AN INVESTIGATION INTO THE EFFECTS OF FREQUENT TAX POLICY CHANGES ON FIRM RISK

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

Frequent changes in the tax laws have made estimates of the future returns from investment in a firm more uncertain. It is difficult, if not impossible, to predict what changes to the tax laws will be made in the future because the process is driven largely by political considerations. As a result of instability in the political process, major tax provisions have been enacted and repealed within the span of a few years. Since changes in the tax law can affect the cash flows of firms which in turn may affect the price of its stock [Madeo and Pincus, 1985], returns to investors may be affected. For example, one recent study indicated that the impact of recent changes brought about by the Tax Reform Act of 1986 should boost equity prices by ten to thirteen percent [Downs and Hendershott, 1987]. The difficulty in predicting tax changes and their effect on a firm's cash flows introduces another area of uncertainty to the estimation of potential returns on particular equity investments.

Tax changes do not impact all firms equally. Some tax changes are meant to have the greatest effect on one particular industry or group of industries. An example of this type of change was the repeal of the law that had previously allowed banks to use a unique and very favorable method of computing bad debt expense for tax purposes. Other tax changes may not be meant to target a specific industry or group of firms but nevertheless have a larger effect on the cash flows of some firms than those of other firms. This difference in effects might be the result of differences in the nature of the firms in question. For example, a change in depreciation rates would have a greater effect on the cash flows of capital-intensive firms than those of labor-intensive firms.

Unfortunately, the effects of tax changes that occur in one year may be wholly or partially offset by changes or reversals in tax policy in subsequent years. Such inconsistency makes it difficult to predict the effect of tax changes over the long run.

Research Objective

A firm's expected cash flows partially determine the prices and returns of that firm's stock [Fama, 1972]. If the cash flows of some firms are more affected by tax changes than those of others, then the prices of the stocks of the more affected firms are more affected by tax changes. Since the prices of stocks have an effect on the measures of systematic, unsystematic, and total risk, the following question arises: have the effects of recent tax changes on the cash flows of firms in the United States had any significant effect on the systematic, unsystematic, or total risk of stocks? If some firms have been more significantly affected by tax changes over the years than other firms, the changes may have had an effect on the risk of the firms most greatly affected (henceforth referred to as "tax-change-affected" firms).

This study examines the relationship between a history of frequent tax-change-induced cash flow changes and systematic, unsystematic, and total risk. Many previous studies have shown that individual tax changes can produce abnormal returns around certain announcement dates [Madeo and Pincus, 1985; Ayres, 1982]. These studies have not suggested that isolated instances of abnormal returns significantly affected the risk of the stocks, nor have they investigated this possibility. One study has investigated changes in risk levels concurrent with the dates of introduction and passage of a single law concerning regulation in the gas industry, rather than a tax change [Chandy and Davidson, 1986]. In that study no evidence of a significant shift in risk was found.

Rather than focus on a single regulatory change, as Chandy and Davidson [1986] did, this study examines the relationship between the cash flow effects on a firm of a number of tax changes and the riskiness of that firm's stock. Specifically, this research addresses the following research questions:

(1) Have the tax changes in recent years affected the total risk of the stocks of tax-change-affected firms?

(2) Have the tax changes in recent years affected the systematic risk of the stocks of tax-change-affected firms?

(3) Have the tax changes in recent years affected the unsystematic risk of the stocks of tax-change-affected firms?

These research questions all focus on the potential effects which a history of tax-induced changes in cash flows may have on the different measures used to assess the risk of a firm's stock.

The methodology by which these research questions were investigated can be summarized as follows. A sample of firms was chosen, and three cross-sectional stepwise regressions were run. The dependent variable in the first regression was the variance of returns, the dependent variable in the second regression was systematic risk, and the dependent variable in the third regression was unsystematic risk. The three regressions had a total of nine independent variables available for selection by the stepwise procedure. All but one of these variables have been shown in prior studies to be related to risk. The other variable, the ratio of property, plant, and equipment to total assets, was added to insure that the tax-change variables were not a proxy for the relative amount of property, plant, and equipment the firm possessed.

At this point outliers were excluded from the data set, and further regressions were run on the new data sets using the variables selected above, plus the tax-change variables. The exclusion of outliers had to be postponed until this point because the method used to select potential outliers [Belsley, Kuh, and Welsch, 1980] was dependent on the stability of the coefficients of the tax-change variables. The stepwise procedure, by limiting the number of variables in the final model, excluded several variables that were potentially collinear with the tax-change variables of interest. This collinearity between the tax-change variables and some of the variables excluded by the stepwise procedure could have made the coefficients in the model, and, therefore, also the identification of the outliers using the Belsley, Kuh, and Welsch method, less reliable.

The tax-change variables are measures of (1) the frequency of tax changes experienced by the firm in recent years, (2) the variability of the cash flow effect of recent tax changes, and (3) the effect of recent tax changes on the variance of cash flows. The hypotheses stated in Chapter III were then tested using the significance of the coefficients of the tax-change variables. The next section explains the importance of the research questions involved.

Importance of the Problem

A finding of a significant relationship between a history of frequent tax changes and risk is important for several reasons. First, it may aid in the estimation of the risk of a stock. As Foster [1986] points out, such estimates can be used (1) by investors in security investment decisions, (2) by managers in determining estimates of cost of capital for management decisions, and (3) by regulators to help establish allowable returns in rate regulation cases.

Second, the existence of a positive relationship between frequent tax changes and risk might be of interest to policy makers. Assuming that investors are risk averse and that increasingly frequent tax changes cause an increase in the risk of some firms relative to others, the stock prices of the affected firms are likely to be lower than they otherwise would be. This would result in a higher cost of capital for affected firms than unaffected firms. To the extent that the cost of capital has been raised, the affected firms would have to either pass such increases in cost on to consumers in the form of higher output prices (which would likely result in reduced demand for their products), or restrict expansion and production. Either of these alternatives would likely reduce the quantity of the firm's products consumed by society. In such a scenario, the relative frequency and variability of the cash-flow effects of tax changes affects the allocation of resources in the economy. If such an effect does exist, policy-makers should be made aware of it so that the impact of frequent changes in the tax law on resource allocation can be specifically considered when tax legislation is proposed.

The implications for policy-making of such a finding differ depending on which variable, the frequency of the tax changes or the magnitude of the effect of tax changes on the variability of a firm's cash flows, is found to be significantly related to the risk of stocks. If the frequency of tax changes is found to increase the risk of stocks, this might help persuade policy-makers to call for a moratorium on tax changes for a period of time. On the other hand, if the magnitude of the effect of tax changes on the variability of a firm's cash flows over time is found to be related to risk, this might help persuade policy-makers to make less drastic changes at any one time, or to allow for longer phase-in periods on the changes that they do make.

In summary, the overall objective of this study is to empirically evaluate if the effects of tax changes on the cash flows of a firm are related to the riskiness of that firm's stock. Prior research has shown that the variability of a firm's cash flows is related to the riskiness of its stock [Rosenberg and Guy, 1976]. Numerous changes in the tax laws could affect the variability of cash flows for those companies most affected by the tax changes, which in turn may affect their relative risk.

The remainder of this dissertation is separated into four chapters. Chapter II reviews the literature on (1) the determinants and measurements of risk and (2) the impacts of tax changes on the values of securities. Chapter III describes the theoretical framework underlying this research, the hypotheses that were tested, and the methodology used to test them. The results of the analysis are presented in Chapter IV. A summary of the conclusions of the study as well as the limitations appear in Chapter V.

CHAPTER II

REVIEW OF THE LITERATURE

The literature review is separated into two parts. In the first part, the empirical literature on the factors which affect risk are reviewed. The second part then reviews the empirical literature utilizing market information to study the effects of tax changes on security returns.

Determinants of Risk

This section begins with a brief discussion of the nature of risk in the context of financial investments and then reviews the literature on the factors that determine the risk of an investment. While there is no agreement in the financial community about exactly what risk is [Farrelly, Ferris and Reichenstein, 1985], there is general agreement that risk is associated with the degree of unpredictability of future returns[1] [Lorie and Hamilton, 1973]. Despite the disagreement in the financial community concerning the definition of risk, much of the literature about risk has focused on three interrelated measures of risk; systematic, unsystematic, and total risk [Foster, 1986].

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[1]Returns, for the purposes of this study, are calculated according to

$$r_t = [(P_t - P_{t-1} + D_t)/P_{t-1}],$$

where r_t is the monthly rate of return for a stock during period t, P_t is the price of the stock at the end of period t, and D_t is the dividend of the stock in period t.

Systematic risk is the covariability of the returns of an individual stock with the returns of the market. This covariability is generally operationalized as the covariance of the security's returns with the market returns, divided by the variance of the market returns [Foster, 1986]. In the market model (identified by equation (1), below) systematic risk is signified by the coefficient of R_{mt}. The market model is commonly identified as follows:

$$R_{it} = \alpha_i + ß_i R_{mt} + u_{it} \qquad (1)$$

where

R_{it} = return on security i over time period t;
R_{mt} = return on a market portfolio over time period t;
u_{it} = unsystematic or residual portion of the return of firm i over time period t;
α_i = intercept of linear relationship; and
$ß_i$ = slope of linear relationship.

Since systematic risk is usually measured using the coefficient of R_{mt}, or $ß_i$, a measurement of the systematic risk of a stock is often referred to as its "beta".

