.708	5.028	3.821
FVM	3.461	3.454	3.459	3.676	4.168	3.923	4.151	3.783
t-value	0.76	0.87	0.66	-0.62	0.05	1.26	1.03	0.08
p-value	0.44	0.38	0.51	0.54	0.96	0.21	0.31	0.93

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7-year period

FV : Firms changed from fixed to variable debt payments

FVM : FV's industry matched control sample

ZSCORE :  $1.2 * \text{working capital} + 1.4(\text{Retained Earnings/Total assets}) + 3.3(\text{Operating Income}) + 0.6(\text{Market Value of Equity} + \text{preferred stock}) + 0.99(\text{sales/total assets})$

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

**Panel D: FV Versus VF**

**LEV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
FV	0.175	0.190	0.190	0.206	0.216	0.220	0.226	0.204
VF	0.229	0.236	0.260	0.275	0.267	0.263	0.293	0.260
t-value	-2.02	-1.72	-2.76	-2.89	-1.99	-1.58	-1.39	-2.67
p-value	0.04	0.09	0.00	0.00	0.04	0.11	0.17	0.00

**INTCOV**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
FV	4.316	4.173	3.852	4.329	4.829	4.734	4.392	4.306
VF	3.483	3.111	3.321	3.304	3.949	4.218	4.090	3.652
t-value	1.20	1.85	0.75	1.91	1.54	0.92	0.49	1.39
p-value	0.23	0.06	0.45	0.05	0.12	0.36	0.62	0.16

**ROE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
FV	0.063	0.067	0.070	0.066	0.056	0.065	0.063	0.064
VF	0.059	0.062	0.059	0.051	0.045	0.047	0.055	0.054
t-value	0.49	0.87	1.58	1.89	0.82	1.93	0.76	1.43
p-value	0.62	0.38	0.11	0.06	0.41	0.06	0.44	0.15

**PE**

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG
FV	11.24	11.84	12.02	12.64	11.47	12.59	12.94	12.09
VF	11.21	11.60	11.56	11.11	10.32	10.57	11.49	11.18
t-value	0.02	0.27	0.54	2.19	0.90	2.31	1.59	1.65
p-value	0.98	0.78	0.58	0.03	0.37	0.02	0.12	0.10

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7-year period

LEV : Long-term Debt/Total Assets

INTCOV : Operating Income/Interest Expenses

ROE : Net Income/Market Value of Equity

PE : Market Price per Share/Primary Earnings Per Share

**Table 7 Mean Difference T-test Results for Selected Variables  
(continued)**

Panel D: FV versus VF (Continued)

ZSCORE

	t-3	t-2	t-1	t	t+1	t+2	t+3	AVG*
FV	3.830	3.866	3.763	3.411	4.196	4.708	5.028	3.821
VF	3.372	3.292	3.111	2.868	3.121	3.542	4.454	3.243
t-value	1.22	1.60	1.88	1.76	2.69	2.21	0.71	1.70
p-value	0.22	0.11	0.06	0.08	0.00	0.03	0.48	0.09

t indicates the swap year.

\* AVG indicates the average values for each variables over the 7-year period

VF (FV) firms are the ones which changed from variable (fixed) debt payments to fixed (variable).

ZSCORE:  $1.2 * \text{working capital} + 1.4(\text{Retained Earnings/Total assets}) + 3.3(\text{Operating Income}) + 0.6(\text{Market Value of Equity} + \text{preferred stock}) + 0.99(\text{sales/total assets})$

**Table 8. Multivariate Logit Analysis**

Model :  $Y = a + b_1 \text{ LEV} + b_2 \text{ LSALE} + b_3 \text{ ROE} + b_4 \text{ ZSCORE}$

$Y = 1$  if test samples, VF, VF, FV or Swappers

$0$  if control samples, VFM, FV, FVM or Non-swappers

Pair :	VF-VFM		VF-FV		FV-FVM		Swappers-Non-swappers	
	1	2	1	2	1	2	1	2
a	-3.34	-3.53	4.74	5.74	-4.41	-4.89	-3.54	-3.64
se	0.88	1.18	1.49	2.14	1.61	2.15	0.73	0.99
b1	5.90	7.29	6.00	4.40	3.25	4.57	4.94	5.95
se	1.48	1.98	2.40	3.11	2.81	3.64	1.22	1.60
p	0.00	0.00	0.01	0.15	0.24	0.20	0.00	0.00
b2	0.25	0.22	-0.68	-0.70	0.59	0.57	0.32	0.29
se	0.11	0.11	0.18	0.19	0.21	0.21	0.09	0.09
p	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00
b3	0.40	0.39	-1.51	-0.96	-9.67	-10.58	0.12	0.08
se	0.79	0.84	2.88	3.02	6.94	7.17	0.62	0.66
p	0.61	0.64	0.59	0.75	0.15	0.13	0.84	0.90
b4		0.02		-0.18		0.11		0.03
se		0.12		0.21		0.21		0.10
p		0.89		0.38		0.57		0.77

se = Standard Error

LEV = Long-term Debt/Total Asset

LSALE = Natural Log of Sale

ROE = Net Income / Market Value of Equity

ZSCORE =  $1.2 * \text{working capital} + 1.4(\text{Retained Earnings/Total assets}) + 3.3(\text{Operating Income}) + 0.6(\text{Market Value of Equity} + \text{preferred stock}) + 0.99(\text{sales/total assets})$

Swappers: both VF and FV combined

VF(FV) firms are the ones which changed from variable (fixed) debt payments to fixed(variable).

Non-swappers: both VFM and FVM combined

VFM firms are VF's industry matched control sample

FVM firms are FV's industry matched control sample

## **Chapter 3. Hypotheses**

### **3.1. Hypotheses Development**

Following Watts and Zimmerman (1978), much of the positive accounting literature takes the view that managers behave opportunistically in choosing accounting methods or lobbying for accounting standards. They act to maximize their own utility, which is affected by their compensation and indirectly or directly by the firm's stock price. According to this perspective, the motivation for choosing or lobbying for a particular accounting method arises not from maximization of firm value but from a transfer of wealth between bondholders, shareholders and management. Increased stock price increases management utility because of management holdings of stock and stock options and because of their bonus compensation plans.

The economic efficiency perspective takes a different view. With respect to the accounting choice this view implies that accounting methods will be selected to minimize costs (i.e., interest cost) and thereby to maximize the value of the firm. This view provides a richer description of the accounting choice setting and can be used to explain why leverage and accounting method choice might be related even in the absence of bond covenants, or why large firm do not always choose income reducing accounting techniques as suggested by the political cost hypothesis. Zimmer (1986), in his study of accounting for interest, argues that management choice of

accounting technique is the results of ex-ante contracting to enhance economic efficiency, rather than a manifestation of opportunistic behavior itself.

### **3.2. Economic Efficiency Hypothesis**

Bicksler and Chen (1986) report that interest rate swaps are based upon the principle of comparative advantage. Certain anomalies in markets have made it possible to utilize a particular type of financing to obtain a lower cost or higher yield than otherwise available. Whittaker (1987) argues that these situations occur when certain markets are not equally accessible to all participants in the market.

To illustrate the above market anomalies, consider the following example. High-rated (Aaa) corporations have swapped new and existing fixed-rate debt service for floating-rate payments indexed to LIBOR. The Aaa- or Aa-rated borrower can exploit a market anomaly by funding its side of a transaction at prime credit commercial paper rates, which are typically 75 to 100 basis points<sup>24</sup> lower than the LIBOR-based rate that it receives. This results in a reduction in fixed-rate funding costs of, say, 75 basis points and may provide fixed-rate funds below equivalent term treasuries. Under certain conditions, which have been observed to exist in the financial markets, this quality spread actually provides an exploitable opportunity for corporate borrowers. For example, assume that a Baa corporation can borrow from banks at a floating rate

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<sup>24</sup> One-hundredth of one percent

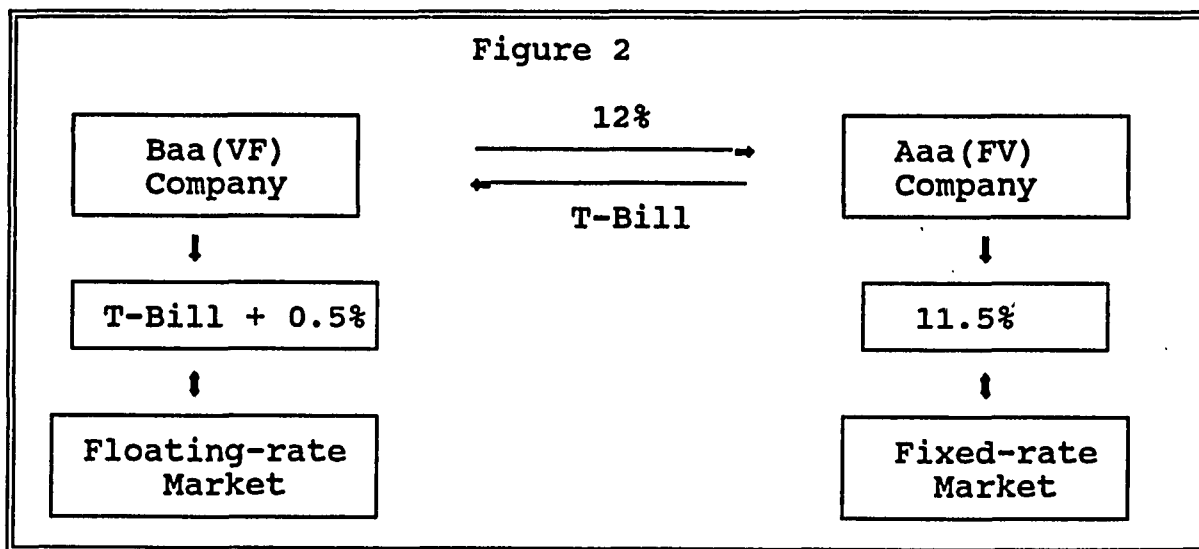
equal to the T-Bill rate plus one-half percent and that an Aaa corporate borrower can borrow at a floating rate equal to the T-Bill plus one-fourth percent. Also assume that in the long-term bond market the quality spread between the two firms is 1.5 percent for a five-year bond. The Aaa firm would pay a fixed rate of 11.5 percent while the Baa firm would have to pay a fixed rate of 13 percent. That is, the long-term bond market requires a quality spread 1.25 percent larger than the short-term credit market. Thus, Bicksler and Chen (1986) and Hammond (1987) report that the two corporate borrowers can enter into an interest rate swap agreement and capture the economic benefits that result from savings in their costs of borrowing.

The Aaa company issues a bond of \$100 million at 11.5 percent and enters into a rate swap under which it is paid 12 percent in exchange for paying a six-month T-Bill rate. The net cost to the Aaa firm is the six-month T-Bill rate minus one-half percent, representing a saving of 0.75 percent in raising the required amount of money in the floating-rate market as illustrated in Figure 2.

The Baa company borrows floating rate funds at the six-month T-Bill rate plus one-half percent and enters into the rate swap under which it pays fixed rate of 12 percent and receives the T-Bill rate. Thus, the net fixed-rate cost to Baa is 12.5 percent. In other words, the Aaa firm is raising 5-year debt at the T-Bill rate minus one-half percent instead

of having to pay one-fourth percent over the T-Bill rate, a net saving of 0.75 percent. The Baa firm is effectively raising 5-year debt at a fixed rate of 12.5 percent (12 percent paid to the Aaa firm plus the 0.5 percent arbitrage cost on the floating rate funds). The combined savings of 1.25 percent shared by the two firms represents the quality spread differential (arbitrage opportunity) between the two markets.<sup>25</sup>

Swap's credit losses resulting from the nonperformance of the counterparty are minimal because the swap does not change the hand of the debt itself and the swap market prescreens the participants by selecting them with a minimum credit rating of investment grade (BBB) [Litzenberger (1992)].



Typically, fixed-rate bond markets have tended to require

<sup>25</sup> In case of an intermediary setting up the transaction, part of the 1.25% savings will be paid in commission on the deal (bid-ask spread).

a wider quality spread between higher- and lower-rated counterparties than is typical of floating-rate markets.<sup>26</sup> Although the highly-rated issuer borrows more cheaply than does the lower-rated issuer in both markets, the high-rated participant generally enjoys a greater advantage in the long-term bond market. Conversely, the lower-rated issuer faces less of a quality differential in the short-term variable debt market. If each borrower raises funds in the market in which it has a comparative advantage, the resultant interest rate payments can be swapped to achieve cheaper funding for both

Exhibit 2		
Before Swap		
Company	Fixed Rate	Floating Rate
Aaa (FV)	11.5%	T+0.25%
Baa (VF)	13%	T+0.5%
After Swap		
Aaa (FV)	Pays fixed rate to bondholders	11.5%
	Pays floating rate to Baa	T-Bill
	Receives fixed rate from Baa	(12%)
	Net Costs to Aaa	T-0.5%
	Net Savings to Aaa= $T+0.25-(T-0.5)$	= 0.75%
Baa (VF)	Pays floating rate to bondholders	T+0.5%
	Pays fixed rate to Aaa	12%
	Receives variable from Aaa	(T-Bill)
	Net Costs to Baa	12.5%
	Net Savings to Baa= $13-12.5\%$	= 0.5%

<sup>26</sup> Many reasons for this relative borrowing cost differential have been proposed, including relatively greater risk aversion among investors in the bond markets and differences in information across markets. Some of these factors suggest only temporary arbitrage opportunities, while others will persist. Therefore, the incentives for swap transactions are not likely to disappear.

participants [Bicksler and Chen (1986), Litzenberger (1992)].

The above transaction is summarized to see the effect of swap more clearly in Exhibit 2.