Unsystematic risk is a measure of the portion of a stock's price volatility that is not related to the movement of the market. It is operationalized as the variance of the residual in the market model, or $\sigma^2(u_{it})$ [Sharpe, 1964]. At the individual security level, it has been shown on average to account for 70% of the total variance in a security's return, while systematic risk accounts for the other 30% [Sharpe (1978)].

While unsystematic risk is less often the focus of study than total or systematic risk, Frankfurter and Booth [1985] have provided evidence of its importance in investment decisions. They ranked a total of 1,457 common stocks in descending order based on their level of unsystematic risk. From this ranking they separated the stocks into

15 different groups. Using the techniques developed by Markowitz [1952] and Sharpe [1963] they then selected a Markowitz-Sharpe efficient portfolio (MSEP) from each of the 15 groups of stocks.

Previous research [Frankfurter and Frecka, 1979] had shown that portfolios selected according to the Markowitz-Sharpe model outperform the "market portfolio" as measured by several of the more well known stock market indexes. The unsystematic risk of these "market portfolios" had been completely diversified away. For the MSEP's, on the other hand, it has been shown [Frankfurter, 1981] that unsystematic risk makes up at least 20 to 25 percent of total risk. To underscore the importance of unsystematic risk to MSEP's, it should be pointed out that the estimation of total risk, which includes both systematic and unsystematic risk, is necessary in the process of selecting MSEP's.

For these portfolios, Franfurter and Frecka found that the relationship between return (either ex ante or ex post) and unsystematic risk was actually stronger than the relationship between return and systematic risk. They also calculated the difference between expected (ex ante) return and actual (ex post) return. This difference was called the expectation bias. They found that the relationship between the expectation bias and unsystematic risk was also stronger than that between the expectation bias and systematic risk.

The total risk of a security is usually operationalized as the variance of the security's returns, or $\sigma^2(R_{it})$ [Sharpe, 1964]. Total risk is actually a function of systematic and unsystematic risk. The market model, as stated before, is as follows.

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it} \qquad (1)$$

The variance of a security's returns would be

$$\sigma^2(R_{it}) = \sigma^2[\alpha_i + \beta_i R_{mt} + u_{it}], \tag{2}$$

or

$$\sigma^2(R_{it}) = \sigma^2(\beta_i R_{mt}) + \sigma^2(u_{it}) \quad . \tag{3}$$

Moving the β_i outside the parentheses, the following is obtained;

$$\sigma^2(R_{it}) = (\beta_i)^2\sigma^2(R_{mt}) + \sigma^2(u_{it}) \quad . \tag{4}$$

The importance of any of these different types of risk to an investor considering a security as an investment generally depends on the level of diversification of the investor's portfolio. The additional risk undertaken by an investor who purchases a security is that security's contribution to the unpredictability of future returns associated with an individual's entire portfolio, or the overall portfolio risk [Dyckman and Morse, 1986]. The additional portfolio risk undertaken because of the purchase of an individual security depends in part on whether or not the portfolio is diversified. This relationship can be operationalized as [Sharpe,1964]:

$$\sigma^2(p_t) = [\sum_{i=1}^{n}(X_{it}\beta_i)^2]\sigma^2(R_{mt}) + \sum_{i=1}^{n}[X_{it}{}^2\sigma^2(u_{it})] \quad , \tag{5}$$

where p_t is the return of the entire portfolio of n securities during period t and X_{it} is the fraction of the entire portfolio accounted for by the investment in security i during period t. As the X_{it}'s become smaller (as the portfolio becomes more diversified) the far right term approaches zero, and the other term on the right side of the equals sign approaches the variance of the market returns.

As can be seen from equation (5), if an individual security is the only security in a portfolio, then X_{it} equals one, and the right side of equation (5) collapses to equal the right side of equation (4). In such a case, the left sides of the two equations would be equal, and the individual security's contribution to the investor's overall portfolio risk would be the total risk of the security. If, on the other hand, a portfolio is fully diversified, then the addition to the risk of the portfolio caused by the inclusion of an individual security in the portfolio is dependent on the covariability of the returns of the individual security with the returns of the market, or its ß.

Because of the importance of risk in the investment decision, there have been many attempts to model the risk of individual investments. While most of these studies have focused on systematic risk [Foster, 1986], several have attempted to model total risk [Ang, Peterson, and Peterson, 1985; Christie, 1982; Melicher, Rush, and Winn, 1976; Winn, 1977].

Various factors have been studied to determine the relationship between those factors and the systematic and total risk of investments in common stocks. Previous studies have used several different schemes to classify these factors. These factors can be categorized as follows: (1) firm-specific accounting-based variables [Ang, Peterson and Peterson, 1985; Beaver, Kettler, and Scholes, 1970; Ben-Zion and Shalit, 1975; Bildersee, 1975; Christie, 1982; Hamada, 1972; Logue and Merville, 1972; Melicher, 1974; Moyer and Chatfield, 1983; Patel and Olsen, 1984; Pettit and Westerfield, 1972; Rosenberg and McKibben, 1973; Turnbull, 1977; Winn, 1977], (2) other non-accounting firm-specific variables [Ang, Peterson and Peterson, 1985; Ben-Zion and Shalit, 1975; Fabozzi and Francis, 1979; Gordon, 1962; Lev, 1974; Mandelker and Rhee, 1984; Melicher, 1974; Melicher, Rush and Winn, 1976; Moyer and Chatfield, 1983; Patel and Olsen, 1984; Rosenberg and Mckibben, 1973; Winn, 1977], and (3) macroeconomic variables [Robichek and Cohn, 1974].

The accounting-based variables that have been investigated to determine their relationship to the systematic and total risk of a firm include (1) variability of earnings [Beaver, Kettler and Scholes, 1970; Bildersee 1975; Patel and Olsen, 1984; Rosenberg and McKibben, 1973], (2) accounting beta [Beaver, Kettler, and Scholes, 1970; Bildersee, 1975, Rosenberg and McKibben, 1973], (3) growth [Beaver, Kettler and Scholes, 1970; Bildersee, 1975; Logue and Merville, 1972; Moyer and Chatfield, 1983; Pettit and Westerfield, 1972; Rosenberg and Mckibben, 1973; Turnbull, 1977], (4) leverage [Ang, Peterson, and Peterson, 1985; Beaver, Kettler and Scholes, 1970; Bildersee, 1975; Ben-Zion and Shalit, 1975; Christie, 1982; Hamada, 1972; Logue and Merville, 1972; Patel and Olsen, 1984; Rosenberg and McKibben, 1973; Moyer and Chatfield, 1983], (5) firm size [Ang, Peterson, and Peterson, 1985; Beaver, Kettler and Scholes, 1970; Ben-Zion and Shalit, 1975; Fabozzi and Francis, 1979; Melicher, 1974; Moyer and Chatfield, 1983; Logue and Merville, 1972; Rosenberg and McKibben, 1973; Winn, 1977], and (6) dividend payout [Beaver, Kettler and Scholes, 1970; Logue and Merville, 1972; Melicher, 1974; Rosenberg and McKibben, 1973; Pettit and Westerfield 1972; Moyer and Chatfield, 1983]. Any association between these variables and total, systematic or unsystematic risk supports the hypothesis that accounting-based data reflect the underlying characteristics of the firm which determine risk [Beaver, Kettler and Scholes, 1970].

All of the above variables can be viewed as measures that attempt to indicate some aspect of the total expected variability of the firm's future stream of cash flows. Since the firm's cash earnings can be derived from accounting earnings by adjusting for depreciation and similar accounting variables [Fama and Miller, 1972], the firm's earnings variability should be related to the firm's cash flow variability, and therefore its variability of returns. Rosenberg and McKibben [1973] found that earnings variability was, in fact, related to variance of returns, or total risk.

While there is no direct relationship between the variability of a firm's earnings and systematic risk, Bowman [1979] showed analytically that there should be an indirect relationship between these two measures. Confirming Bowman's analytical work, empirical studies have consistently found a significant relationship between the variability of the firm's earnings and the magnitude of the systematic risk of the firm's stock [Beaver, Kettler and Scholes, 1970; Bildersee 1975; Patel and Olsen, 1984; Rosenberg and McKibben, 1973]. Since the variability of both corporate earnings and corporate cash flows can be affected by tax changes, a relationship may exist between the risk of a firm and the history of tax changes which affect it's cash flows.

The relationship between accounting beta (the covariability of reported earnings with the reported earnings of a market portfolio) and systematic risk is dependent on the relationship between the firm's earnings and the earnings of the market as a whole. Theoretically, the more closely a firm's earnings mirror the earnings of a market portfolio, the more closely its price fluctuations should mirror those of the market portfolio. Two previous studies have found a significant correlation between accounting beta and systematic risk [Beaver, Kettler, and Scholes, 1970; Bildersee, 1975]. While Rosenberg and McKibben [1976] did not find a significant relationship between systematic risk and accounting beta, they did find a significant relationship between total risk and accounting beta. However, the model in which Rosenberg and McKibben found no significant relationship between accounting beta and systematic risk had 31 other variables, so it is possible that collinearity with one of these other variables caused the accounting beta coefficient to appear insignificant.

The relationship between growth and systematic risk is the subject of some disagreement. Growth is usually defined as the change in sales, earnings, or assets from year to year. According to analytical work by Turnbull [1977], growth should be negatively correlated with systematic risk. One of Turnbull's assumptions was that the expected growth of a firm's cash flows are constant. This assumption is contrary to the theoretical analysis used by Beaver, Kettler and Scholes [1970], as explained below, and might explain why the two studies came to different conclusions as to the theoretical relationship between growth and risk. Turnbull's study was strictly analytical, and did not attempt to empirically verify the proposed relationship between growth and systematic risk.

Beaver, Kettler and Scholes [1970] hypothesized that growth should be positively correlated with systematic risk. Their basis for this position was that high growth is associated with areas of the economy where high levels of profit are expected. Presumably, large expected profits provide incentives to invest, which in turn result in a high growth rate. Where there are larger than normal profits and no significant barriers to entry in the market, more firms will enter the market to take advantage of these abnormal profits. Output will increase, forcing prices and the level of profits down. Because of this process, Beaver, Kettler and Scholes argue that streams of excessive earnings are more uncertain than the "normal" earnings streams of other firms, and the stock of higher-growth firms is thus riskier than that of lower-growth firms.

When growth is measured in terms of the change in the amount of assets, the evidence has sometimes shown a significant relationship between growth and systematic risk [Beaver, Kettler and Scholes, 1970; Bildersee, 1975]. Where growth is measured in terms of changes in sales or earnings per share, the results are also varied, with some studies finding a significant relationship [Rosenberg and McKibben, 1973; Moyer and Chatfield, 1983] and others finding no evidence of a relationship [Pettit and Westerfield, 1972; Logue and Merville, 1972]. Rosenberg and McKibben [1973] also found no significant relationship between growth (in sales and earnings per share) and total risk.

The relationship between leverage and systematic risk has been the subject of a large amount of research, both theoretical and empirical. Analytical research has indicated that as debt is introduced, the future cash flows to equity holders become more variable [Modigliani and Miller, 1958]. The empirical literature is virtually unanimous in its finding of a significant positive relationship between leverage and systematic risk [Beaver, Kettler and Scholes, 1970; Bildersee, 1975; Patel and Olsen, 1984; Ben-Zion and Shalit, 1975; Hamada, 1972; Logue and Merville, 1972; Rosenberg and McKibben, 1973; Moyer and Chatfield, 1983]. A significant relationship between leverage and total risk has also been found by researchers [Ang, Peterson, and Peterson, 1985; Rosenberg and McKibben, 1973].

The analytical arguments supporting the existence of a relationship between firm size and risk are based on evidence that indicates that the default risk of large firms is generally less than that for small firms. Presumably, if returns for individual investments are not perfectly correlated, the cash flows of larger firms (with a greater number of investments) will have a lower variance than the cash flows of smaller firms. If the investment returns are independent, the variance of the overall returns will decrease proportionally as size increases [Beaver, Kettler and Scholes, 1970].

The empirical results of investigations of the relationship between firm size and systematic risk have also been mixed. When firm size is measured as the natural logarithm of the assets of the firm, most researchers have found a significant relationship between size and systematic risk [Ang, Peterson, and Peterson, 1985; Melicher, 1974; Logue and Merville, 1972], but some have not [Beaver, Kettler and Scholes, 1970; Moyer and Chatfield, 1983]. Research has also shown a significant relationship between firm size, measured as total assets, and total risk [Ang, Peterson, and Peterson, 1985; Rosenberg and McKibben, 1973; Winn, 1977].

When size is measured by the natural logarithm of sales and systematic risk is the dependent variable, the size variable has generally been found to be insignificant [Ben-Zion and Shalit, 1975; Fabozzi and Francis, 1979; Moyer and Chatfield, 1983]. If size is measured by the market value of the firm's equity, it has also been found to be unrelated to systematic risk [Bildersee, 1975]. Based on the empirical evidence to date, the relationship between systematic risk and the natural logarithm of total assets is stronger than the relationship between systematic risk and either total sales or the market value of the firm's equity.

Dividend payout has also been investigated as being related to systematic and total risk. Because of aversion to reducing the dividend, management presumably sets the dividend so that there is a low probability of earnings ever falling below the dividend level. If this scenario is realistic, then the dividend is a surrogate for management's assessment of the lower range of earnings [Beaver, Kettler, and Scholes, 1970; Petit and Westerfield, 1972]. The empirical literature has largely supported the existence of a negative relationship between systematic risk and dividend payout [Beaver, Kettler and Scholes, 1970; Melicher, 1974; Pettit and Westerfield 1972; Moyer and Chatfield, 1983]. However, there have been systematic risk studies that found the dividend payout ratio to be insignificant [Logue and Merville, 1972; Rosenberg and McKibben, 1973]. The one study that investigated the relationship between total risk and the dividend payout ratio found the relationship to be significant [Rosenberg and McKibben, 1973].

Other studies have attempted to determine if systematic and total risk are related to other non-accounting firm-specific variables. These variables include: (1) market activity [Ben-Zion and Shalit, 1975; Melicher, 1974; Patel and Olsen, 1984], (2) dividend record [Ben-Zion and Shalit, 1975; Fabozzi and Francis, 1979; Gordon, 1962], (3) the industry in which the firm operates [Fabozzi and Francis, 1979], (4) market concentration [Melicher, Rush, and Winn, 1976; Moyer and Chatfield, 1983; Winn, 1977], and (5) operating leverage [Ang, Peterson, and Peterson, 1985; Lev, 1974; Mandelker and Rhee, 1984].

The theoretical relationship between market activity and risk is not clear-cut. Patel and Olsen [1984] suggest that marketability refers to the availability of willing buyers at near the current market value. If a security is highly marketable, an investor should be able to sell his investment in that security without large reductions in price. Patel and Olsen suggested that the more marketable a security is, the less variable the capital gain portion of the investor's return would be. They therefore expected to find an inverse relationship between systematic risk and marketability.

Ben-Zion and Shalit [1975], on the other hand, maintain that a high level of trading activity reveals that investor's expectations with respect to the distribution of future stock returns are very diverse. They theorized that this diversity of opinion causes higher trading intensity, and that as a consequence there should be a relationship between the uncertainty with respect to future returns, or risk, and the trading intensity of a given stock.

The stock turnover ratio (shares traded divided by shares outstanding) has been used as a surrogate for both marketability and trading activity. Melicher [1974], looking strictly at electric utilities, found a significant positive relationship between systematic risk and stock turnover. Other studies have found the relationship to be insignificant [Patel and Olsen, 1984].

Several links between risk and the dividend record, or the number of years the firm has maintained uninterrupted dividend payments, have been suggested. First, various studies have shown that firms' dividend payments are significantly related to earnings stability [Gordon, 1962]. Second, a firm's dividend record may reflect its growth and expansion plans, since growth can be financed with earnings retained in the business instead of paid out in dividends. Third, the length of continuous dividend payments is often reflective of the age of the firm, which may be interpreted as an indication of the strength of established market positions [Fabozzi and Francis, 1979]. The studies that have been done concerning dividend record have indicated that it is inversely related to the risk of the firm [Ben-Zion and Shalit, 1975; Fabozzi and Francis, 1979]. However, these studies have omitted from their models other important variables, such as size (measured by total assets), dividend payout ratio, and earnings variability, for which the dividend record might be a proxy.

The industry in which the firm operates could theoretically be related to the expected variability of future cash flows through the growth, leverage and size factors. These variables could, in turn, be related to the industry of the firm. The growth of the firm could be dependent on the industry in which it competes [Fabozzi and Francis, 1979]. Also, competitive conditions in a particular industry could cause the firms within that industry to have similar leverage ratios and be of similar size.

Thus, the characteristics of a firm could be related to its industry affiliation. Since risk has been shown to be dependent on the characteristics of a firm, it follows that there could be a relationship between industry affiliation and risk. Fabozzi and Francis did find, for a few industries, a relationship between the industry in which a firm operates and the systematic risk of the firm. However, the model they used contained only two significant variables other than the industry-specific binary variables, indicating that their model might have been misspecified (that is, lacking some significant variables). For the few industries for which a significant relationship between systematic risk and the industry of the firm was found, the binary (dummy) industry variable might have been a proxy for a missing variable or set of variables.

The number of competitors in the market in which a firm operates is thought to be linked to the risk of the firm because of the use of limit pricing as a barrier to entry in concentrated industries. Under limit pricing, prices are adjusted to maximize profits, but such price adjustments are subject to the constraint that prices be kept low enough to discourage entry into the market by new competitors. When limit pricing is used, unfavorable market shocks can be passed along to the customers, but favorable market shocks are likewise passed to the customers since the price must be kept low to discourage entry by competitors. The net effect is that risk tends to be borne by the firm's customers through price variation rather than by its creditors and owners through profit (and cash flow) variation. Evidence indicating an inverse relationship between market concentration and systematic risk has been found [Moyer and Chatfield, 1983]. Studies have also shown a relationship between market concentration and total risk [Melicher, Rush, and Winn, 1976; Winn, 1977].

Operating leverage is the ratio of fixed to variable costs [Foster, (1986)]. If fixed costs are higher relative to variable costs, the firm has less flexibility, and will be less able to adapt to changing conditions. If the economy is healthy and sales increase, fixed costs per unit will decrease, and profit per unit should also increase. On the other hand, if the economy is not healthy and sales decrease, fixed costs per unit will increase, and profit per unit will decrease. This behavior tends to exaggerate the earnings swings of firms with higher operating leverage, and thus increase both systematic and total risk.