VF firms are expected to have limited access to the fixed-rate debt with which they are more comfortable than with the short-term variable debt in meeting the interest obligations. One of the reasons why they swap to a fixed interest payment is to hedge the future fluctuations of market interest rate partly because they already have such level of interest rate payments that they can not afford the fluctuating market interest payment. These firms will be asked to pay a higher premium for such a long-term fixed capital if they go to the long-term fixed debt market directly. In other words, the premium charged to less credit worthy firms in the variable short-term market is less than the premium charged in the long-term fixed debt market. This creates an arbitrage opportunity between these firms with different credit ratings. Due to this difference in accessing the bond market, VF firms are expected to borrow funds from variable debt market where they have comparative advantage over higher-rated firms (Bicksler and Chen [1986]). After borrowing short-term variable debt these lower-rated firms try to avoid the market interest rate risk on this short-term debt and simultaneously fix their interest payments because of their limited ability to deal with variable interest payments. One relatively less costly way of achieving this objective is

to engage in VF swap transactions. A FV swap makes the firm vulnerable to the fluctuation of the market interest rate since they are now taking over the variable side of the interest payment. However, they expect to save interest costs with the swap. The fact that they can risk the future fluctuation of market interest rate implies that they have financial slack available. Therefore, both VF and FV firms can reduce interest expenses by engaging in the swap transactions. VF firms are expected to be lower rated firms than FV firms.

Litzenberger (1992) argues that a swap in which the lower rated firm pays fixed interest and the higher rated firm pays floating reduces the former's long-term fixed borrowing costs and the latter's floating borrowing costs. This discussion leads to the following testable hypothesis.

**H<sub>1</sub>: Due to the difference in accessing both variable and fixed debt markets, VF swap firms are lower-rated firms than FV firms at the time of swap transaction.**

### 3.2.1. Methodology

H<sub>1</sub> can be written as follows;

$$H_0: CR_{fv} = CR_{vf}$$

$$H_1: CR_{fv} > CR_{vf}$$

where:

CR<sub>fv</sub>: FV firms credit rating

CR<sub>vf</sub>: VF firms credit rating

To test  $H_1$ , Mann-Whitney U-test<sup>27</sup> and mean difference t-test<sup>28</sup> are used to see whether the credit ratings for VF and FV firms at the time of the swap transactions are different. Standard and Poor's bond ratings from the 1992 Compustat Tape are used to test this hypothesis.

Mann-Whitney U-test is performed to test whether the rank sum scores from FV bond ratings tend to be higher than those of VF bond ratings. The appropriate Z-statistics are:

$$Z = \frac{2R_{fv} - n_{vf}(n_{fv})}{\sqrt{\frac{n_{fv} * n_{vf}(N+1)}{3}}}$$

where:

$R_{fv}$  = FV firms' rank sum

$n_{vf}$  = number of VF sample firms

$n_{fv}$  = number of FV sample firms

$N$  =  $n_{vf} + n_{fv}$

To be consistent with the previous literature which tested similar sample differences, a difference-in-means test is also run to find out the significance of the bond rating difference between FV and VF groups. The appropriate t-

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<sup>27</sup> Dopuch and Pincus (1988) use the same statistics for a similar sample of LIFO versus FIFO comparison.

<sup>28</sup> Lee and Hsieh (1985) use this test for a similar sample of LIFO versus FIFO comparison.

statistics used are:

$$t = \frac{\text{Bondr}_{vf} - \text{Bondr}_{fv}}{\sqrt{s^2 \left( \frac{1}{N_{vf}} + \frac{1}{N_{fv}} \right)}}$$

where  $s^2 = ((N_{vf}-1)s_{vf}^2 + (N_{fv}-1)s_{fv}^2) / (N_{vf}+N_{fv}-2)$ ,

$s_{vf}^2$  = sample variance of VF firms

$s_{fv}^2$  = sample variance of FV firms

$\text{Bondr}_{vf}$  = S&P Bond ratings for VF firms

$\text{Bondr}_{fv}$  = S&P Bond ratings for FV firms

### 3.2.2. Empirical Results

Panel A of Table 9 shows the Wilcoxon rank sum test results. Rank sum scores between the two groups are statistically significant (p-value, 0.00). Panel B of the same table reports the t-test results for the bond rating difference between the two groups. This test result also supports the hypothesis that FV firms have higher bond ratings than VF firms. Mean bond ratings for FV firms are grade between AA- and A+ (6.18), while VF firms have mean bond-rating of A- to BBB+ (9.37). This result is consistent with the observations made by Litzenberger (1992) that the lowest credit ratings swappers have are investment grade (BBB) because the market prescreens the swap participants through swap contracts so that they can minimize the default risks. In order for swappers to take advantage of the arbitrageable difference between variable rate debt and fixed rate debt

market, both VF and FV swappers must have enough difference in their credit ratings to justify the swap transactions. The first presumption of the swap transaction is that there would not be a swap unless there is an arbitrageable difference between the fixed debt and variable debt markets. This arbitrageable difference partly explains the reason why we are observing the emergence of this rapidly growing segment of capital market. With these transactions, swappers are realizing economic gains by sharing this arbitrageable difference with their swap partners.<sup>29</sup> In other words, the swap transaction is motivated to increase the firm value with an economic efficiency consideration on the part of managers, rather than with the managerial opportunism described in the positive accounting literature.

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<sup>29</sup> Ali Satrap of Salomon Brothers explaining the arbitrageable differences in the swap market structure suggests that they can make both parties of swap participants better off, while intermediaries also receive a fee (bid-ask spread) from arranging swap transactions.

**Table 9. Results of Wilcoxon Rank Sum Test and T-test of the Economic Efficiency Hypothesis**

**Panel A: Wilcoxon Rank Sum Test Results**

	n	Sum of Scores	$\sigma$ Under $H_0$	Mean Scores	Z	Prob> Z
Bondr <sub>fv</sub>	22	487.50	75.78	22.16		
Bondr <sub>vf</sub>	46	1958.50	75.78	40.40		3.58 0.00
T-test approximation Significance					0.00	
Prob > $\chi^2 = 0.00$						
Bondr <sub>fv</sub> = S&P Bondrating for FV group						
Bondr <sub>vf</sub> = S&P Bondrating for VF group						

**Panel B: Mean Difference t-test Results**

	n	Mean	Median	Standard Deviation	t	Prob> t
Bondr <sub>fv</sub>	22	6.18	6.50	2.89		
Bondr <sub>vf</sub>	46	9.37	9.00	3.21	4.11	0.00
Bondr <sub>fv</sub> = S&P Bondrating for FV group						
Bondr <sub>vf</sub> = S&P Bondrating for VF group						

\* S&P Bond-rating from Compustat takes the following numerical values, each corresponding to the letter grading.

2 -- AAA	3 -- AAA-	4 -- AA+	5 -- AA
6 -- AA-	7 -- A+	8 -- A	9 -- A-
10 -- BBB+	11 -- BBB	12 -- BBB-	

### 3.3. Hedging Hypothesis

A swap may be entered into for hedging purposes. For example, a company may have long-term fixed rate liabilities and assets whose returns vary with fluctuations in interest rates. To ensure that variable asset returns are matched with variable liability payments, the company may swap its fixed liability payments for the variable payments being made by another company or bank. In this manner, the company's variable inflow of receipts is matched with its variable outflow of payments. This type of interest rate swap is described as a matched swap in the popular press. To see the effect of this matched swap on the financial statements consider the following simplified versions of balance sheets for Company A and B. Company A has fixed-income assets with variable-rate debt whereas Company B has the opposite balance sheet structure before swap.

Both Companies A and B are exposed to the fluctuation of market interest rate before the swap: Company A on the liability side of the balance sheet, Company B on the asset side:

#### Before Swap

Company A		Company B	
Fixed Assets at 10%	Variable-rate Debt payment at 8%	Variable Assets at 10%	Fixed-rate Debt payment at 8%

Therefore, both companies are experiencing a mismatch

between assets and liabilities before the swap. Assuming Company A and B engage in a swap transaction with each other, they will then have the following asset and liability structure:

**After Swap**

Company A(VF)		Company B(FV)	
Fixed Assets at 10%	Fixed Debt Payment at 8%	Variable Assets at 10%	Variable Debt Payment at 8%

After the swap transaction, therefore, both companies eliminate interest rate risk by matching the configuration of their assets with those of their liabilities. The motivation for the firms to swap is to reduce the variability of their interest cash flows [Biedleman (1987)]. By switching to the fixed (variable) payment these firms now have an improved accuracy in forecasting their interest payments.

Smith and Stulz (1985) argue that hedging could be used to reduce the expected costs of financial distress. Because bond covenants use accounting numbers to define states where the firm's activities are restricted [Holthausen and Leftwich (1983), Press and Weintrop (1990)], a firm that wants to decrease the probability of financial distress must manage its accounting numbers so that bond covenants do not become binding. It is thus expected for firms to use swaps to reduce the variance of its accounting earnings.

**H<sub>2</sub>: Swappers' post-swap time-series of earnings variance are lower than pre-swap earnings variance.**

Santomero (1983) examines the choice between fixed and variable debt and derives the conditions which determine the optimal quantity of each. He argues that variable (fixed) debt is an efficient way to shift interest rate risk when project returns are positively (negatively) correlated with the movement in market interest rates.

An interest rate swap affects firms' expected cash flows. Its primary objective is to exchange floating-rate interest payments for fixed-rate payments, or vice versa. In the past most contractual interest payments were fixed over the life of a debt instrument. However, as a result of innovations in financial instruments, many debt issues in recent years call for interest payments that are revised every three or six months. The basis for these revisions is some well-recognized market rate such as the LIBOR, short-term treasury rate, commercial paper rate, or other index. Because the interest rate floats with market rates, floating-rate interest payments are less certain than those of fixed-rate instruments.

This uncertainty can be removed by swapping the floating-rate payments for a set of fixed-rate payments. Switching to the variable-rate debt payment (FV) will be desirable if the nature of a firm's cash flows have changed such that the firm now prefers floating-rate debt. Biedleman (1987) argues that this change in preference happens when a firm merges with or acquires another firm or firms which have a different nature of operating cash flows. Other examples

would be that the fixed- or floating-rate basis incorporated in an instrument may have lost its appeal, or the floating-rate reset frequency may have become undesirable, or the level or term structure of interest rate may have changed thus making the contractual interest payments now less desirable than alternative configurations currently available. Because of swaps, greater flexibility is now available to firms.

Firms which have reliable, long-term cash flow expectations are expected to demonstrate a strong preference for a long-term, fixed-cost capital. These firms' minimum operating cash flows are relatively stable regardless of the level of the market interest rates. A reliable minimum level of operating income necessary to service fixed-rate debt is expected to be the sufficient condition for this group of firms to change their variable-rate debt into fixed. While VF firms are primarily concerned with locking in interest payments because of their relatively fixed cash inflows, FV firms are expected to have operating cash flows which are more dependent on market interest rate. In other words correlations between interest rates and operating cash inflows for FV firms are higher than for VF firms. This leads to the following hypothesis.

**H<sub>2a</sub>: Correlation between interest rates and operating cash flow for FV firms is higher than VF firms for both before and after the swap.**

### **3.2.1. Methodology**

H<sub>2</sub> can be expressed as follows:

$$H_0: \sigma^2_{\text{epsas}} = \sigma^2_{\text{epsbs}} \quad H_a: \sigma^2_{\text{epsas}} < \sigma^2_{\text{epsbs}}$$

where:  $\sigma^2_{\text{epsas}}$  = Variance of 8 Quarterly EPS after swap  
 $\sigma^2_{\text{epsbs}}$  = Variance of 8 Quarterly EPS before swap  
 An F-test can be used to test equality between  $\sigma^2_{\text{epsas}}$  and  $\sigma^2_{\text{epsbs}}$ .

Hypothesis for  $H_{2a}$  is as follows:

Swap Quarter

$H_0$	$FV\rho_{(CFO,i)} = VF\rho_{(CFO,i)}$	$H_0$	$FV\rho_{(CFO,i)} = VF\rho_{(CFO,i)}$
$H_a$	$FV\rho_{(CFO,i)} < VF\rho_{(CFO,i)}$	$H_a$	$FV\rho_{(CFO,i)} > VF\rho_{(CFO,i)}$

where,

$\rho$  = correlation

$i$  = 6-month T-Bill rate

$CFO = (\text{Working Capital from Operation} + \Delta \text{ in Total Current Liabilities} - \Delta \text{ in Total Assets} + \Delta \text{ in Cash}) - \text{Interest Expenses}^{30}$

Pearson correlation coefficients between CFO and market interest rate are computed for both FV and VF firms for the eight quarters following and the eight quarters preceding the swap and will be tested to see the difference in means. The six-month T-bill rate is chosen because this rate is one of the most common variable interest rates used in swap transactions. This rate is available from the 1992 CITI BASE Tape.

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<sup>30</sup> Interest Expenses from the 1992 Quarterly Compustat Item #22-footnote #7

### 3.3.2. Empirical Results

Smith and Stulz (1985) posit that hedging reduces the variability of earnings, therefore increasing firm value. Variance analysis of earnings per share before and after the swap (for both VF and FV firms ) supports the hedging motivation and confirms the predicted effects of the swap transactions. Panel A of Table 10 describes the time-series pattern of EPS for eight quarters preceding and eight quarters following the swap quarter. EPS variance before the swap is 0.06047 as opposed to 0.01173 after the swap as shown in Table 10. This difference is statistically significant (p-value, 0.03), based on an F-test between variance of 8 quarterly EPS before swap ( $\sigma^2_{\text{epsbs}}$ ) and after swap ( $\sigma^2_{\text{epsas}}$ ). Figure 3 graphically illustrates the dramatic difference in EPS variance before and after the swap. Unlike the sharp fluctuation observed in the variance during before-swap period, after-swap EPS variance exhibits a rather stable pattern. The limitation in this section is that after-swap impact on EPS can be measured more accurately if each swapper's gain or loss on the swap transaction is available.