Lev [1974] found a significant relationship between operating leverage and both systematic and total risk, but operating leverage was the only variable in Lev's model, and he only investigated companies in three industries. Mandelker and Rhee [1984] only found a significant relationship between operating leverage and systematic risk, and this finding of significance was dependent upon the manner in which the stocks were segregated into portfolios. Additionally, the sample in the Mandelker and Rhee study was made up of only manufacturing firms, and financial leverage was the only other variable in the model used, so the model might have been misspecified. Ang, Peterson, and Peterson [1985] used a model with four variables besides the operating risk variables, and selected their sample from all non-regulated industries. They found no consistent relationship between operating leverage and either systematic risk or total risk.

There has also been an attempt to relate the risk of firms to macroeconomic variables. Robichek and Cohn [1974] showed in their theoretical analysis that it was likely that the risk of a firm would change with changes in macroeconomic variables. After considering the alternatives, they decided to limit the variables studied to the rate of inflation and the rate of real growth of the economy. Their empirical tests indicated that the systematic risk of a small number of firms does depend, over time, on the rate of inflation and the rate of real growth in the economy.

For some of the above variables, the empirical support for a relationship with either total or systematic risk is unanimous, and there were no questionable methodological issues associated with the studies that investigated them. These variables were earnings variability [Beaver, Kettler and Scholes, 1970; Bildersee 1975; Patel and Olsen, 1984; Rosenberg and McKibben, 1973], leverage [Beaver, Kettler and Scholes, 1970; Bildersee, 1975; Patel and Olsen, 1984; Ben-Zion and Shalit, 1975; Hamada, 1972; Logue and Merville, 1972; Rosenberg and McKibben, 1973; Moyer and Chatfield, 1983], and market concentration [Melicher, Rush, and Winn, 1976; Moyer and Chatfield, 1983; Winn 1977].

For some other variables, the preponderance of the evidence indicates that there is a relationship between these other variables and total or systematic risk, and the studies involved also had no unresolved methodological issues. These variables were accounting beta [Beaver, Kettler and Scholes, 1970; Bildersee, 1975; Rosenberg and McKibben, 1973], growth [Beaver, Kettler and Scholes, 1970; Bildersee, 1975; Logue and Merville, 1972; Pettit and Westerfield, 1972; Moyer and Chatfield, 1983; Rosenberg and McKibben, 1973], asset size [Ang, Peterson, and Peterson, 1985; Beaver, Kettler and Scholes, 1970; Logue and Merville, 1972; Moyer and Chatfield, 1983; Rosenberg and McKibben, 1973], and dividend payout ratio [Beaver, Kettler and Scholes, 1970; Logue and Merville, 1972; Moyer and Chatfield, 1983; Rosenberg and McKibben, 1973].

The evidence outlined above indicates that all of the above variables should be considered when risk is being modeled. For other variables the evidence of a relationship with risk is mixed or inconclusive. Different studies have found the relationship between stock turnover and systematic risk to be significant [Melicher, 1974] and insignificant [Patel and Olsen, 1984]. As indicated previously, Melicher's findings are of questionable generalizability since his entire sample consisted of electric utilities.

The conclusions of the studies finding a positive relationship between systematic risk and dividend record [Ben-Zion and Shalit, 1975; Fabozzi and Francis, 1979] are also questionable. These studies used at most two variables other than dividend record in their models, so the models might have been misspecified. Specifically, their models did not include variables such as size, earnings variability, or dividend payout ratio, variables for which the dividend record might be a proxy.

The one study that investigated the effect of the industry of the firm on systematic risk also used a model with only three variables, leaving out asset size, industry concentration, earnings variability, and several other variables mentioned previously for which industry could be a proxy [Fabozzi and Francis, 1979]. Operating leverage is another variable which some studies found to be significantly related to systematic risk in models with a very limited number of variables [Lev, 1974; Mandelker and Rhee, 1984]. However, when variables such as size, dividend payout ratio, and financial leverage were included in the model being used, operating leverage was found to be insignificant [Ang, Peterson, and Peterson, 1985]

The literature reviewed above indicates that many variables have been investigated to determine if they are significantly related to risk. Some have been found to be significantly associated with total and/or systematic risk, while others have not. The evidence indicates a significant relationship between total and/or systematic risk and earnings variability, accounting beta, growth, financial leverage, size (measured as total assets), dividend payout ratio, and market concentration. In general, these variables have been thought to affect risk through their effect on the variability of cash flows. The propensity of some firms to be more greatly affected by tax changes is another variable that might affect the variability of cash flows, and thus risk.

Studies Utilizing Market Information to Test Tax Effects

For a history of frequent tax changes to influence the risk of stocks it is necessary for a history of tax changes to have affected the prices, and thus the returns, of stocks. This is because the measures of total, systematic, and unsystematic risk are dependent on returns (see equations 2 through 4), and returns are dependent on prices (see footnote 1). Only one study, Chandy and Davidson [1986], has investigated the effect on risk of changes in the law. They used a dummy variable regression model to investigate whether or not the introduction or passage of the Natural Gas Policy Act caused any significant shift in the systematic risk of natural gas firms, but found no evidence of such a shift. They also used security price movement information in their study of the effects of deregulation of natural gas on the returns and risk of stocks in the natural gas industry. Their investigation of the abnormal and cumulative abnormal returns on or near the event dates revealed no significant stock price reaction to the introduction or the passage of the Natural Gas Policy Act.

While only one study [Chandy and Davidson, 1986] has investigated the effect of tax or other law changes on the risk of stocks, various other studies have used financial market information to investigate the effects of tax changes on the values and returns of stocks. Although he used no empirical data to demonstrate the technique, Schwert [1981] recognized and expanded on the possible uses of security price information in the evaluation of the effects of unanticipated changes in regulation.

Schipper and Thompson [1983] investigated the market reaction to both regulatory and tax changes. They investigated the impact on merger-engaged firms of the Williams Amendments to the securities laws, the 1969 Tax Reform Act, Accounting Principles Board (APB) Opinions 16 and 17, and the SEC's segment disclosure rules. Investigating abnormal returns calculated using a generalized least squares procedure, they found that the Williams Amendments and the 1969 Tax Reform Act had a significant effect on the returns of companies engaged in merger activity. The effects on the returns of such firms of APB Opinions 16 and 17 and the SEC's segment disclosure rules were found to be insignificant.

Other studies have dealt specifically with market reactions to actual tax changes. Bathke, Rogers, and Stern [1985] analyzed the impact of four tax acts on "flower" bond[2] prices using a capital markets methodology. The cumulative abnormal returns of these flower bonds on the dates surrounding certain tax acts were studied. The results indicated that tax-induced market reactions did take place.

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[2]"Flower" bonds are bonds for which there are special estate tax advantages upon the death of the owner.

However, results concerning the commencement dates of the market reactions were mixed.

Rather than focus on a change in the statutory tax laws, Madeo and Pincus [1985] examined the market reactions to changes in Internal Revenue Service procedural guidelines. They investigated the effect of the issuance and subsequent recall of Revenue Procedure 80-55 on the stock price movements of a selection of banks [Madeo and Pincus, 1985]. Because all of the stocks were in the same industry, it was necessary to use a seemingly unrelated regressions approach to identify effects. Unlike similar event studies, it was possible to estimate the direct cash flow effect of the announcements. In fact, the "bad news" announcements were only detectible when the magnitude of the direct cash flow impact was included in the model. The effects of the "good news" announcements were detectible whether the magnitude of the direct cash flow impact was included in the model or not.

The seemingly unrelated regressions approach was also used by Manegold and Karlinsky [1988] to study the effects of changes to the tax laws concerning the advantageous treatment of revenues generated by possessions corporations (i.e., corporations doing business in Puerto Rico). They found that for companies that owned these possessions corporations there were significant market reactions to the legislative progress of these changes at three critical dates. These three dates corresponded to the passage of related changes by the Senate Finance Committee, the full Senate, and a Joint Conference Committee. Manegold and Karlinsky also used the residuals of the seemingly unrelated regressions to estimate the total impact of the changes on the market value of the effected companies. They found that this estimated impact on market value was fairly close to the present value of the additional tax revenue estimated by the Treasury to result from these changes.

Market reactions to changes in the tax laws concerning percentage depletion and the investment tax credit have also been investigated. Lyon [1986] investigated the abnormal returns of stocks in connection with the 1969 reduction in the percentage depletion allowance and the four changes in the investment tax credit from 1966 to 1971. He found significant declines in the value of oil companies at the time of Congressional action on percentage depletion. Further, a significant association between increases in the share value of firms and their expected receipt of investment credits was found. Ayres [1982] had previously found a statistically significant association between abnormal security price performance and the level of tax credit benefit received or lost as a result of the above legislation.

The effects on stock prices of the passage of the safe harbor rules for leases under the Economic Recovery Tax Act of 1981 have been investigated by Owers and Rogers [1985] and by Shaw [1986]. In both of these studies, the returns of a sample of firms that announced participation in safe harbor lease transactions during 1981 were investigated for evidence of any abnormality over the period in which the safe harbor lease transaction was announced. Both studies found a negative price reaction near the announcement date for the lessors (buyers). While Shaw found positive abnormal returns for the lessees (sellers) near the announcement date, Owers and Rogers found no evidence of abnormal returns near that date for the lessees.