Panel A of Table 11 reports VF firms' correlation coefficients between operating cash flow and 6-month T-bill rate for the 8 quarters before and after the swap. There are four negative coefficients before the swap and the coefficient for the fifth quarter preceding the swap is marginally significant. However, the hedging effect of the swap is

evident after the swap. Six quarters after the swap have statistically significant coefficients, although there is a negative but insignificant coefficient for the third quarter following the swap. Panel B of Table 11 shows the mean correlation for the 8 quarters before the swap is 0.0149; the after swap mean correlation coefficient is 0.1514. The difference between these values is statistically significant at the p-value of 0.00.

Panel A of Table 12 shows the correlation coefficients for FV firms for 8 quarters before and after the swap, as well as the swap quarter. All 17 quarters show statistically significant coefficients between CFO and the market interest rate. However, comparisons (Panel B) show that the average over 8 quarters after the swap coefficient is statistically higher than that before the swap (p-value, 0.01). This result suggests that there is a hedging motivation, as well as confirming its effect of the swap transactions as predicted.

Taken together, the difference in the correlation coefficient between cash flow from operation and market interest rate for VF and FV firms is statistically significant both before and after swap period, as shown in Figure 4.

Table 10. Test of H2 (EPS Variance Change)

Panel A: Time-series Patterns of Quarterly EPS for All Swappers

time	n	mean	$\sigma$	std error	variance
EPSt-8	176	0.3211	0.9540	0.0719	0.9102
EPSt-7	174	0.3088	0.9094	0.0689	0.8270
EPSt-6	175	0.3379	0.8714	0.0658	0.7594
EPSt-5	175	0.0673	2.8713	0.2170	8.2445
EPSt-4	176	0.2806	1.1900	0.0897	1.4163
EPSt-3	179	0.1060	2.4242	0.1811	5.8769
EPSt-2	176	0.2608	0.8997	0.0678	0.8095
EPSt-1	174	0.1625	1.7714	0.1342	3.1397
EPSt=0	174	0.2679	0.9744	0.0738	0.9495
EPSt+1	175	0.3869	0.5432	0.0410	0.2951
EPSt+2	174	0.3469	0.8618	0.0653	0.7427
EPSt+3	174	0.3399	0.7393	0.0560	0.5467
EPSt+4	176	0.2981	0.6008	0.0452	0.3610
EPSt+5	174	0.3207	0.6677	0.5062	0.4459
EPSt+6	178	0.3769	0.7527	0.5642	0.5666
EPSt+7	177	0.2806	0.7032	0.5286	0.4945
EPSt+8	176	0.2810	1.0521	0.0793	1.1071

"t=0" indicates the swap quarter.  
 $\sigma$  indicates the standard deviation.

## Panel B: F-test Results for Before and After Swap EPS Variance Analysis

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$$\sigma_{\text{epsbs}}^2 = 0.06047 \quad \sigma_{\text{epsas}}^2 = 0.011738$$

$$\text{F-ratio} = \sigma_{\text{epsbs}}^2 / \sigma_{\text{epsas}}^2 = 5.1516$$

Significant at 0.03 level

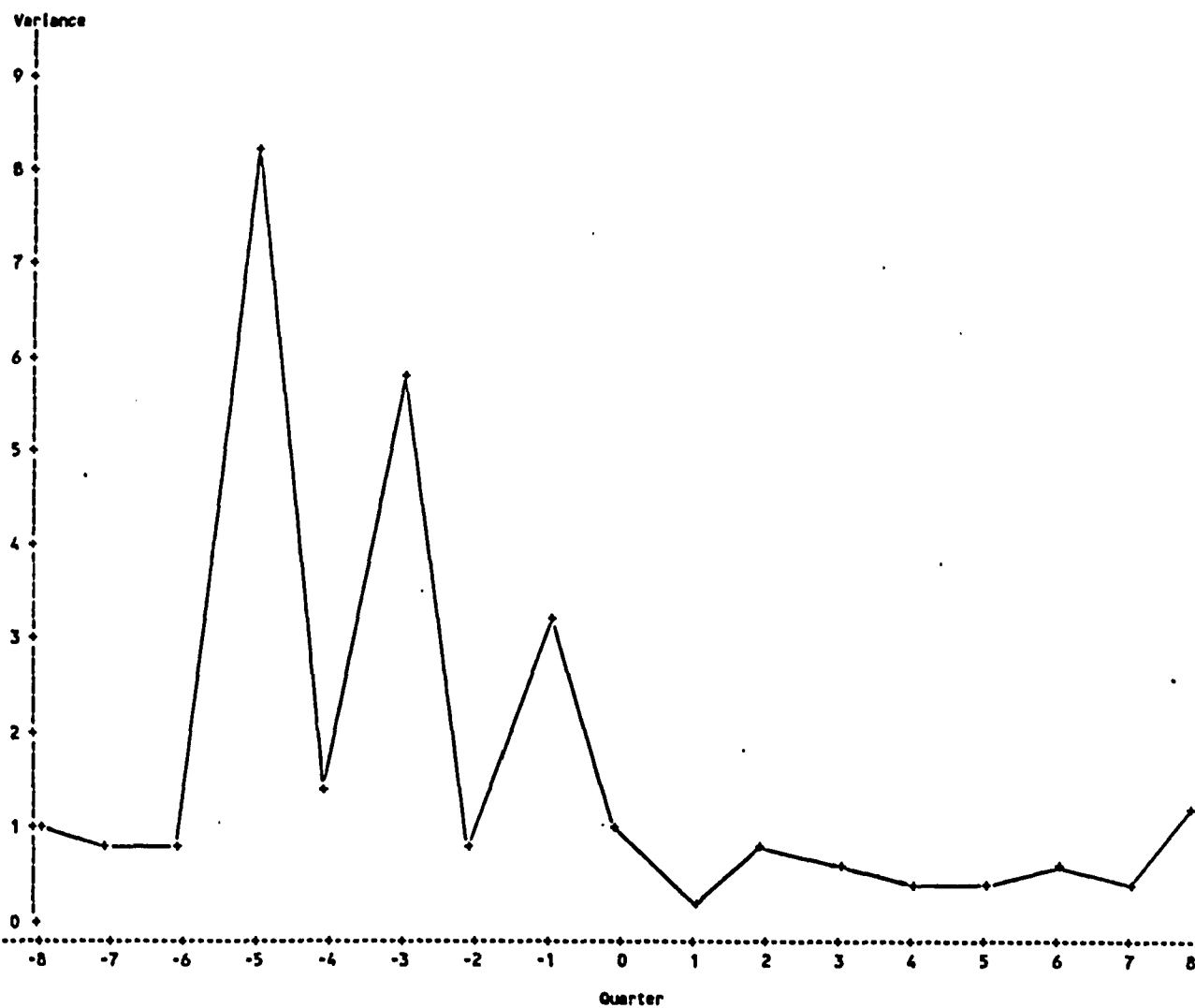
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Swappers: both VF and FV combined

VF(FV) firms are the ones which changed from variable (fixed) debt payments to fixed (variable).

$\sigma_{\text{epsas}}^2$  = Variance of 8 Quarterly mean EPS after swap  
 $\sigma_{\text{epsbs}}^2$  = Variance of 8 Quarterly mean EPS before swap

Figure 3. Plot of Quarterly EPS Variance Before and After Swap for All Swappers



Quarter "0" indicates the swap quarter  
 Swappers: both VF and FV combined  
 VF(FV) firms are the ones which changed from variable (fixed) debt  
 payments to fixed (variable).

**Table 11. Test of H2a (Hedging Hypothesis)**

Panel A: Pearson Correlation Coefficients and P-value between Operating Cash Flow<sup>31</sup> and T-Bill Rate<sup>32</sup> for VF<sup>33</sup> firms

Otr			Otr		
t-8	Coefficient	-0.0383	t+1	Coefficient	0.1565
	P-value	0.51		P-value	0.00
t-7	Coefficient	0.0544	t+2	Coefficient	0.0526
	P-value	0.34		P-value	0.31
t-6	Coefficient	0.0011	t+3	Coefficient	-0.0623
	P-value	0.99		P-value	0.22
t-5	Coefficient	0.1077	t+4	Coefficient	0.2850
	P-value	0.08		P-value	0.00
t-4	Coefficient	0.0637	t+5	Coefficient	0.2058
	P-value	0.27		P-value	0.00
t-3	Coefficient	-0.0090	t+6	Coefficient	0.2409
	P-value	0.87		P-value	0.00
t-2	Coefficient	-0.0011	t+7	Coefficient	0.2387
	P-value	0.98		P-value	0.00
t-1	Coefficient	-0.0591	t+8	Coefficient	0.0940
	P-value	0.27		P-value	0.06
t	Coefficient	0.1790			
	P-value	0.00			

Panel B. Mean Difference T-test of Correlation Coefficients for Before and After Swap

	Mean <sup>34</sup>	Median	Standard Deviation
Before	0.0149	0.0000	0.0059
After	0.1514	0.1812	0.1166
t-value	-2.99		
p-value	0.00		

<sup>31</sup> (Cash Flow from Operation or Working Capital from Operation adjusted by Current items) - Interest Expenses

<sup>32</sup> T-bill rate is the 6 month Treasury Bill Rate from the 1992 CITIBASE tape.

<sup>33</sup> VF firms changed from variable to fixed debt payments.

<sup>34</sup> Mean Correlation Coefficient for 8 quarters before and after the swap.

**Table 12 Test of H2a (Hedging Hypothesis)****Panel A: Pearson Correlation Coefficients and P-value between Operating Cash Flow<sup>35</sup> and T-Bill Rate<sup>36</sup> for FV<sup>37</sup>**

Otr		Otr			
t-8	Coefficient	0.7187	t+1	Coefficient	0.6331
	P-value	0.00		P-value	0.00
t-7	Coefficient	0.5035	t+2	Coefficient	0.7172
	P-value	0.00		P-value	0.00
t-6	Coefficient	0.6026	t+3	Coefficient	0.6189
	P-value	0.00		P-value	0.00
t-5	Coefficient	0.5812	t+4	Coefficient	0.6261
	P-value	0.00		P-value	0.00
t-4	Coefficient	0.2601	t+5	Coefficient	0.7530
	P-value	0.01		P-value	0.00
t-3	Coefficient	0.4141	t+6	Coefficient	0.6813
	P-value	0.00		P-value	0.00
t-2	Coefficient	0.4972	t+7	Coefficient	0.6634
	P-value	0.00		P-value	0.00
t-1	Coefficient	0.5211	t+8	Coefficient	0.6779
	P-value	0.00		P-value	0.00
t	Coefficient	0.3623			
	P-value	0.00			

**Panel B. Mean Difference T-test of Correlation Coefficients for Before and After Swap**

	Mean <sup>38</sup>	Median	Standard Deviation
Before	0.4277	0.4403	0.0984
After	0.5616	0.6076	0.1104
t-value	-2.88		
p-value	0.01		

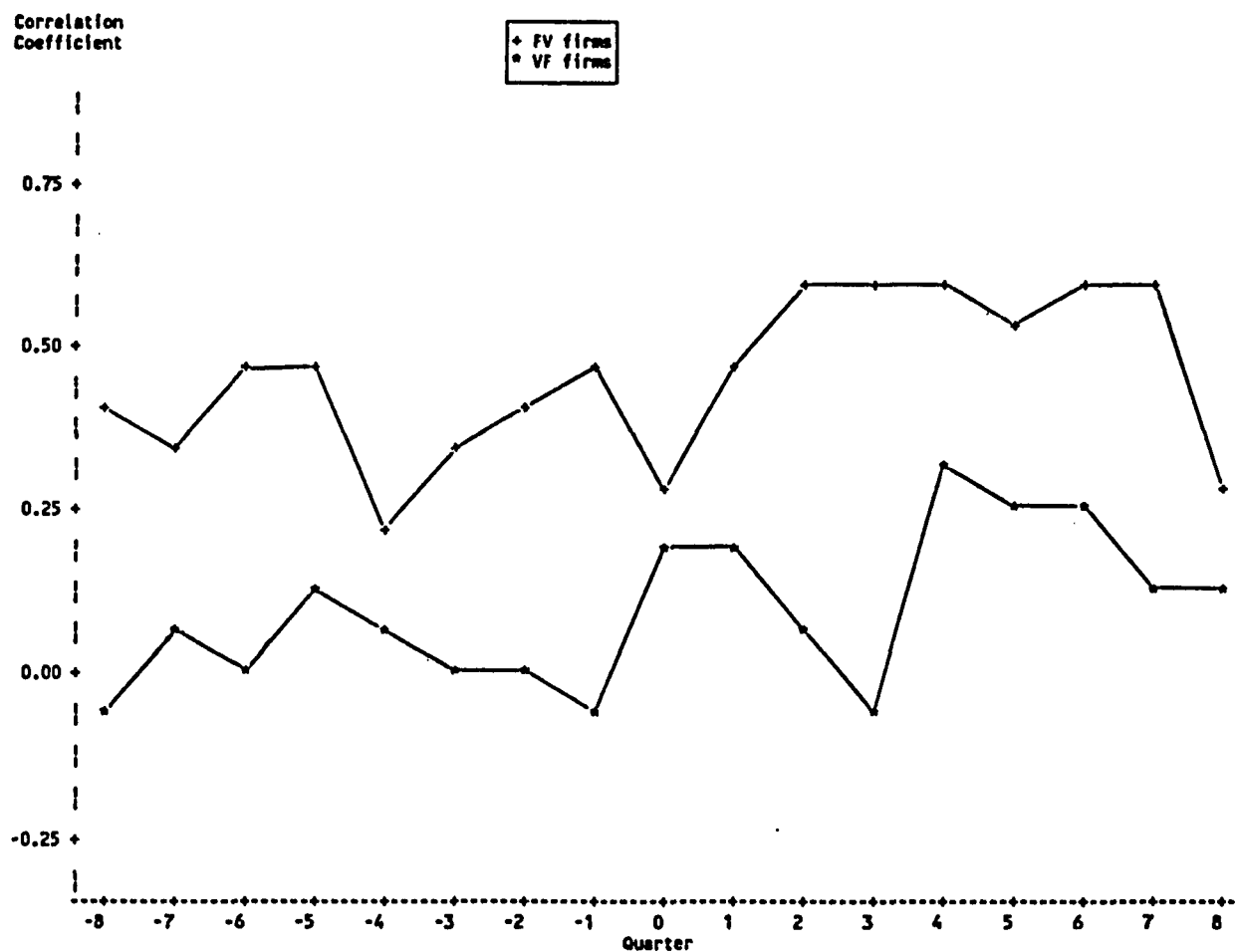
<sup>35</sup> Cash Flow from Operation or Working Capital from Operation adjusted by Current items from the Compustat Tape.

<sup>36</sup> T-bill rate is the 6 month Treasury Bill Rate from CITIBASE tape. During the study period (1984-1989) the 6-month T-Bill Rate has the following statistics. Mean: 7.20%, Median 7.09%, Standard Deviation 1.20%, Maximum 10.65% and Minimum 5.26%.

<sup>37</sup> FV firms changed from fixed to variable debt payments.

<sup>38</sup> Mean Correlation Coefficient for 8 quarters before and after the swap.

Figure 4. Time-Series Correlation Coefficients between T-bill and CFO for FV and VF firms



	Before			After		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
VF	0.0149	0.0000	0.0059	0.1514	0.1812	0.1166
FV	0.4277	0.4403	0.0984	0.5616	0.6076	0.1104
t-value	-10.32			-7.28		
p-value	0.00			0.00		

T-bill: 6-month Treasury Bill Rate from the 1992 CITIBASE Tape  
 CFO : CFO or WCFO adjusted by current items from Compustat - Interest Expenses  
 VF (FV) firms are the ones which changed from variable (fixed) to fixed (variable) payments  
 Before: Mean correlation coefficients for 8 quarters before swap  
 After : Mean correlation coefficients for 8 quarters after swap

### 3.4. Signalling Hypothesis

Signalling theory addresses problems of information asymmetry in markets. The theory shows how this asymmetry can be reduced by the party with more information signalling to others. Although the theory was developed in the labor market [Spence (1973,1974)], signalling is a general phenomenon applicable to any market with information asymmetry. This perspective suggests that changes in financial leverage convey management expectations about the firm's prospects [Ross(1977), Heinkel(1982)]. Assuming that managers possess superior information relative to the market about the "intrinsic value" of the firm, their model suggests that the firm's capital structure changes are valid signals that allow managers to convey their inside information to investors.

Leland and Pyle (1977) consider a manager seeking additional equity financing for a single project. The manager knows the project's expected return but outside investors do not. However, the outside investors observe the fraction of the manager's personal wealth( $\alpha$ ) committed to the project and set their perceived value of the firm( $V$ ) accordingly. Empirical evidence supporting this hypothesis is provided by Downes and Heinkel (1983). Titman and Trueman (1986) develop a model that shows the owner's incentive to signal through the quality of the investment banker or auditor selected for the issue. Their model shows that an owner with favorable information about the firm can convey this information to the

market through the quality of the investment banker or auditor and therefore positively affect the market valuation of the issue. Although a swap does not involve changes in leverage itself, its effect can be viewed as "debt substitution" [i.e., replacement of fixed (variable) interest debt with variable (fixed) interest debt after the firm has raised debt valued at prices commensurate with fixed (variable) interest debt].

Arak et al (1988) argue that if firms expect their credit standing to be better, those firms will issue short term variable debt and swap into long-term fixed-rate debt (VF transactions). This process of financing would enable firms to achieve fixed interest payments and to eliminate exposure to interest rate risk. While keeping short-term variable rate debt on their balance sheet for a while, these companies would be able to borrow short-term variable debt later at a lower premium with better credit ratings when the favorable information is released. In this way a VF swap signals to the market that managers of VF firms have inside information about the future cash flows, information which will improve the firms' credit standing once it is available to the market. The cost of a false signal is a higher expected short-term borrowing cost than could have been achieved had a fixed rate bond been issued directly [Litzenberger (1992)]. A VF swap would allow managers to exploit their inside information to reduce the financing costs without exposing the firm to the interest rate risk.

**H<sub>3</sub>: As VF firm's managers may have inside information on future earnings, VF swappers signal to the market that firm's credit ratings will improve after the swap.**

### 3.4.1. Methodology

Each VF sample firms' bond ratings for the four years following the swap are examined to find out whether bond ratings are improved after swap, compared to the swap year's bond rating.

The following criteria are applied to classify VF firms into the different categories.

- Improve (+)** : Bond ratings improved in any year following the swap.
- Decline (-)** : Bond ratings were down-graded in any year following the swap.
- No Change (NC)** : Bond Ratings did not changed after the swap.
- Not Available (NA)**: VF firms with less than 3 year's rating history available following the swap. Also included in this category are the firms whose ratings are improved, then declined or vice versa.

The following Z-statistics are used to test the hypothesis.

$$Z = \frac{(k+0.5) - 0.5n}{0.5\sqrt{n}}$$

where:

$k$  = test statistics (number of "improve (+)" ratings)

$n$  = number of observations excluding "NA"

A second approach used to investigate the bond rating change after the swap is a plotting procedures: (1) to plot a time-series pattern of annual mean bond rating for 4 years preceding and 4 years following the swap and (2) to see whether bond ratings for the sample have improved.

### 3.4.2. Empirical Results

To analyze after-swap bond ratings, VF samples are restricted to those which have an event year bond rating and at least 3 bond ratings after the swap. This requirement reduces the VF sample firms to 57.

Out of a total of 88 VF firms whose bond ratings are available from Compustat, 29 firms improved their bond ratings after swap, as opposed to 17 firms whose bond ratings deteriorated after swap and 11 firms remains unchanged. Z statistics for "Improve", compared to the total eligible samples, are 0.26 as shown in Tables 13 and 14. It is hypothesized that VF firms expect their credit standing to be better in the future. Therefore, they will issue short-term debt and swap into long-term fixed debt. This process of financing enable VF firms to achieve fixed interest payments and to eliminate its exposure to market interest rate risk. Contrary to the hypothesis, the empirical findings do not support the above arguments and show no evidence of changed bond ratings for VF firms after the swap. Therefore, the

signalling theory advanced by Arak et. al (1988) and Litzenberger (1992) is not supported by the empirical findings based on this particular sample. However, findings should be carefully interpreted because this result is somewhat sensitive to the sample size and the fact that bond ratings for 67 firms are not available from the Compustat tape.

Figure 5 plots the average bond rating of the VF sample for the 8 years surrounding the swap year. This plotting reveals that VF firms' bond rating is deteriorating toward the swap period but the trend after swap shows a rather stable but decreasing rating pattern. It is interesting to note that the bond rating for the year preceding the swap year is the lowest over the 9-year period. This average bond rating plot also refutes the signalling hypothesis developed in the recent literature.

An FV swap cannot be implemented by the VF firms as signalling device. In order to swap into variable payments, firms should have or borrow fixed long-term fixed debt first, which is a costly financing process, if not impossible, for a firm with a lower credit rating. Therefore, lower-rated firms with favorable inside information on the future cash flows borrow variable short term debt which is relatively cheaper than the long-term fixed debt, then swap into the fixed payments.

Table 13. Time Series Listing of Bond Rating for VF Firms

CNUM	-4	-3	-2	-1	0	+1	+2	+3	+4	CHANGE
001361	.	.	.	.	11	11	.	.	.	NA
001765	.	.	.	.	9	9	8	8	8	+
017634	.	.	.	.	.	13	16	16	16	NA
023127	12	12	13	13	15	14	12	12	12	+
023551	12	17	17	.	.	.	.	.	.	NA
030789	.	.	.	.	16	22	.	.	.	NA
043413	10	10	10	12	14	13	12	11	11	+
071813	6	6	6	10	10	10	10	10	10	NC
080555	.	.	.	.	.	11	11	12	.	NA
087509	8	11	11	13	15	18	23	14	14	+
091797	7	7	7	7	9	9	13	14	.	-
099599	7	7	7	7	7	7	7	7	7	NC
121897	5	5	5	8	8	8	9	9	11	-
153897	10	9	9	9	9	9	9	8	8	+
156503	.	.	.	17	17	18	18	18	18	-
172576	16	16	16	17	22	22	.	.	.	NA
200336	13	12	11	11	11	10	.	.	.	+
207651	11	10	10	10	10	9	9	9	.	+
283677	7	8	8	10	10	11	12	12	13	-
293561	7	9	8	11	12	12	12	11	11	+
293567	8	8	8	8	10	10	10	10	10	NC
302491	8	8	8	14	14	14	14	14	.	NC
313693	12	12	12	14	14	15	15	13	13	+
368682	15	15	15	13	15	15	15	15	.	NC
370838	5	5	5	8	8	8	8	8	8	NC
373298	9	10	10	9	10	10	13	.	.	NA
382388	11	12	12	12	12	13	13	12	11	+
382550	9	9	9	12	12	12	12	.	.	NA
383883	10	10	10	10	10	10	12	12	12	-
418056	.	15	12	12	12	12	12	11	11	+
452540	.	.	.	.	.	15	15	15	15	NA
458140	8	7	7	8	8	8	8	8	.	NC
462470	5	5	5	5	5	5	5	.	.	NA
470349	.	.	12	12	11	10	10	10	10	+
478366	8	8	8	8	8	8	8	8	8	NC
485260	12	11	11	11	10	10	10	10	10	NC
501044	8	7	7	7	7	8	16	16	16	-
505862	.	.	.	.	.	10	9	9	.	+
539821	.	.	9	9	9	8	8	8	8	+
542290	12	14	14	14	14	14	14	.	.	NA
546268	9	9	9	10	10	10	11	11	.	-
548661	.	8	8	8	8	8	8	.	.	NA
552618	.	.	11	11	11	12	12	14	.	-
565097	11	10	10	10	10	10	10	11	.	-
577778	5	5	5	5	6	6	7	7	8	-
578813	.	.	.	.	19	18	18	18	18	+
581556	.	.	.	.	8	8	8	8	7	+
613334	8	10	10	10	10	10	10	9	9	+
636886	9	9	10	11	11	11	11	.	.	NA

CNUM	-4	-3	-2	-1	0	+1	+2	+3	+4	CHANGE
646025	9	9	8	8	8	8	8	8	.	NC
653522	.	.	.	9	9	9	11	11	10	+
654086	.	.	.	.	.	.	.	11	11	NA
693320	6	6	6	6	7	7	7	.	.	NA
694232	9	9	9	9	11	11	11	.	.	NA
694308	6	6	8	8	8	7	7	7	8	+
695114	11	11	11	11	10	9	9	9	9	+
717081	5	5	5	5	5	2	2	2	.	+
759458	.	.	17	17	16	16	16	16	16	NC
761763	16	16	16	18	18	16	13	10	10	+
771758	5	4	4	4	4	2	2	2	2	+
783764	.	.	.	.	.	.	.	11	12	NA
786514	8	8	8	8	8	16	16	16	16	-
812387	5	5	5	5	5	6	6	7	7	-
817587	.	16	16	16	17	17	.	.	.	NA
841297	11	11	11	13	16	15	15	15	.	+
844895	11	11	11	11	11	12	.	.	.	NA
845467	.	.	.	10	10	10	9	9	9	+
851783	11	10	11	11	11	11	11	10	10	+
872649	7	9	9	9	9	9	9	.	.	NA
879868	.	.	.	.	8	8	8	.	.	NA
880370	8	8	8	8	9	10	10	10	10	-
883203	6	6	6	10	10	11	11	11	11	-
887360	6	6	6	6	6	7	7	7	6	+
891490	.	.	.	.	.	.	.	.	16	NA
892027	.	.	.	.	.	18	18	23	.	NA
896047	.	.	7	7	7	7	7	.	.	NA
896678	11	11	10	.	8	8	8	.	.	NA
898813	7	7	7	9	9	14	17	.	.	NA
900262	18	17	17	17	17	17	.	.	.	NA
903293	5	5	5	6	6	8	8	15	16	-
908640	.	17	13	13	13	.	.	.	.	NA
911905	9	9	9	.	.	.	.	.	.	NA
915289	4	11	12	.	.	.	.	.	.	NA
919138	11	11	11	11	14	14	14	12	13	+
958043	17	15	15	18	18	19	22	22	22	-
961896	10	9	9	9	9	10	.	.	.	NA
969457	12	12	13	15	15	15	15	12	11	+
989070	17	17	17	17	17	22	22	22	22	-

+ Improve credit rating after swap

- decline credit rating after swap

NC No change

NA Not Enough Observation from  
Compustat

\* S&P Bond-rating from Compustat takes  
the following numerical values, each  
corresponding to the letter grading.