Market reactions to tax law changes brought about by court decisions have also been studied. The impact on stock returns of the

Supreme Court decision prohibiting the use of the lower of cost or market method of valuing excess inventories was investigated by Wilkie [1984]. Using questionnaires to obtain confidential tax return information, this study found that firms affected by the mandated change in tax accounting methods suffered statistically significant declines in value relative to similar, but unaffected firms.

The market effects of the removal of the withholding tax on interest paid by Canadian corporations to non-Canadian debt holders was studied by Brean [1984]. The effects of this 1975 change were studied by investigating the differentials in the U.S. and Canadian yields for corporate and government bonds. The Canadian corporate/government bond yield differential dropped significantly after the repeal of withholding, indicating that the original provision had increased the cost of capital for Canadian firms.

The effect of the Tax Reform Act of 1986 on the valuation of equity securities has been estimated using a cash flow model. One factor in this analysis was that the elimination of the investment tax credit and the lengthening of depreciation periods favors existing investment over new investment. From the cash flow model it was estimated that stock prices would increase by ten to thirteen percent because of the 1986 Act [Downs and Hendershott, 1987]

The literature reviewed in this chapter indicates that a large number of factors have been investigated to determine their impact on the risk of stocks. The literature also shows that an individual tax change can have a significant effect on the prices of stocks affected by the tax change. In fact, the literature shows that even the passage of a change by a Congressional committee or the news that a change is contemplated by policy makers can have a significant effect on the prices of stocks affected by the change. Given the potential stock price effects of individual tax changes, it seems possible that if some firms have been more frequently affected by tax changes, or if tax changes have had a more variable effect on the cash flows of some firms than others, the returns of the more affected firms might be significantly riskier than the returns of the less affected firms. However, there is an absence of research into the relationship between the frequency and the variability of the cash flow effects of tax changes and the concurrent levels of risk of individual stocks.

The theoretical framework underlying this research and the methodology used to test the hypotheses are explained in the next chapter.

CHAPTER III

HYPOTHESES AND METHODOLOGY

Development of Hypotheses

As explained in Chapter II, tax changes can have an effect on the returns of stocks. A history of tax changes might therefore have an effect on a stock's measures of total, unsystematic, or systematic risk, since these measures are dependent on the returns to a stock.

The Effects of a History of Tax Changes on Unsystematic and Total Risk

Unsystematic risk is operationalized as the variance of the error term in the market model. As given in Chapter II, the market model is commonly identified as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it} \quad , \tag{1}$$

where,

R_{it} = return on security i during time period t;
R_{mt} = return on a market portfolio during time period t;
u_{it} = unsystematic or residual portion of the return of security i during time period t;
α_i = intercept of linear relationship; and
β_i = slope of linear relationship.

Unsystematic risk is a measure of the portion of a stock's price volatility that is not related to the movement of the market. It is operationalized as the variance of the residual in the market model, or $\sigma^2(u_{it})$ [Sharpe, 1964]. It follows that any factor that increases the deviation of a stock's returns from a linear correlation with the movement of the market returns increases unsystematic risk. Thus, any factor that causes price movements which are independent of the market movement should increase unsystematic risk. These stock price changes can occur when new information, in this case concerning the possible effect of tax changes on the firm's cash flows, becomes available [Ball and Brown, 1968]. There are four stages at which such new information might produce relatively greater price changes for tax-change-affected firms.

First, when economic and political developments indicate that a tax change is probable, the stock prices of tax-change-affected firms should show more movement than non-tax-change-affected firms as a tax change becomes likely. Investors are likely to anticipate that firms affected by tax changes in the past will be affected by a likely, but as yet unknown, future tax change.

Second, the stock prices of tax-change-affected firms might show additional movement when actual proposals to change the tax laws are introduced in the legislative process. If these proposals are not in line with investors' previously formed tax-change expectations, there should be a readjustment of expectations with respect to the future cash flows of the firm. This readjustment should be accompanied by a change in the price of a firm's stock. In fact, such a price change has been found in response to the news that a tax change was merely being considered [Madeo and Pincus, 1985]. To the extent that tax changes continue to be concerned with the same items (e.g., depreciation, investment tax credit, tax rates, etc.) proposals should continue to have a greater impact on the stock prices of tax-change-affected firms than non-affected firms.

Third, the actual passage of legislation and the resulting reduction of uncertainty about the tax change may cause greater changes in the stock prices of tax-change-affected firms than in the prices of other firms. If investors are significantly uncertain about the final form of a tax act or the probability that a tax act will become law, then passage of the tax act should reduce that uncertainty and change investor expectations with respect to the future cash flows of a firm. Such a change in investor expectations should cause a change in the price of the stock. Numerous studies have found a significant market reaction to the passage of new tax laws [Ayres, 1982; Schipper and Thompson, 1983; Madeo and Pincus, 1985].

Fourth, the stock prices of tax-change-affected firms might experience additional adjustments when the financial statements following the change are disclosed and it becomes clearer what the actual impact of the change on the cash flows of the firm are. If the actual cash-flow impact of a change is different from the impact expected based on the law that was passed, the stock price should change. If the stock prices of tax-change-affected firms are affected at one or more of the four stages described, then the variance of the error terms in the market model will be greater for these firms than for non-affected firms, all other things being equal.

Tax changes can cause abrupt changes in the level of a firm's cash flows, which in turn should affect a firm's stock price, thereby causing returns to vary independently of the market returns. In fact, the relative magnitude of tax-change-induced changes in the levels of cash flows has been shown to be associated with the relative magnitude of related stock price changes [Madeo and Pincus, 1985; Manegold and Karlinsky, 1988]. It is also possible that the tax changes may have simply made the cash flows of the firm more variable. Since additional variability of the firm's cash flows should increase the variability of the stock price, unsystematic risk may be affected via this relationship.

Total risk, as discussed in the literature review, is dependent on both systematic and unsystematic risk, and any of the factors that affect either systematic risk or unsystematic risk also may affect total risk. Thus, tax changes may affect total risk through their effect on systematic or unsystematic risk. Since the frequency and the variability of the tax-change-induced cash flow changes can affect unsystematic risk, they can also affect total risk.

Although total risk is a function of unsystematic risk, the level of assurance (as measured by the p value) that there is a relationship between tax changes and unsystematic risk is not necessarily the same as the level of assurance that there is a relationship between tax changes and total risk. Total risk is a function of systematic risk and unsystematic risk. If there is strong evidence (as measured by the p value) of a relationship between tax changes and systematic risk, the evidence of a relationship between tax changes and total risk could also be strengthened. On the other hand, if the evidence of a relationship between tax changes and systematic risk is very weak, it could further weaken the evidence of a relationship between tax changes and total risk. The hypotheses to be tested should therefore indicate the investigation of the relationships between tax changes and total risk as well as unsystematic risk.

It is possible that unsystematic and total risk are related independently to the frequency of these tax changes, regardless of the variability of the cash flow effects resulting from tax changes. Therefore, the following sub-hypotheses (stated in the null form) were tested:

$H1.00_o$: The relative frequency of tax changes to firms is not related to the unsystematic risk of stocks.

$H1.01_o$: The relative frequency of tax changes to firms is not related to the total risk of stocks.

On the other hand, it is also possible that the unsystematic and total risk of stocks are affected independently by the variability of the effects on firms' cash flows of tax changes, regardless of the frequency of the tax changes. Consistent with this possibility, the following sub-hypotheses (stated in the null form) were tested:

$H1.10_o$: The relative variability of tax-change-induced cash flow changes is not related to the unsystematic risk of stocks.

$H1.11_o$: The relative variability of tax-change-induced cash flow changes is not related to the total risk of stocks.

It is also possible that the unsystematic and total risk of stocks is affected jointly by the frequency and the variability of the effects of tax changes on a firm's cash flows. To investigate this possibility, the following sub-hypotheses (stated in the null form) were tested:

$H1.20_o$: The relative frequency and variability of tax-change-induced cash flows to firms are not related to the unsystematic risk of stocks.

H1.21$_o$: The relative frequency and variability of tax-change-induced cash flows to firms are not related to the total risk of stocks.

If the null hypothesis of no significance were rejected, it would indicate that there is a relationship between the relative frequency and variability of the effects of tax changes on firms' cash flows and the unsystematic and total risk levels of individual companies.

The previous sub-hypotheses concerning variability have focused on possible relationships between total or unsystematic risk and the variability of the cash flow changes caused by tax changes. As indicated in Chapter II, the unsystematic and total risk of a firm should also be affected by the overall variability of its total cash flows. By affecting the variability of a firm's cash flows, tax changes could also affect the total and unsystematic risk of a firm's stock. To investigate this possibility, the following null hypotheses were tested:

H2.0$_o$: The effects of tax-change-induced cash flow changes on the variability of firms' cash flows are not related to the unsystematic risk of stocks.

H2.1$_o$: The effects of tax-change-induced cash flow changes on the variability of firms' cash flows are not related to the total risk of stocks.

The Effect of a Pattern of Tax Changes on Systematic Risk

The theoretical support for a relationship between a history of frequent tax-change-induced cash flow changes and systematic risk is somewhat different than that discussed in the preceding section for unsystematic and total risk. A history of tax changes might affect the variability of a firm's cash flows, but there is no direct relationship between variability in cash flows at the firm level and the systematic risk of the firm's stock [Bowman, 1979]. However, Bowman [1979] indicates that there are numerous ways of showing a positive but <u>indirect</u> relationship between the variance of the firm's earnings and the systematic risk of the firm's stock.