2 -- AAA	3 -- AAA-	4 -- AA+	5 -- AA
6 -- AA-	7 -- A+	8 -- A	9 -- A-
10 -- BBB+	11 -- BBB	12 -- BBB-	

Table 14. Test of Signalling Hypothesis

Improve (+)	29 firms
Decline (-)	17 firms
No Change (NC)	11 firms
Not Available (NA)	31 firms
No Rating in Compustat	68 firms
Total VF firms	156 firms

$$Z = \frac{(k+0.5) - 0.5n}{0.5\sqrt{n}}$$

k= test statistics(number of "improve (+)" signs)  
n= number of observations(57)

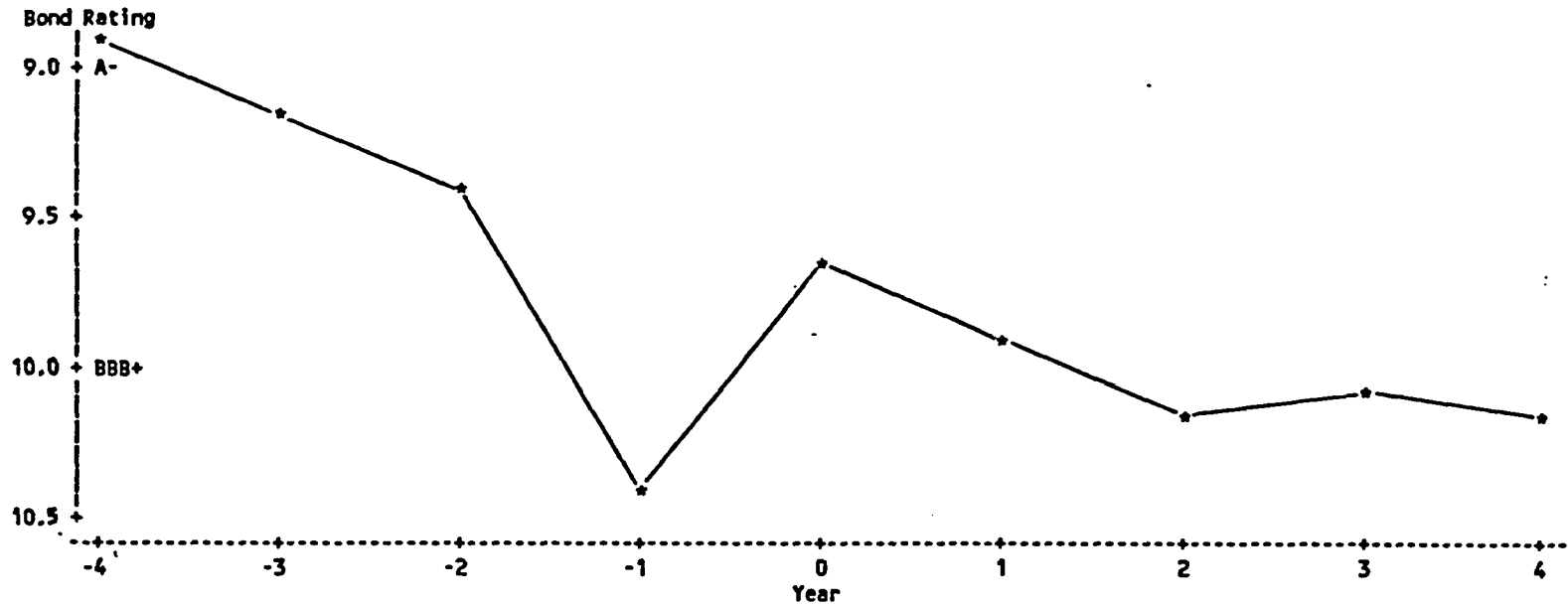
Z Statistics = 0.26

---

VF firms are the ones which changed from variable debt payments to fixed.

Improve (+) : bond rating improved after swap  
Decline (-) : bond rating deteriorated after swap  
No change (NC) : bond rating did not change after swap  
Not Available (NA) : not enough rating data from compustat  
No rating in Compustat: Bond rating is not available in Compustat at all.

Figure 5. Plot of Annual Mean Bond Rating for VF firms



Year indicates the swap year.

Bond rating: Standard and Poor's bond ratings from the 1992 Annual Compustat Tape  
 VF firms are the ones which changed from variable debt payment to fixed.

\* S&P Bond-rating from Compustat takes the following numerical values, each corresponding to the letter grading.

2 -- AAA	3 -- AAA-	4 -- AA+	5 -- AA
6 -- AA-	7 -- A+	8 -- A	9 -- A-
10 -- BBB+	11 -- BBB	12 -- BBB-	

### 3.5. Cash flow Hypothesis

Another motivation for FV swap transactions is provided by the lump sum payment. Firms switching from fixed to variable interest payments may receive lump sum amounts equal to the present value of the fixed interests payments for the whole swap period. The swap partner makes this payment at the inception of the contract in exchange for the promise to pay the variable rate interest payments based on the market rates effective later.

On February 7, 1989 the Internal Revenue Service released Notice 89-21, which provides rules regarding the timing for tax purposes of lump sum payments received in connection with interest rate swap. Previously some FV firms recognized the lump sum payments as income when received, relying on the U.S. Supreme Court precedents involving prepaid services contracts. This current inclusion practice is believed to have inspired a series of transactions designed effectively to accelerate income to the year of receipt of lump-sum payment under a swap contract. However, FV firms' freedom of choice in recognizing the lump-sum receipt as income to the current year is constrained by GAAP, which stipulates such a lump sum should be amortized over the life of the swap contracts. Therefore, only part of the those amounts should be recognized as income to the current year. The partially recognized income, however, will be offset by the payments they make to their swap partners (VF). Therefore, the impact of this transaction

on the income statement involves only the difference between the recognized income for the current year and the swap payments made. Therefore, the real motivation behind this transaction for these group of firms is not based on any income effect but on the opportunity to relax operating cash flow problems.

**H<sub>4</sub>: FV firms which receive the present value of future fixed interest rate payments at the time of swap transactions are expected to show the presence of cash flow problems.**

### 3.5.1. Methodology

To test H<sub>4</sub>, FV firms' annual reports are examined to identify the firms with swap lump sum receipts. For these firms, a mean difference t-test is performed to investigate whether there is a statistical difference between cash flows including the lump sum (CFO) and excluding lump sum payment (CFOBL) during the swap year. Cash Flows for two years before and after the swap are collected from the 1992 Annual Compustat Tape.

$$t = \frac{cfo - cfobl}{\sqrt{S^2 \left( \frac{1}{N_{cfo}} + \frac{1}{N_{cfobl}} \right)}}$$

where cfo = cash flow of fv firms including lump sum

cfobl = cash flow of fv firms excluding lump sum

$$S^2 = \left\{ (N_{cfo} - 1) s_{cfo}^2 + (N_{cfobl} - 1) s_{cfobl}^2 \right\} / (N_{cfo} + N_{cfobl} - 2),$$

$s_{cfo}^2$  = sample variance of firms including lump sum

$s_{cfobl}^2$  = sample variance of firms excluding lump sum

Secondly, a time series analysis will be performed to analyze the difference between the cash flows of FV firms with lump sum and FV firms without lump sum payments. Two years of cash flows before and after the swap are plotted to see the difference between the two cashflow streams.

#### 3.4.2. Empirical Results

Panel A of Table 15 shows that FV firms without lump sum cash receipts have a stronger cash flow position than firms with lump sum receipts over the 5 year period. Mean difference t-tests show that cash flow differences between these two group are statistically significant for the entire period examined. The implication is that firms with lump sum receipts experience cash flow problems, relative to firms without lump sum payments and that this is especially true at the time of the swap transaction (p-value, 0.02). This result supports the hypothesis that FV firms which received lump sums engaged in a structured swap transaction so that they can mitigate the presence of operating cash flow problems.

This argument is marginally supported by another measure of cash flow. Panel B of Table 15 is an analysis of operating cash flows scaled by the market value of equity. Although the difference in this ratio between two group is not as pronounced as that for unscaled operating cash flow, the difference is significant in the swap year using a two-tail test. Figure 6 shows the cash flow trend over a five year period for FV firms with and without lump sum payment.

Although firms with the lump sum experience a decline in CFO at the swap year, these firms would have experienced even lower cash flows without the swap lump sum. This difference is statistically significant (p-value, 0.02) as shown in Panel A of Table 15.

**Table 15. CFO Analysis for FV firms With and Without Lumpsum<sup>39</sup>**

Panel A: CFO analysis

	CFO <sub>t-2</sub> <sup>40</sup>	CFO <sub>t-1</sub>	CFO <sub>t=0</sub> <sup>41</sup>	CFO <sub>t+1</sub>	CFO <sub>t+2</sub>
<u>FV firms without Lumpsum (n=28)</u>					
Mean	1110	1092	1236	1466	1537
Median	767	567	679	518	751
Standard Deviation	1389	1288	1721	1990	2325
<u>FV firms with Lumpsum (n=12)</u>					
Mean	418	421	329	438	415
Median	490	296	244	557	461
Standard Deviation	207	444	283	320	277
T-statistics	2.164	2.004	2.433	2.249	1.958
p-value	0.03	0.05	0.02	0.03	0.06
CFO Difference between Total FV firms(n=46) and Lumpsum Firms(n=12) at t=0			t-statistics	2.176	
			p-value	0.02	

---

<sup>39</sup> For 12 FV firms which received lump sums equivalent to present value of total interest payments from swap partners at the inception of the swap contract.

<sup>40</sup> Cash Flow from Operations and Working Capital from Operation adjusted by changes in current items for the previous periods from the Compustat Tape.

<sup>41</sup> "t=0" indicates the swap year.

Table 15. CFO Analysis for FV firms With and Without Lump sum<sup>42</sup>  
( Continued )

Panel B. CFORAT(CFO/MVQ)<sup>43</sup>

	CFORAT <sub>t-2</sub>	CFORAT <sub>t-1</sub>	CFORAT <sub>t=0</sub> <sup>44</sup>	CFORAT <sub>t+1</sub>	CFORAT <sub>t+2</sub>
<u>FV firms without Lumpsum (n=28)</u>					
Mean	0.138	0.132	0.135	0.147	0.172
Median	0.124	0.113	0.130	0.152	0.122
Std. Deviation	0.064	0.078	0.074	0.082	0.112
<u>FV firms with Lumpsum (n=12)</u>					
Mean	0.130	0.106	0.099	0.105	0.125
Median	0.094	0.098	0.083	0.152	0.116
Std. Deviation	0.063	0.033	0.047	0.073	0.055
T-statistics	0.226	1.245	1.556	1.308	1.455
p-value	0.82	0.22	0.13	0.21	0.16
CFORAT Difference between Total FV firms(n=46) and Lumpsum firms(n=12) at t=0			t-statistics	1.676	
			p-value	0.10	

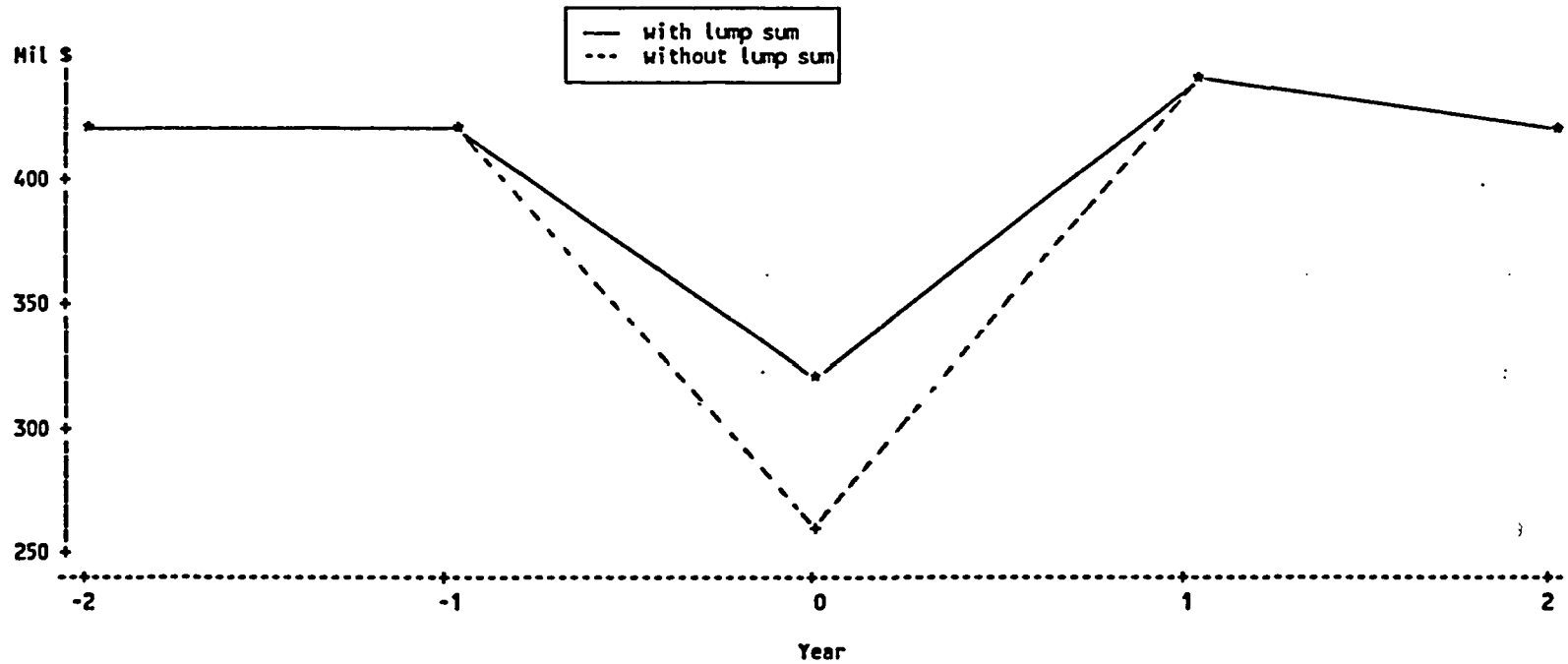
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<sup>42</sup> For 12 FV firms which received lump sum equivalent to the present value of total interest payments from swap partners at the inception of the swap contract.

<sup>43</sup>CFORAT is ratio of CFO to Market Value of Equity (MVQ) which is calculated by multiplying total common stock outstanding by year-end market price per share.

<sup>44</sup> "t=0" indicates the swap year.

Figure 6. Plot of FV firm's CFO With and Without Lump sum Receipts(n=12)



Year "0" indicates the swap year.

FV firms changed from fixed debt payments to variable.

CFO: Cash flow from operation or working capital from operation adjusted by current items from the Compustat

Lumpsum: For 12 FV firms (p. 10) which received lump sum equivalent to the present value of total interest payments from swap partners at the inception of the swap contract.

#### **Chapter 4. Differential Market Reactions to Information Release: Earning Response Coefficients (ERC)**

Holthausen and Verrechia (HV) (1988) and Choi and Salamon (CS) (1988) developed theoretical models which identify the determinants of the magnitudes of price reaction to firm specific information releases by relaxing the assumption of constant ERC.

The HV and CS models are constructed on slightly different assumptions, but both models show that the earnings response coefficient is inversely related to the noise or garbling in the earnings signal. The HV model demonstrates that the variance of price changes at the time of information releases are associated with the market's priors about the liquidating dividends releases in conjunction with the market's information about the noise in the information signals.

In the CS model, for a given amount of unexpected earnings, the more the perceived firm specific uncertainty in the announcing firm's production/investment activities, the larger the effect of the firm's unexpected price change, and the greater the magnitude of the noise in an announcing firm's reporting system, the smaller the impact of its unexpected price change.

Empirical research has documented cross-sectional differences in stock price responses to earnings releases. These studies attribute the cross-sectional variations in market responses to differential information environments

across firms. For example, Grant (1980) reports a larger market reaction to OTC firms' annual earnings releases than to reports of NYSE firms. Atiase (1985) provides significant evidence that the degree of unexpected security price changes in response to earnings reports is inversely related to the market value (size) of firms.

Easton and Zmijewski (1989) hypothesize that ERCs are (1) positively associated with revision coefficients and (2) negatively associated with expected rates of return. Their random coefficient regression model provides evidence consistent with their hypotheses. Collins and Kothari (1989) predict and document evidence that the ERC is a function of riskless interest rates, the riskiness, and the growth and/or persistence of earnings.

Kormendi and Lipe (1987) test and confirm that the magnitude of the effect of unexpected earnings on stock returns is correlated with the present value of revisions in the expected future earnings (i.e., earnings persistence) derived from a univariate time series model. Some studies argue that the capital market reacts differentially to accounting information releases, and have attributed these differences to different levels of noise or garbling which is determined by the particular set of accounting measurement rules used to delineate the underlying economic events. Collins and Salatka (1988) provide the evidence of differential earnings response for different methods of

accounting foreign currency transactions.

This section describes the research design and methodology used to examine changes in the earnings response coefficients before and after swaps transactions.

Collins and Kothari (1989) document that ERCs are a negative function of risk, among other factors. They used the common stock beta as a proxy for risk. By changing interest rate payments from fixed (variable) to variable (fixed), uncertainty about future expected cash flows is expected to be increased (decreased) as will the market's perceived risk of the future expected cash flow. However, to the extent that FV firms are engaging in hedging activities to match variable-return assets with variable debt, these FV firms' post-swap risk will be reduced, even with the increased variability in cash flow.

In an attempt to test the model proposed by Holtauthen and Verrecchia (1988) and Choi and Salamon (1989), Collins and DeAngelo (1990) test market and analyst's reactions to earnings during the proxy contests for board seats and after proxy-contest-induced management changes. They found market and analyst's reaction are more pronounced in prior periods and earnings surprise explains more of the cross-sectional variation in these reaction. Their study is important because it is the first empirical paper to assess the information content of earnings in a particular decision context.

Following the line of reasoning presented in Collins and

DeAngelo (1990) and the discussion in Chapter 3, it is expected that swappers decrease uncertainty in earnings as well as variability after the swap. The variability in swappers' reported earnings is expected to be inversely related to ERCs. Based on the above arguments and those presented in the previous chapters, therefore, I hypothesize the following.

**H<sub>5</sub>: Swappers' post-swap ERCs are greater than their pre-swap ERCs.**

#### 4.1. Estimation of Unexpected Earnings

Unexpected earnings (UE) are defined to be the difference between earnings forecasts and actual earnings deflated by the beginning of the year price [Christie (1987)].

$$UE_{it} = \frac{E_{it} - FE_{it}}{P_{t-1}}$$

where  $E_{it}$  = a firm's fiscal year end earnings per share,

$FE_{it}$  = IBES security analysts' earnings per share forecasts prior to the earnings announcements.

$P_{t-1}$  = the market price of a firm's security at the beginning of the fiscal year.

Measurement error in unexpected earnings weakens the ERC and thus makes it difficult to detect the impact of noise in earnings on the ERC [Collins and Kothari (1989)]. The empirical proxies for unexpected earnings are measured with errors due to the factors (such as the risk free interest

rate, earnings persistence, systematic risk, information environment) that affect the return/earnings relation.

Another reason for the errors-in-variable problem results from estimating timing of market expected earnings. The perfect situation would be to measure unexpected earnings conditioned on the market's expectations of earnings right before the earnings release. However, the forecasts gathered by IBES are not all made on the day before earnings announcements but at various times throughout the year. The return window cannot reflect the true forecast period for the IBES forecast, thus there is measurement error in the estimated independent variable  $UE_{it}$ . This biases an estimated ERC.

One method of reducing the measurement error is to vary return windows to match approximately with market earnings expectations [Easton and Zmijewski (1989)]. However, there exists a trade-off in using available analysts' forecasts when employing the above method. A short (long) holding period results in fewer (more) confounding events that impact the abnormal return, but more (less) measurement error in the unexpected earnings measure. To reduce the errors-in-variables problem and to assess the effect of these trade-offs, this study uses both a short holding period association model and several long holding period association models.

#### 4.2. Estimation of Unexpected Security Returns and Empirical Model

Cumulative abnormal return is used as a dependent variable. The correct dependent variable is the return on the security entirely generated from the changes in market participants expectations due to the annual earnings announcement. Daily expected returns are computed from a one factor market model:

$$R_{it} = a_i + b_i R_{mt} + e_{it}$$

where  $a_i$  and  $b_i$  are the firm specific intercept and slope, respectively. The stochastic disturbance term,  $e_{it}$ , is assumed to have a zero mean, be independent of  $b_i$ , and be uncorrelated across firms.

$$U_{it} = R_{it} - (a_i + b_i R_{mt})$$

where:

$R_{it}$  = the return of firm  $i$  in day  $t$ ,

$a_i$  and  $b_i$  = the intercept and slope coefficients, respectively, which are estimated from a market model regression using 200 daily returns up to 30 days prior to the annual earnings announcement.

A cross-sectional regression analysis is used to test whether swappers' post-swap ERCs are greater than their pre-swap ERCs. The question is whether swappers' the ERCs differ before and after the swap transactions.

CAR, as calculated in the below, is used as a dependent variable and is regressed on unexpected earnings to get the ERC [Easton and Zmijewski(1989)].

$$\begin{aligned} \text{CAR} &= a_1 D_1 + a_2 D_2 + b_1 (D_1 * UE_{it}) + b_2 (D_2 * UE_{it}) + e_{it} \\ &= a_1 + (a_2 - a_1) D_2 + b_1 UE_{it} + (b_2 - b_1) D_2 * UE_{it} + e_{it} \end{aligned}$$

where:

$\text{CAR}(n, 0)_{it}$  = the prediction error from one the factor market model accumulated from n days prior to the day of firm i's annual earnings announcement (day 0) for year t,

$UE_{it}$  = unexpected earnings of firm i for year t deflated by the beginning of the year price,

$D_2 = 1$  if swappers  
       0 nonswappers

Therefore, the above equation gives the following regression models:

$$\begin{aligned} \text{After swap: } \text{CAR}(n, 0)_{it} &= a_1 + (a_2 - a_1) + b_1 UE_{it} + (b_2 - b_1) UE_{it} + e_{it} \\ &= a_2 + b_2 UE_{it} + e_{it} \end{aligned}$$

$$\text{Before Swap: } \text{CAR}(n, 0)_{it} = a_1 + b_1 UE_{it} + e_{it}$$

$H_5$ , accordingly, can be written as follows:

$$H_0 : b_2 = b_1$$

$$H_a : b_2 > b_1$$

Apart from testing the hypothesis developed above, the following regression is run to investigate further the impact of the swap on the informativeness of earnings by including non-swappers. In addition to the before- and after-swap analysis for swappers, the following regression incorporates the before- and the after-swap analysis for non-swappers and compares the earnings informativeness for swappers with those

for non-swappers.

$$\text{CAR}(n, 0)_{it} = a_0 + a_1 \text{UE}_{it} + a_2 (T * \text{UE}_{it}) + a_3 (S * \text{UE}_{it}) + a_4 (T * S * \text{UE}_{it}) + e_{it}$$

where:

t= EPS for both the swap year and the prior year.

$\text{CAR}(n, 0)_{it}$  = the prediction error from the one factor market model accumulated from n days prior to the day of firm i's annual earnings announcement (day 0) for year t,

$\text{UE}_{it}$  = unexpected earnings of firm i for year t deflated by the beginning of the year price,

T = 0 if before swap  
1 if after swap

S = 0 if Non-Swappers  
1 if Swappers

$e_{it}$  = random disturbance assumed  $N(0, \sigma)$

The independent variable UE is deflated by the stock price at time t-1 [Christie (1987)]. Employing a simple dividend capitalization model, Collins and Kothari (1989) theoretically prove that the coefficient on unexpected earnings scaled by price is the ERC when unexpected returns are regressed on unexpected earnings.

Since hedging reduces the variabilities of earnings [Smith and Stulz (1985)], the degree of earnings informativeness for swappers is expected to be higher than that for non-swappers, after the swap and those of pre-swap. This is expected to be true for the case of each groups. Swappers' earnings informativeness is expected to be higher than that of non-swappers because swappers now match their

interest rate expense with cash flow. Therefore swappers' absolute value of  $a_1$ ,  $a_2$ ,  $a_3$  and  $a_4$  are expected to be greater than those of the non-swappers.

#### 4.3. Empirical Results

Table 16 shows results for the test of differential market reaction to earnings releases before- and after-swap for swappers. CAR from the one factor market model is used as the dependent variable in Panel A and B. Although the expected sign for the independent variable (UE) is correct, none of them is statistically significant across the different regressions. The results are the same when dependent variable is replaced with the Sholes and Williams CAR, adjusting the non-synchronous trading problem ( Panel C and D). In other words, post-swap earnings response coefficients are not different from the pre-swap ERCs for the swappers.

Table 17 shows results for the test of differential market reaction for swappers versus non-swappers. Forecast error deflated by beginning of the price, together with dummy variables for swappers/nonswappers and before/after the swap are regressed on the cumulative abnormal return (CAR). The first dependent variable used is CAR calculated from the risk-adjusted one-factor market model. When the independent variable includes only UE and UET, none of these two coefficients is significant, although each parameter sign is consistent with predictions. When the independent variables include UE and UES, UE becomes significant at the p-value of

0.05 level (using a one-tail test) but UES is still statistically insignificant (with the correct sign). When both UES and UET are included in the model, results remain virtually unchanged. UE is marginally significant but UES and UET still fall short of statistical significance (with correct signs). When the interaction variable (UEST) is included in the regression, UET becomes significant (p-value, 0.10), meaning that after-swap ERC is greater than before-swap ERC. However, results should be interpreted with caution because the interaction variable now has a inconsistent sign with the predicted one.

When the dependent variable, CAR, is replaced with the Sholes and Williams nonsynchronous trading adjusted CAR (SWCAR), empirical results are not different from those found using the previous regression. Recalling the economic efficiency hypothesis posited in the Chapter 3, it is not surprising to observe these results because swappers are larger in size than non-swappers, and thus would not have non-synchronous trading problem.

Overall significance of model is marginal with low adjusted  $R^2$  (from 0.01 to 0.04). A limitation of this part is that swappers, due to inconsistent and incomparable disclosure practice among the sample firms during the study period, may not have previously conveyed sufficient information for the capital market to appreciate this creative financial transaction.