Since firms' earnings changes and firms' cash flow changes are very highly correlated [Beaver and Dukes, 1972], there should also be a positive, although indirect, relationship between variance in the firm's cash flows and the systematic risk of its stock. Thus, to the extent that a history of frequent tax-change-induced cash flow changes has increased (decreased) the variance of a firm's cash flows relative to other firms, it should also have increased (decreased) the systematic risk of its stock.

By affecting the overall variability of firms' cash flows, a history of tax changes could be related to the systematic risk of stocks. To test for such a relationship, the following null hypothesis was tested:

> $H3.0_o$: The effects of firms' tax-change-induced cash flow changes on the variability of firms' cash flows are not related to the systematic risk of stocks.

As indicated in this section, it is possible that tax changes could affect total, systematic and unsystematic risk. Total and unsystematic risk might be affected by the frequency or variability of tax changes, as well as the effect of tax changes on cash flow variability. Systematic risk could also be affected if tax changes cause a change in cash flow variability. The manner in which these relationships were investigated is explained in the next section.

Methodology

A sample of firms was selected and the cash flow effects of recent tax acts on these firms was modelled. Systematic, unsystematic, and total risk measures were computed for each of the sample firms. These measures were each used as dependent variables in separate regression models. The possible independent (explanatory) variables in the models were earnings variability, accounting beta, growth, financial leverage, size (measured as total assets), dividend payout ratio, market concentration, and the property, plant and equipment to total assets ratio.

The variables from the above group that were ultimately included in the final models were selected using a stepwise regression procedure. Outliers were then excluded, and the tax-change variables were added to the models. The effects of tax changes on the total, systematic, and unsystematic risk measures was then evaluated, based on the regression results.

The Sample

To choose a sample, a listing of the companies that were on the Compustat data base for every year from 1975 to 1988 was obtained. The fourteen-year period from 1975 through 1988 was used in this study for three reasons: (1) prior to 1975 there were relatively few "major" tax acts, so the 1975-88 period encompasses years with a relatively higher concentration of tax changes, (2) more 10-K reports are generally available for this period, so the finer APB Opinion No. 11 - mandated disclosures are obtainable for this period, and (3) it is possible that tax changes made before 1975 (there were no major tax acts from 1971 through 1974) are now largely ignored by the investment community and are irrelevant to the investment decisions made today.

A random sample of 110 firms was originally taken from this Compustat list. As the data was collected for these firms, it became apparent that many of them would have to be dropped because of the unavailability of certain information necessary to estimate the effect of the tax changes in question. At a minimum, an amount for capital expenditures and a figure for the equipment/total property, plant and equipment ratio for the industry was necessary to estimate the cash flow effects of the changes in the rules for depreciation and ITC. See Appendix B for a further explanation of the calculation of the cash flow effects of the tax changes and the information necessary for those calculations.

To ensure that the sample size would remain large enough to obtain reliable results, another random sample of 70 firms was chosen, for a total of 180 firms selected. However, twelve of the firms in the second sample were identical to firms in the first sample, so the final sample contained 168 firms. A check of the CRSP monthly returns tape revealed that 41 of these 168 firms were not on the CRSP tape for every year of the period, so these firms were dropped from the sample.

A total of 59 firms were dropped because of the unavailability of necessary information, as described in the previous paragraph. Of these 59 firms, 38 were either utilities (22) or financial service firms, that is, banks and insurance companies (16). Notwithstanding the limited information available for these utilities and financial service firms, a good case could be made for excluding them from the sample anyway on the grounds that they are much more regulated than the other firms in the sample. The regulations they operate under might make their cash flows responsive to different variables from unregulated firms, and could, particularly in the case of utilities, make the cash flows more certain. In addition, the value of their common stock tends to be unusually dependent on the prevailing interest rate.

The selection of the sample can be summarized as follows:

Original random sample from Compustat		168 firms
Companies not on CRSP for all years		(41)
Companies with inadequate information		
Utilities	(22)	
Financial service companies	(16)	
Others	(21)	(59)
Total companies in final sample		68

The distribution of the firms among the different industries, as represented by their SIC codes, is given in Table VI of Appendix D. No more than six sample firms came from any two-digit industry grouping, indicating that no particular industry dominates the the sample.

Variables Used to Investigate Unsystematic and Total Risk

The manner in which a history of frequent tax changes affects unsystematic risk is different from the manner in which a history of tax changes affects systematic risk. Thus, when unsystematic risk was being investigated it was necessary to use the estimates of the effects of tax changes on a firm's cash flows in a different manner from the way they were used when systematic risk was being investigated. The manner in which these estimates of the effects of tax changes on a firm's cash flows was used to investigate unsystematic risk will be described first

For each firm in the sample, the cash-flow impact of each tax change under consideration was estimated for the first three years for which the tax change was effective The reasoning behind choosing three years was as follows Predictions of the cash flow effects in future years of a current-year tax change should become more unreliable as the length of time between the year being predicted and the current year becomes longer It was felt that any prediction of the effect of a tax change on cash flows four years hence might be so unreliable as to be unusable by investors On the other hand, it was felt that a prediction one, two, or even three years into the future should be reliable enough to be of some use to investors

The estimates of the cash flow effects for these three years were totaled, giving a measure of the magnitude of the cash flow effects of each tax change This total could be shown as

$$TC_{ij} = C_{i1} + C_{i2} + C_{i3} \qquad (6)$$

where

C_{ij} = the cash flow effect of the tax change on firm i in the jth year following the tax change

Since the absolute size of the impact of a tax change on a firm's cash flows could be expected to vary with the size of the tax liability, the tax change impact was scaled to provide a measure of the relative importance of the tax change to each firm The total market value of a firm's common stock has often been used as a scaling factor [Beaver, Kettler and Scholes, 1970] This study also used the total market value of the firm's outstanding common stock as of the end of the year of the tax change to scale the impact of the tax changes on the firm's cash flows

The estimation process produced a series of fractions for each firm In this series, there is one fraction for each year in the period being studied The numerator of each fraction is the cash flow impact (the total effect on cash flows for the first three years) of tax changes in the related year, or the TC_{ij} value Thus, for years in which there were no tax changes, the numerator, and also the resulting fraction, is zero The denominator of each fraction is the total market value of the firm's outstanding common stock in that year

Thus, if

TC_{ij} = the cumulative three-year cash flow effect of a tax change on firm i in year j,

and if

MV_{ij} = the market value of the common stock of firm i at the end of year j,

then the scaled cash flow effect of a tax change for firm i in year j, denoted as T_{ij}, is

$$T_{ij} = TC_{ij}/MV_{ij} \qquad (7)$$

These T_{ij} values were then used to produce measures of the relative frequency and variability of the cash flow effects of tax changes undergone by each firm

The effect of tax changes on the variability of cash flows could be specified by the use of a probability distribution of the different possible magnitudes of tax-change-induced cash flow effects An investor could use the moments of this distribution as inputs in the process of estimating the overall probability distribution of cash flows to the firm However, a reliable estimation of a "tax-change" probability distribution was not available in this case because of the limited number of "tax change" observations Instead, this study used measures of the overall frequency and variability of the tax-change-induced cash flow changes to indicate the effect of tax changes on the volatility of cash flows

The variability measure should indicate the relative extent to which these cash flow changes are affecting overall cash flow volatility, while the frequency measure should indicate the likelihood of there being a tax-change-induced cash flow change in any year Two measures that have been used as proxies for the volatility of cash flow changes are (1) their variance [Rosenberg and Guy, 1976, Rosenberg and McKibben, 1973], and (2) their standard deviation [Ang, Peterson and Peterson, 1985, Gahlon and Gentry, 1982]

Since the dependent variables that this variability measure is being related to, total risk (the variance of returns) and unsystematic risk (the variance of the error term in the market model), are both operationalized as variances, the variance appears to be a more appropriate measure of variability to use in this instance than the standard deviation For this reason, the variance of the T_{ij} values was used in this study to measure the volatility of the tax-change-induced effects on firms' cash flows when the total risk or unsystematic risk are the dependent variables of interest

The frequency measure should in some way indicate the probability of a tax change causing a significant cash flow effect in any given year Any tax change that affected the perceived volatility of a stock's returns should be classified as significant, and any change that did not affect the perceived volatility of a stock's returns should be classified as not significant Unfortunately, no research has been done to indicate what might be "significant" in this situation and what might be "insignificant" In fact, "significance" in the sense that it is described above, might be different for each firm As a result, any formulation of the term "significant" in this context is ad hoc

Two possible methods of defining significance are (1) by reference to another variable, such as net income, and (2) by ranking the data in question with respect to magnitude and classifying all those data items that ranked above a certain percentile to be significant The first method would define significance in terms of a percentage of a reference variable, such as net income Unfortunately, as explained in the preceding paragraph, the use of any such percentage would be arbitrary

In order to avoid defining significance in terms of some arbitrary percentage of a variable such as net income, this study defined significance using the second method While still arbitrary, at least it utilizes the characteristics of the data at hand to determine the cutoff point Under this method, there are several possible ways of choosing a percentile which will separate significance from insignificance One could use the mean or the median as the cutoff point The distribution of the T_{ij} measures could also be investigated, and the location of any large groupings might indicate where the cutoff point should be located