**Table 16. Differential Market Reaction to Swap Transactions**

$$CAR(n,0)_{it} = a_0 + a_1(T*UE_{it}) + e_{it}$$

Panel A: Dependent Variable CAR (-1,1)

Expected(Sign)	(+) UET		Adj-R <sup>2</sup>	F-value
	a <sub>0</sub>			
Coefficient	-0.002	0.007	0.02	1.58
T-Value	-0.15	0.05		(0.21)

Panel B: Dependent Variable CAR (-2,2)

Expected(Sign)	(+) UET		Adj-R <sup>2</sup>	F-value
	a <sub>0</sub>			
Coefficient	0.007	0.053	0.03	1.73
T-Value	1.11	0.54		(0.19)

Panel C: Dependent Variable SWCAR (-1,1)

Expected(Sign)	(+) UET		Adj-R <sup>2</sup>	F-value
	a <sub>0</sub>			
Coefficient	-0.032	1.834	0.02	1.64
T-Value	-0.06	0.20		(0.20)

Panel D: Dependent Variable SWCAR (-2,2)

Expected(Sign)	(+) UET		Adj-R <sup>2</sup>	F-value
	a <sub>0</sub>			
Coefficient	0.419	4.924	0.04	1.78
T-Value	0.67	0.51		(0.18)

---

CAR = cumulative abnormal return

SWCAR = Scholes and Williams Non-synchronous trading day adjusted CAR

UE =  $E_{it} - FE_{it} / P_{t-1}$

$E_{it}$  = Fiscal year-end Primary EPS

$FE_{it}$  = IBES Security analysts EPS Forecast prior to earnings announcement

T = 1 if after swap: 0 otherwise

Table 17. Differential Market Reaction to Swap Transactions

$$\text{CAR}(n,0)_{it} = a_0 + a_1 \text{UE}_{it} + a_2 (\text{T} * \text{UE}_{it}) + a_3 (\text{S} * \text{UE}_{it}) + a_4 (\text{T} * \text{S} * \text{UE}_{it}) + e_{it}$$

Panel A: Dependent Variable CAR (-1,1)

E(Sign)	a <sub>0</sub>	(+) UE	(+) UET	(+) UES	(+) UEPT	Adj-R <sup>2</sup>	F-value
Coeff.	-0.125	2.206	1.692			0.02	1.62
T-Value	-0.63	0.97	0.61				(0.20)
Coeff.	-0.003	0.056		0.018		0.02	2.03
T-Value	-0.69	1.91*		0.27			(0.13)
Coeff.	-0.003	0.045	0.030	0.020		0.02	1.62
T-Value	-0.83	1.24*	0.61	0.29			(0.19)
Coeff.	-0.004	0.025	0.095	0.067	-0.119	0.04	1.81
T-Value	-0.86	0.63	1.60*	0.66	-0.90		(0.13)

Panel B: Dependent Variable SWCAR (-1,1)

E(Sign)	a <sub>0</sub>	(+) UE	(+) UET	(+) UES	(+) UETS	Adj-R <sup>2</sup>	F-value
Coeff.	-0.003	0.045	0.033			0.03	2.42
T-Value	-0.63	1.25*	0.68				(0.09)
Coeff.	-0.136	2.539		1.417		0.02	1.37
T-Value	-0.62	1.68*		0.37			(0.26)
Coeff.	-0.171	2.005	1.490	1.489		0.01	1.11
T-Value	-0.73	0.96	0.53	0.37			(0.35)
Coeff.	-0.003	0.035	0.052	0.085	-0.114	0.02	1.42
T-Value	-0.78	0.93	0.95	0.85	-0.91		(0.23)

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\* Significant at .10 level with one-tail test

CAR = cumulative abnormal return

SWCAR = Scholes and Williams Non-synchronous trading day  
adjusted CAR

UE =  $E_{it} - FE_{it} / P_{t-1}$

$E_{it}$  = Fiscal year-end Primary EPS

$FE_{it}$  = IBES Security analysts EPS Forecast prior to earnings  
announcement

T=1 if after swap; 0 otherwise

S=1 if swappers; 0 otherwise

## Chapter 5. Summary and Conclusions

Interest rate swaps have been introduced to the financial market as a logical response to the market interest rate fluctuations followed by the Federal Reserve's change in interest rate policy in 1979. Since its inception the swap market has grown to a volume of \$ 3 trillion in notional amount in 1992 and represents one of the major segments of the capital markets. For the sample studied notional amount for each swap transaction amounts to \$100 million and firms swapped, on the average, 29 percent of their long-term debt over a 5-year period. Taken together, interest rate swaps are material transactions which have a significant impact on the financial statements.

This study identifies the characteristics of the different types of swappers and analyzes why they engage in these transactions. It further investigates the differential market reactions to these transactions for the swappers versus non-swappers.

Economies of scales and lower probabilities of bankruptcies enable large firms to take on relatively more debt [Ben-Zion and Salit (1975)]. Collins, Rozeff and Dhaliwal (1981) argue that larger firms tend to have higher debt equity ratio. Since firms swap their interest payments based on notional amount of their long term debt, it is expected that swappers are larger in size and more leveraged than non-swappers. Empirical findings support those

predictions in both univariate and multivariate settings. In other words, swaps have been undertaken by larger firms with higher debt as a creative financing mechanism. The evidence of higher leverage for swappers suggests that the one of the objectives of swap transactions is to lock in interest payments to protect firms from adverse movements of market interest rates.

Differences among firms' access to the variable and fixed-rate debt markets enables firms to share the arbitrageable difference based on the principle of comparative advantage. Swappers undertake the swap to realize economic gains, as opposed to managerial opportunism, in dividing this arbitrageable difference. Swaps also serve as an effective hedging mechanism. Swappers have rather stable post-swap EPS variances after experiencing sharp fluctuations before the swap. The difference between before- and after-swap variance is statistically significant. It may safely be said that swappers smooth out EPS variance with swaps, consistent with arguments by Smith and Stulz (1985). FV (VF) firms have higher (lower) correlation coefficients between quarterly CFO and market interest rates and the coefficients are on the increase after the swap for both groups. Not surprisingly VF firms have 5 quarters of negative correlation coefficients before the swap and only a single negative coefficient afterwards.

The signalling hypothesis for the VF swap is not

supported by empirical testing. One of the VF swapper's motivation is to utilize the probable improvement in future credit ratings to borrow long-term fixed debt while borrowing cheaper short-term variable debt and swapping into fixed. Although the absolute number of firms with improving credit rating after swap is greater than those with deteriorating credit rating, the test results do not support the hypothesis at the conventional significance level.

A subset of FV firms structured swap transactions in such a way that they received the present value of future fixed interest payments in return for future variable payments. The motivation behind this transaction is believed to be the presence of operating cash flow problems for this group of firms. Empirical evidence supports the hypothesis that swappers with lump sum payments do indeed engage in these transactions to relax operating cash flow constraints.

The capital market's reaction to these financial instruments is not observable with the proposed methodology. This result is believed to be due to inconsistent and incomparable disclosure about the swap during the swap period. The swap's impact on earnings quality could be measured more accurately after mandatory disclosure of swap transactions, which begins in 1993.

In summary, large firms with high leverage undertake interest rate swaps for economic gains and hedging considerations. More sophisticated analyses of these

relatively new transactions are warranted. However, the unavailability of swap gain or loss data leaves no choice but to wait for more systematic disclosures on swap transactions under SFASs 105 and 107.

**Appendix A Glossary of Terms<sup>45</sup>**

**AIC or All-in-Cost:** The rate of return of the fixed side of a swap. Swap prices are quoted as AIC, versus the floating rate. For example, a seven year LIBOR swap would be quoted as "treasuries plus 90 basis points versus six month LIBOR." A trader would call the floating side "LIBOR flat."

**Asset Swaps:** Asset swaps can be used to create "synthetic" fixed or floating rate securities. For example, an "undervalued" fixed rate bond or floating rate note can be restructured through a swap to yield a higher rate of return than is offered in the open market.

**Basis Swaps:** A swap where the counterparties exchange interest payments tied to two different floating rates such as the prime rate and LIBOR.

**Cap:** A cap reimburses a party for extra interest costs incurred when rates rise over a set level. The seller of a cap agrees to pay the buyer the difference between LIBOR rates (usually three or six months LIBOR) and the "strike" rate on the contract when LIBOR rises above that strike.

**Floors:** The opposite of caps, floors are used to protect an investor against a decline in interest rates. A cap buyer will often seek to reduce the up-front premium by simultaneously selling a floor, establishing a limit for benefitting from lower interest rates.

**LIBOR:** London Interbank Offered Rate. The floating rate of reference for the swap, LIBOR is the rate that the major international banks charge each other for deposits in the Eurodollar or Euro Currency Market.

**Mark-to-Market:** This is the periodic revaluation of a swap portfolio to reflect current levels of interest rates or currency values, or both. This practice permits a dealer to accurately determine his exposure and to allocate appropriate amounts of capital to the swap portfolio.

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<sup>45</sup> Source: "Interest Rate and Currency Swaps", International Swap Dealer's Association, New York, 1991

**Appendix A Glossary of Terms - Continued**

**Underlying index** on which the contractual payments will be based. Several commonly used indices are LIBOR, commercial paper, prime rate, Treasury bills or certificates of deposits.

**Strike rate** at which cash flows will be exchanged. While caps with a higher strike rate have lower upfront premiums, the trade-off between the premium and the strike rate is not directly proportional.

**Settlement frequency** refers to the frequency with which the rates will be compared to determine the amount of cash flows to be exchanged. At settlement, the determination of the cash flow to be exchanged could be based on either the average daily rate prevailing during the repricing interval or the spot rate on the settlement date.

**Upfront Premium** is the fee which is paid to obtain the protection against changes in the relevant interest rate. This fee is similar to the premium paid to purchase options and is determined by factors such as the strike rate, volatility of the underlying index, the length of the agreement and the principal amount protected.

**Zero Coupon Swap:** An interest rate swap in which the fixed-rate payments are made in one lump sum at maturity. Payments are usually made on the floating-rate side.

## Appendix B

A: List of VF Test Sample

SIC	CUSIP	Company Name
4512	001765	AMR CORP-DEL
3812	006354	ADAMS RUSSEL
2221	012348	ALBANY INTL CORP NE
3714	017634	ALLEN GROUP
5311	019519	ALLIED STORES
3334	023127	AMAX INC
2761	024763	AMERICAN BUSINESS P
3711	027627	AMERICAN MOTOR
4841	030187	AMERICAN TV & COMMU
4213	040789	ARKANSAS BEST CORP
3330	043413	ASARCO INC
5311	045573	ASSOCIATED DRY GOODS
2670	053627	AVERY INTEL
3824	056525	BADGER METER INC
5661	057232	BAKER INT'L CORP
5072	067806	BARNES GROUP INC
2834	071813	BAXTER INTERNATIONAL
3312	087509	BETHLEHEM STEEL COR
8798	088088	BEVERLY INVESTMENT
3540	091797	BLACK & DECKER CORP
2020	099599	BORDEN INC
4011	121897	BURLINGTON NORTHERN
4011	126137	CNW GROUP
5311	146016	CARSON PIRIE SCOTT
5051	148411	CASTLE (A.M.) & CO
4911	153897	CENTRAL LOUISIANA E
2840	163596	CHEMED CORP
4011	167166	CHICAGO & NORTHWES
3490	186757	CLEVEPAK CORP
2086	191098	COCA-COLA BTLNG CON
4924	207651	CONNECTICUT NATURAL
1311	208285	CONQUEST EXPLORAT
3585	211615	CONTINENTAL MATERIA
3420	268226	EAC INDUSTRIES
4911	283677	EL PASO ELECTRIC CO
3452	291210	EMHART
7389	292573	ENDATA INC
4923	293561	ENRON CORP
4923	293567	ENSERCH CORP
2670	296683	ESSELTE BUSINESS
2800	302491	FMC CORP
5940	302846	FABRI-CENTERS OF AM
2631	313693	FEDERAL PAPER BOARD

## Appendix B - continued

A: List of VF Test Sample

SIC	CUSIP	Company Name
3711	313855	FEDERAL SIGNAL CORP
3823	337693	FISCHER & PORTER CO
7359	338909	FLEXI-VAN CORP
3716	339099	FLEETWOOD ENTERPRIS
1600	350244	FOSTER WHEELER CORP
3823	351604	FOXBORO
2870	356903	FREEPORT MCMORAN RE
2891	359694	FULLER (H. B.) CO
3760	368682	GENCORP INC
2430	373298	GEORGIA-PACIFIC COR
3420	375766	GILLETTE CO
2821	382388	GOODRICH (B.F.) CO
3011	382550	GOODYEAR TIRE & RUB
5944	382748	GORDON JEWELRY CORP
2800	383883	GRACE (W.R.) & CO
7359	388235	GRANTREE CORP
2650	391090	GREAT NORTH. NEKOO
5812	398028	GREYHOUND DIAL
2731	411631	HARCOURT BRACE JOVA
3944	418056	HASBRO INC
3724	422805	HEICO CORP
5712	422893	HEILIG-MEYERS CO
2870	449669	IMC FERTILIZER GROU
3829	452540	IMO INDUSTRIES INC
5734	453233	INACOMP COMPUTER CE
3330	457729	INSPIRATION RESOUR
3674	458140	INTEL CORP
4924	458196	INTER-CITY
2834	459884	INT'L MINERAL & CHE
4931	462470	IOWA-ILLINOIS GAS &
1731	466265	JWP INC
2621	470349	JAMES RIVER CORP OF
3334	483102	KAISERTECH
3334	483102	KAISER ALUMINUM
5411	501044	KROGER CO
3678	502127	LPL INVESTMENT
3270	505862	LAFARGE CORP
4922	521890	LEAR PETROLEUM
2330	527010	LESLIE FAY COMPANIE
3760	539821	LOCKHEED CORP
3241	542290	LONE STAR INDUSTRIE
7812	544157	LORIMAR TELE
2911	546268	LOUISIANA LAND & EX

## Appendix B - continued

A: List of VF Test Sample

SIC	CUSIP	Company Name
3674	552618	M/A-COM INC
3330	559177	MAGMA COPPER NEW -
5311	577778	MAY DEPARTMENT STOR
3334	577913	MAXXAM
2090	579780	MCCORMICK & CO
5122	581556	MCKESSON CORP
2600	582834	MEAD CORP
2711	584404	MEDIA GENERAL -CL
4812	59163C	METRO MOBILE CTS IN
3561	602108	MILTON ROY
4833	62545K	MULTIMEDIA INC
1531	628912	NVR -LP
5099	629193	NMC
4924	646025	NEW JERSEY RESOURCE
2711	652487	NEWS CORP LTD -ADR
4931	653522	NIAGARA MOHAWK POWE
4924	654086	NICOR INC
4922	669771	NOVA CORP OF AL
3842	681904	OMNICARE INC
3910	682505	ONEIDA LTD
5047	690730	OWENS & MINOR INC
8741	691435	OXFORD FIRST CORP
7510	693320	PHH CORP
4924	694232	PACIFIC ENTERPRISES
5140	694291	PACIFIC GAMBLE ROBI
4931	694308	PACIFIC GAS & ELECT
2421	694529	PACIFIC LUMBER
2911	694792	PACIFIC RRESOURCE
4813	694876	PACIFIC TELECOM INC
4931	695114	PACIFICORP
5211	704378	PAYLESS CASHWAY
2834	717081	PFIZER INC
5065	723877	PIONEER STANDARD EL
4924	741903	PRIMARK CORP
3621	759458	RELIANCE ELECTRIC
3334	761763	REYNOLDS METAL
4813	771758	ROCHESTER TELEPHONE
1531	783764	RYLAND GROUP INC
7373	78424R	SHL SYSTEMHOUSE INC
5411	786514	SAFEWAY INC
2060	804795	SAVANNAH FOODS & IN
2821	808194	A SCHULMANN
5311	812387	SEARS ROEBUCK & CO

## Appendix B - continued

A: List of VF Test Sample

SIC	CUSIP	Company Name
2631	835495	SONOCO PRODUCTS CO
3241	841297	SOUTHDOWN INC
5412	844436	SOUTHLAND CORP
4923	845467	SOUTHWESTERN ENERGY
2211	851783	SPRINGS INDUSTRIES
3842	867910	SUNRISE MEDICAL
5082	871786	SYRACUSE SUPPLY
4841	872241	TCA CABLE
3714	872649	TRW INC
2631	879868	TEMPLE-INLAND INC
3523	880370	TENNECO INC
3720	883203	TEXTRON INC
2011	885184	THORN APPLE VALLEY
2721	887224	TIME INC
2711	887360	TIMES MIRROR CO-DEL
2911	891490	TOSCO CORP
2911	891508	TOTAL PETROLEUM OF
3911	892027	TOWN & COUNTRY CORP
2711	896047	TRIBUNE CO
3490	896678	TRINOVA CORP
4911	898813	TUCSON ELECTRIC POW
4932	902686	UGI CORP
2911	902905	USX-MARATHON GROUP
3270	903293	USG CORP
1311	904788	UNIMAR CO -LP

## Appendix B - continued

B: List of FV Test Sample

SIC	CUSIP	Company Name
3334	013716	ALCAN ALUMINIUM LTD
3089	042476	ARMSTRONG WORLD IND
2844	054303	AVON PRODUCTS
4813	05534B	BCE INC
1311	136420	CANADIAN OCCIDENTAL
8082	141661	CARE ENTERPRISE
4911	154051	CENTRAL MAINE POWER
7011	189470	CLUB MED INC
4922	190441	COASTAL CORP
4923	197648	COLUMBIA GAS SYSTEM
2860	227111	CROMPTON & KNOWLES
3443	234569	DALLAS CORP
2820	263534	DU PONT (E.I.) DE N
8700	264830	DUN & BRADSTREET CO
3861	277461	EASTMAN KODAK CO
5661	280875	EDISON BROTHERS
3621	291011	EMERSON ELECTRIC CO
3330	292845	ENGELHARD CORP
3760	368682	GENCORP INC
3600	369604	GENERAL ELECTRIC CO
5200	370064	GENERAL HOST CORP
2621	377316	GLATFELTER (P.H.) C
3330	453258	INCO LTD
2020	500755	KRAFT INC
5812	571630	MARRIOTT CORP
5812	580135	MCDONALDS CORP
4911	595832	MIDDLE SOUTH UTILI
2670	604059	MINNESOTA MINING &
5050	606827	NETSU & CO
2890	629853	NALCO CHEMICAL CO
2621	655422	NORANDA INC
1040	70556K	PEGASUS GOLD
2080	713448	PEPSICO INC
2834	717081	PFIZER INC
2000	718154	PHILIP MORRIS COS I
2911	718507	PHILLIPS PETROLEUM
2040	751277	RALSTON PURINA CO
3679	775133	ROGERS CORP
2621	809877	SCOTT PAPER CO
3674	827079	SILICONIX INC
5010	864078	SUBARU OF AMERICA
5140	867884	SUPER FOOD SERVICES
2821	905581	UNION CARBIDE

## Appendix B - continued

C: List of VF Matching Sample

SIC	CUSIP	Company Name
3630	963320	WHIRLPOOL
3861	984121	XEROX
7900	961815	WESTWOOD ONE INC
7830	001669	AMC ENTERTAINMENT INC
3334	013716	ALCAN ALUMINIUM LTD
5311	014752	ALEXANDER'S INC
8741	028882	AMERICAN PHYSICIANS
3270	030710	AMERON INC-DEL
3312	047483	ATHLONE INDS
5065	053807	AVNET INC
1389	055482	BJ SERVICES CO
3490	069567	BARTON INDUSTRIES INC
4924	072612	BAY STATE GAS
3841	075887	BECTON DICKINSON & CO
2221	077491	BELDING HEMINWAY
4813	079860	BELLSOUTH CORP
2621	097383	BOISE CASCADE CORP
5712	097924	BOMBAY CO INC
3824	103025	BOWMAR INSTRUMENT CORP
7389	123296	BUSINESS RECORDS HLDG
2711	154647	CENTRAL NEWSPAPERS
2090	170268	CHOCK FULL O NUTS CORP
4931	171794	CILCORP INC
4911	186108	CLEVELAND ELECTRIC
3711	194858	COLLINS INDUSTRIES INC
4924	195674	COLONIAL GAS CO
5051	201723	COMMERCIAL METALS CO
2011	205887	CONAGRA INC
3011	216831	COOPER TIRE & RUBBER
3823	218675	CORE INDUSTRIES INC
3490	224399	CRANE CO
6411	224633	CRAWFORD & CO -CL B
7510	228787	CRUISE AMERICA INC
3390	231561	CURTISS-WRIGHT CORP
3823	236235	DANIEL INDUSTRIES
2020	242361	DEAN FOODS CO
3523	244199	DEERE & CO
4512	247361	DELTA AIR LINES INC
2821	252165	DEXTER CORP
5311	254063	DILLARD DEPT STORES
3674	254543	DIODES INC
2621	257561	DOMTAR INC
3420	276317	EASTERN CO

## Appendix B - continued

C: List of VF Matching Sample

SIC	CUSIP	Company Name
4923	294549	EQUITABLE RESOURCES
4924	296772	ESSEX COUNTY GAS CO
3842	299767	EVEREST & JENNINGS
1531	304231	FAIRFIELD COMMUNITIES
3585	313135	FEDDERS CORP
2421	315712	FIBREBOARD CORP
2870	320891	FIRST MISSISSIPPI CORP
1731	337659	FISCHBACH CORP
2741	338892	FLEER CORP
4011	340632	FLORIDA EAST COAST INDS
7812	358616	FRIES ENTERTAINMENT INC
4841	363170	GALAXY CABLEVISION -LP
3561	384109	GRACO INC
5047	384632	GRAHAM FIELD HEALTH PDS
2800	390568	GREAT LAKES CHEMICAL
4512	404073	HAL INC
3621	423276	HELIONETICS
3241	436429	HOLNAM INC
5211	437076	HOME DEPOT INC
2911	440907	HORSHAM CORPORATION
8062	444859	HUMANA INC
2834	452454	IMCERA GROUP INC
2911	453038	IMPERIAL OIL LTD -CL A
4924	454707	INDIANA ENERGY INC
7370	458159	INTELOGIC TRACE INC
2086	462218	IONICS INC
3911	470760	JAN BELL MARKETING INC
4931	485314	KANSAS POWER & LIGHT
2330	488044	KELLWOOD CO
3540	489170	KENNAMETAL INC
3910	521078	LAZARE KAPLAN INTERNAT
5945	536257	LIONEL CORP
5099	538032	LIVE ENTERTAINMENT
2891	540137	LOCTITE CORP
3241	542290	LONE STAR INDUSTRIES
4213	551137	LYNCH CORP
2911	552078	LYONDELL PETROCHEMICAL
4932	552690	MDU RESOURCES GROUP INC
2060	552712	MEI DIVERSIFIED INC
3716	561208	MALLARD COACH CO
3290	565020	MANVILLE CORP
3760	573275	MARTIN MARIETTA CORP
2711	579489	MCCLATCHY NEWSPAPERS -CL A

## Appendix B - continued

C: List of VF Matching Sample

SIC	CUSIP	Company Name
2731	580645	MCGRAW-HILL INC
5311	587533	MERCANTILE STORES CO INC
3678	608554	MOLEX INC
2761	615785	MOORE CORP LTD
5122	615799	MOORE MEDICAL CORP
3350	624756	MUELLER INDUSTRIES
2911	626717	MURPHY OIL CORP
2670	631226	NASHUA CORP
3944	631724	NASTA INTERNATIONAL INC
5311	640204	NEIMAN-MARCUS GROUP INC
2711	650111	NEW YORK TIMES CO -CL A
2870	656531	NORSK HYDRO AS -ADR
4931	665772	NORTHERN STATES POWER-MN
3721	666807	NORTHROP CORP
4922	667748	NORTHWEST PIPELINE CORP
5940	688260	OSHMAN'S SPORTING GOODS
3711	693718	PACCAR INC
4812	695465	PAGE AMERICA GROUP
4922	698462	PANHANDLE EASTERN CORP
2834	698882	PAR PHARMACEUTICAL INC
3490	701094	PARKER-HANNIFIN CORP
6552	703365	PATTEN CORPORATION
3452	707389	PENN ENGINEERING & MFG CORP
5411	707832	PENN TRAFFIC CO
5311	708160	PENNEY (J.C.) CO
3330	717265	PHELPS DODGE CORP
4931	717537	PHILADELPHIA ELECTRIC CO
4924	720186	PIEDMONT NATURAL GAS CO
2430	729416	PLY-GEM INDUSTRIES
4833	741437	PRICE COMMUNICATIONS CORP
4923	748356	QUESTAR CORP
4812	749816	RACAL TELECOM PLC -ADR
3060	758819	REGAL INTERNATIONAL INC
2631	760473	REPUBLIC GYPSUM CO
3760	774347	ROCKWELL INTL CORP
2511	778204	ROSPATCH CORP-DEL
5651	778296	ROSS STORES INC
2631	790161	ST JOE PAPER CO
3674	816850	SEMTECH CORP
2911	822703	SHELL TRAN&TRADE -NY SH
5812	825039	SHONEY'S INC
5411	832388	SMITHS FOOD & DRUG -CL B
3420	833034	SNAP-ON TOOLS CORP

## Appendix B - continued

C: List of VF Matching Sample

SIC	CUSIP	Company Name
4922	835415	SONAT INC
4924	844030	SOUTHERN UNION CO-NEW
4512	844741	SOUTHWEST AIRLINES
2211	851783	SPRINGS INDUSTRIES -CL A
3714	853836	STANDARD PRODUCTS CO
2840	858586	STEPAN CO
2631	861589	STONE CONTAINER CORP
5072	866692	SUN DISTRIBUTORS -LP-CL A
2911	866762	SUN CO INC
5412	867830	SUNSHINE-JR STORES
5140	871829	SYSCO CORP
3812	878308	TECH-SYM CORP
3829	883559	THERMO INSTRUMENT SYSTEMS
1311	885148	THOR ENERGY RESOURCES INC
4922	893532	TRANSCO ENERGY CO
2670	894120	TRANZONIC COS
3330	894745	TREMONT CORP
1311	896750	TRITON ENERGY CORP
1311	91529H	UNOCAL EXPLORATION CORP
2834	915302	UPJOHN CO
4923	918906	VALERO NATURAL GAS PTNR -L
5734	920253	VALMONT INDUSTRIES
5211	929394	WABAN INC
2711	939640	WASHINGTON POST -CL B
4841	900262	TURNER BROADCASTING -CL A
4911	906548	UNION ELECTRIC CO
1381	909218	UNIT CORP
3724	913017	UNITED TECHNOLOGIES CORP
7373	913077	UNITED TOTE INC

## Appendix B - continued

D: List of FV Matching Sample

SIC	CUSIP	Company Name
4911	017411	ALLEGHENY POWER SYSTEM
4813	020039	ALLTEL CORP
3334	022249	ALUMINUM CO OF AMERICA
3679	051042	AUGAT INC
2670	053611	AVERY DENNISON CORP
5140	058459	BALFOUR MACLAINE CORP
2834	097516	BOLAR PHARMACEUTICAL CO INC
7900	102565	BOWL AMERICA INC -CL A
5812	109641	BRINKER INTL INC
1311	122014	BURLINGTON RESOURCES INC
2030	126149	CPC INTERNATIONAL INC
8700	126270	CRSS INC
2000	134429	CAMPBELL SOUP CO
5013	190345	COAST DISTR SYS
4923	209615	CONSOLIDATED NATURAL GAS CO
3460	216669	COOPER INDUSTRIES INC
5661	371532	GENESCO INC
2844	423236	HELENE CURTIS INDS
3089	452308	ILLINOIS TOOL WORKS
3674	460254	INTL RECTIFIER CORP
3829	457776	INSTRON CORP
5051	480827	JORGENSEN (EARLE M.) CO
2040	487836	KELLOGG CO
2621	494368	KIMBERLY-CLARK CORP
7011	504195	LA QUINTA MOTOR INNS
8082	531911	LIFETIME CORP
3621	559424	MAGNETEK INC
2911	565097	MAPCO INC
5812	571630	MARRIOTT CORP
3674	595112	MICRON TECHNOLOGY INC
2911	607059	MOBIL CORP
2890	619331	MORTON INTL INC
3443	624752	MUELLER (PAUL) CO
3640	637657	NATIONAL SERVICE INDS INC
4922	698462	PANHANDLE EASTERN CORP
3600	718337	PHILIPS N V -NY SHARE
3861	731095	POLAROID CORP
2821	747633	QUANTUM CHEMICAL CORP
2834	806605	SCHERING-PLOUGH
2080	811850	SEAGRAM CO LTD
5200	853156	STANDARD BRANDS PAINT CO
2860	858903	STERLING CHEMICALS INC
4911	872375	TECO ENERGY INC

## Appendix B - continued

D: List of FV Matching Sample

<b>SIC</b>	<b>CUSIP</b>	<b>Company Name</b>
2621	905530	UNION CAMP CORP
2820	949702	WELLMAN INC
4922	958255	WESTERN GAS PROCESSORS LTD

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