Another issue which arose in connection with the calculation of the frequency measure was whether the total T_{ij} value or only a portion of each value should be used to determine significance In light of the continued frequency of tax changes in recent years, it is possible that the market has developed some long-run expectations with respect to the probable magnitude and direction of the annual cash flow effect of future tax changes on individual firms If this is the case, then the significance of any tax-change-induced cash flow effect should be measured with reference to its deviation from this "expected" cash flow effect since the market will already have impounded this expected cash flow effect in its estimation of the value of the firm In recent years the effect of tax changes on the cash flows of a firm could probably best be described as random Since the expected value of a random variable is the mean, this study used the mean of the T_{ij} values for each firm as an estimate of the market's long-run expectations with respect to the cash flow effects of future tax changes on that firm Significance was measured with respect to the deviation of each T_{ij} value from the firm-specific mean T_{ij} value

Consistent with the above discussion, the deviations from the firm-specific means were calculated as

$$DIF_{ij} = |T_{ij} - T_i^{avg}|, \qquad (8)$$

where

T_{ij} = the three year cash flow effect on firm i of the tax change in year j, standardized by the total market value of the firm's stock, and
T_i^{avg} = the average of all the T_{ij}'s for each firm i

The DIF_{ij} values for all firms were ranked in ascending order of magnitude The distribution of these DIF_{ij} values was investigated to determine if any large groupings suggested a cutoff point There were no such groupings, so all of the DIF_{ij} values in the upper half of the ranking were defined to be "significant" In this case, a significant DIF_{ij} value was defined as any T_{ij} value whose deviation from the firm--specific mean was greater than the median deviation for all fractions

The frequency measure was defined to be the number of "significant" fractions in a firm's series of fractions, divided by the total number of years in the series The measures for variability and frequency were calculated for each sample firm for the fourteen-year period from 1975 through 1988 The variability and frequency measures, along with the term for the interaction between them, were then used to capture the relative impact of the frequency and variability of tax-change-induced cash flow changes on the total and unsystematic risk of these firms over the described periods Also calculated was the ratio of the variance of a firm's actual cash flows to the variance of its cash flows with the tax changes added back This variable, which is explained in more detail below, was also used to investigate the relationship between the tax changes and total and unsystematic risk

Variable Used to Investigate Systematic Risk

As indicated above, a history of tax changes could affect systematic risk indirectly by causing a change in the variability of cash flows If the relationship between tax changes and systematic risk is being investigated, it is therefore appropriate to measure the effect of tax changes on the overall variability of cash flows If the relationship between the measure of the effect of tax changes on the variability of cash flows and systematic risk is significant, it would indicate that tax changes have had an effect on systematic risk

In keeping with the above discussion, the variable which was used when the relationship of tax changes with systematic risk was being investigated was the quotient produced by dividing the variance of the actual cash flows for the period in question by the variance of the cash flows computed as if the tax changes had not been made (i e , with cash flow effects of the tax changes added back) This gave a measure of the variance of actual cash flows expressed as a percentage of the variance of cash flows without tax changes

Thus, if

σ^2_A = the variance of actual cash flows and
σ^2_W = the variance of cash flows computed as if the tax changes had not been made,

then

σ^2_A/σ^2_W = the appropriate independent variable to use when systematic risk was being investigated

This variable (σ^2_A/σ^2_W) was symbolized by W/WO

One possible problem with the W/WO variable was the effect of growth on its estimation A company with stable growth in cash flows over time will show a positive variance in its cash flows, even though such a stable pattern may not affect the risk of the stock This is because the variance is a measure of the deviation of the individual observations from the mean observation, and constant growth will cause such deviations To deal with the possible effect of cash flow growth on the W/WO variable, the following variable was calculated

$$W/WO_c = \frac{\sigma^2((ACF_i - ACF_{i-1})/ACF_{i-1})}{\sigma^2((CFW_i - CFW_{i-1})/CFW_{i-1})}, \qquad (9)$$

where

ACF_i = actual cash flows for year i,
CFW_i = cash flows for year i with the effect of tax changes added back, and
i = the years from 1975 to 1988

The term $(ACF_i - ACF_{i-1})/ACF_{i-1}$ in the numerator of equation (9) gives the actual percentage cash flow growth in year i The comparable term from the denominator of equation (9) is $(CFW_i - CFW_{i-1})/CFW_{i-1}$ This term gives, for year i, the percentage growth in cash flows with the cash flow effects of the tax changes added back The numerator of W/WO_c is the variance of the year-to-year percentage growth in actual cash flows, while the denominator is the variance of the year-to-year percentage growth in cash flows with the effect of tax changes added back

The variance of the actual percentage growth in cash flows gives a measure of the dispersion of the individual annual cash flow growth percentages about the average annual percentage cash flow growth for the company Since it is only a measure of dispersion about the mean, the variance measure is independent of the mean of the observations It follows that the numerator of equation (9) is independent of the average annual percentage growth in actual cash flows By the same reasoning, the denominator of equation (9) is independent of the average annual percentage growth of cash flows with the cash flow effects of the tax changes added back Since both the numerator and the denominator of equation (9) are independent of the average annual percentage growth of cash flows, the entire W/WO_c variable is independent of the average annual percentage growth of cash flows

Cash flow amounts were either (1) taken from the "cash flows from operations" amount on the Statement of Changes in Financial Position, if available, or (2) computed as in Beaver and Dukes [1972] by adding back to earnings depreciation, depletion, amortization, and the changes in the deferred tax account This independent variable was computed for the period from 1975 through 1988

Estimates of the federal income tax information needed to perform the analysis were obtained primarily from published financial reports

Accounting Principles Board Opinion No 11, Accounting for Income Taxes (1967), requires that firms disclose (1) the timing differences involved in calculating tax expense and (2) a reconciliation between the maximum statutory rate (generally 46%) and the actual effective rate of tax that the company pays These disclosures were used in this study to estimate the actual impact of a tax change on the tax liability of a company

The primary sources of the disclosures used were the Compustat data base and the Securities and Exchange Commission 10-K reports For a more detailed explanation of the calculations used to determine the effect of tax changes on the tax liabilities of individual firms, see Appendix B The stock return information necessary to compute the total, systematic and unsystematic risk measures were obtained from the Center for Research in Security Prices (CRSP) data base

The Model

The first four hypotheses, H1 00_o, H1 01_o, H1 10_o, and H1 11_o, require testing of the significance of the frequency or variability measures independently, while the fifth and sixth hypotheses, H1 20_o and H1 21_o, require testing of the significance of the frequency and variability measures and their interaction as a group The testing procedure was slightly different for each measure of risk (total, systematic and unsystematic) that is investigated

The full regression model used when testing the first six hypotheses (in which total risk or unsystematic risk is the dependent variable) was as follows

$$\Phi_{ij} = b_1 + b_2L_i + b_3D_i + b_4E_i + b_5C_k + b_6A_i + b_7F_i + b_8V_i + b_9F_iV_i + b_{10}G_i^a + b_{11}G_i^c + b_{12}P_i + b_{13}B_i + e_i \qquad (10)$$

where,

Φ_{ij} = either the variance of returns, or the variance of the error term from the market model, for the 60 months ending with December of 1988,

L_i = the financial leverage ratio (the average of the ratio of the total senior debt divided by total assets for firm i over the five years ending in 1988), or

$$L_i = \frac{\sum_{t=1984}^{1988} \frac{(\text{total senior securities})_t}{(\text{total assets})_t}}{5} \qquad (11)$$

D_i = dividend payout (the average of the ratio of dividends paid divided by income available for common stock for firm i over the five years ending in 1988), or

$$D_i = \frac{\sum_{t=1984}^{1988} (\text{cash dividends paid to common stockholders})_t}{\sum_{t=1984}^{1988} (\text{income available for common stockholders})_t} \qquad (12)$$

E_i = earnings variability (the standard deviation of the ratio of earnings divided by the market value of all outstanding common stock for firm i over the 5 years ending in 1988), or

$$E_i = \{\sum_{t=1984}^{1988} (\frac{I_t}{V_{t-1}} - \text{avg}[\frac{I}{V}])^2 \ / \ 5 \ \}^{.5}, \qquad (13)$$

where

$$\frac{I_t}{V_{t-1}} = \frac{(\text{income available for common stockholders})_t}{(\text{market value of common stock at fiscal year-end})_{t-1}}, \text{ and}$$

$$\text{avg}[\frac{I}{V}] = (\sum_{t=1984}^{1988} \frac{I_t}{V_{t-1}}) \ / \ 5 \ , \qquad (14)$$

C_k = market concentration for industry k for the year 1988, (measured as each industry's four-firm concentration ratio, based on total sales), or

$$C_k = \frac{\text{total 1988 sales of the four firms in the sample company's industry with the highest sales}}{\text{total 1988 sales of all firms in the sample company's industry}}, \quad (15)$$

A_i = asset size (the natural logarithm of the average of total assets for firm i over the five years ending in 1988)

$$A_i = \ln \frac{\sum_{t=1984}^{1988} \text{total assets}_t}{5}, \quad (16)$$

F_i = the frequency measure for each firm, or

$$F_i = \frac{\text{the number of "significant" tax changes for the sample company in the period}}{\text{the number of years in the period (14)}}, \quad (17)$$

V_i = the variability of the cash flow effects of tax changes,

$= \text{var}(T_{i1}, T_{i2}, \quad , T_{i14})$,

where,

T_{it} = the cash flow effects of the tax change for the sample firm in year t,

G_i^a = average asset growth for the 5 years ending in 1988

$$G_i^a = \frac{\sum_{t=1984}^{1988} \frac{(\text{total assets})_t - (\text{total assets})_{t-1}}{(\text{total assets})_{t-1}}}{5}, \quad (18)$$

G_i^c = average growth of cash flows for the 5 years ending in 1988, or

$$G_i^c = \frac{\sum_{t=1984}^{1988} \frac{(\text{total cash flows})_t - (\text{total cash flows})_{t-1}}{(\text{total cash flows})_{t-1}}}{5}, \quad (19)$$

P_i = the average ratio of property, plant and equipment to total assets for the 5 years ending in 1988, or

$$P_i = \frac{\displaystyle\sum_{t=1984}^{1988} \frac{(\text{total property, plant, and equipment})_t}{(\text{total assets})_t}}{5}, \qquad (20)$$

B_i = the accounting beta (the covariance of the firm's earnings with the earnings of the market, divided by the variance of the market's earnings, for the ten-year period ending in 1988), or

$$B_i = \frac{\displaystyle\sum_{t=1979}^{1988} (It - I^{avg})(I_t^M - I^{Mavg})}{\displaystyle\sum_{t=1979}^{1988} (I_t^M - I^{Mavg})^2}, \qquad (21)$$

where,

$$I^{avg} = \sum_{t=1979}^{1988} I_t /10 , \qquad (22)$$

$$I_t^M = \sum_{i=1}^{N} I_{it} /N$$ (N = the number of firms for which income data were available on Compustat for year i), and, (23)

$$I^{Mavg} = \sum_{t=1979}^{1988} I_t^M , \qquad (24)$$

b_m = regression coefficients for the variables, and

e_i = an error term

The full model was fitted for each dependent variable (type of risk) and the use of a strictly linear model was verified by plotting the residuals against each variable and inspecting the plots None of the plots exhibited a pattern consistent with that of a non-linear variable

Three of the twelve independent variables in the above model are tax-change variables Of the remaining nine, eight were chosen for inclusion in the model because, as explained in Chapter II, prior studies have indicated that they are related to risk [Beaver, Kettler and Scholes, 1970, Logue and Merville, 1972, Moyer and Chatfield, 1983, Rosenberg and McKibben, 1973] The growth variable was computed as both growth in assets and growth in cash flows

The ninth independent variable, P_i, was chosen for inclusion in the model because many of the tax changes in recent years have affected in some way the tax treatment of the property, plant, and equipment of the firm To verify that the tax-change variables were not merely proxies for the relative amount of property, plant, and equipment the firm possessed, P_1 was included in the model

Testing of $H1\ 00_0$ through $H1\ 11_0$ was begun by performing a stepwise regression twice on the full model using all of the observations The stepwise procedure has the advantage of providing a parsimonious explanatory model, which minimizes the potential for collinearity among the variables One of the above two runs had total risk as the dependent variable and the other used unsystematic risk as the dependent variable This procedure produced two models (one for each dependent variable)

At this point outliers were excluded using the methods recommended by Belsley, Kuh and Welsch [1980] This involved the calculation of the effect of the omission of each observation on the coefficient of interest (in this case, the coefficients of the tax change variables) The models used in this process included the variables obtained from the stepwise procedure above, plus the independent variables of primary interest (the frequency and variability measures)

The process of excluding outliers was postponed until after the stepwise procedure had selected a limited set of variables because of the high possibility of collinearity among the variables in the full model Collinearity between some of these variables and the measures of frequency and variability could be a source of instability in the coefficients of the latter variables Using the Belsley, Kuh and Welsch (1980) outlier exclusion technique, each observation that has an abnormally large effect on the coeffecient of interest (in this case, the coefficients for frequency and variability of the tax change effects) is identified and excluded from the sample Since the computation of the effects of the observation on the coefficient depends on the original calculation of the coefficient, any instability in the coefficient could potentially cause the wrong observations to be identified as outliers

To illustrate the use of this outlier exclusion technique, assume the effect of only one variable on another variable is being investigated Suppose that plotting the observations results in the plot in Figure 1, where the dependent variable (y) is plotted along the verticle axis and the independent variable (x) is plotted along the horizontal axis Two common means of identifying outliers are (1) the examination of the residuals for each observation and (2) the examination of the number of standard deviations each observation is from the mean of each variable These are, according to Belsley, Kuh and Welsch [1980] inappropriate for use in the example given

According to Belsley, Kuh, and Welsch, the observation A, being toward the end of the line of observations, would probably have a larger effect on the computed regression coefficient than would observation B, which is near the center Observation A is therefore more likely to be causing error in the estimation of the coefficient However, the residual for observation B would probably be equal to or

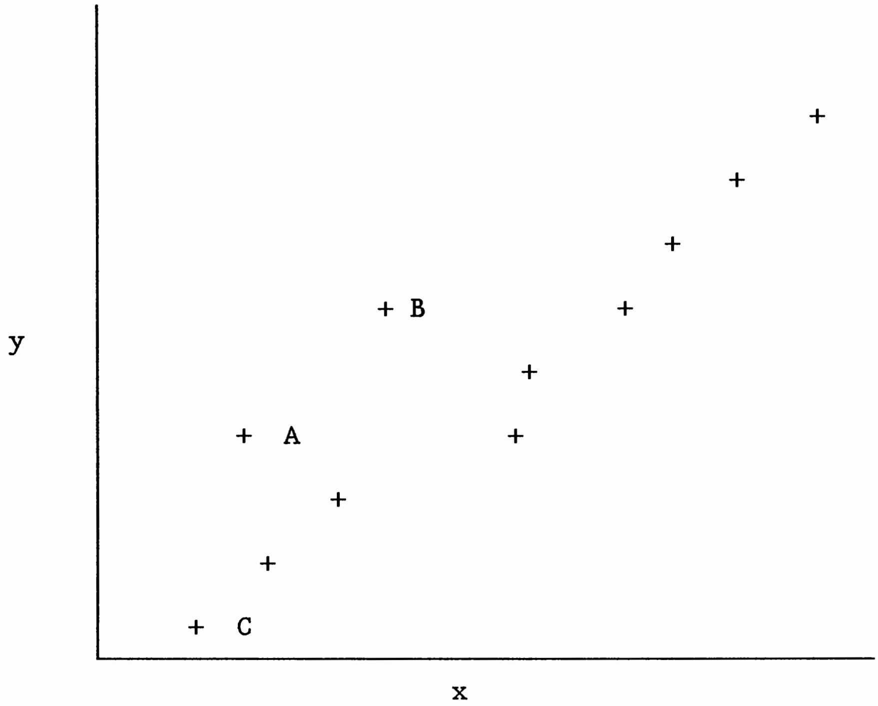

Figure 1 Example of a Plot of Observations

larger than that of observation A, so inspection of the residuals would erroneously make B a more likely candidate for exclusion as an outlier than A Similarly, observation C would be a more likely candidate for exclusion than A based on their standard deviations from the mean, even though observation A will have a greater effect on the computed coefficient

The technique that Belsley, Kuh, and Welsch recommend for the exclusion of outliers is as follows First, for each observation the coefficient with the observation included in the data set and the coefficient without the observation in the data set are computed Second, the difference between these two coefficients is then computed and divided by the variance of the coefficient Third, this measure is then compared to $2/(n)^{5}$, where n equals the number of observations in the data set Belsley, Kuh, and Welsch contend that any observation associated with a measure greater than $2/(n)^{.5}$ is an "influential observation", or outlier, and has an unusually large effect on the coefficient in question

After identification and exclusion of the outliers as described above, independent tests of the significance of the frequency and variability measures were made by testing the significance of the regression coefficients pertaining to those variables Joint tests of the overall significance of the frequency, variability, and interaction terms (H1 00_o and H1 01_o) were made as follows After performing two regressions using the full model (one regression for each dependent variable), the data were used to perform two regressions of a reduced model The reduced model was the full model less the variables for frequency, variability, and interaction

$$\Phi_{ij} = b_1 + b_2L_i + b_3D_i + b_4E_i + b_5C_k + b_6A_i + b_{10}G_i^a + b_{11}G_i^c + b_{12}P_i + b_{13}B_i + e_i \quad (25)$$

An F test of the additional explanation of variation by the full model over that explained by the reduced model was then used to determine the joint significance of the frequency and variability measures on total and systematic risk The F statistic was computed as,

$$F = \frac{SSE(R) - SSE(F)}{(n-10) - (n-13)} \Big/ \frac{SSE(F)}{(n-3)}\,, \quad (26)$$

where,

SSE(R) = the error sum of squares for the reduced model,
SSE(F) = the error sum of squares for the full model, and
n = the number of observations

As indicated by H2 0_o and H2 1_o, it is possible that the effects of tax changes on cash flow variability might affect the total or unsystematic risk of firms To test for this, a process similar to that used to test the individual significance of the frequency and variability measures was used Stepwise regressions were run and two models were formed The variables available for entry into these models were L_i, D_i, E_i, C_k, A_i, G_i^a, G_i^c, P_i and B_i One model had total risk as its dependent variable, and the other had unsystematic risk as its dependent variable

Four models were then formed from the two models arrived at above The model in which the dependent variable was total risk first had the variable W/WO_c (described above) added to its list of independent variables to form one model Another model was formed in the same way by adding W/WO_a (described in the next chapter) instead of W/WO_c W/WO_c and W/WO_a are variables that compare cash flow variance with the tax changes to cash flow variance without the tax changes The separate addition of these variables resulted in two models in which total risk was the dependent variable

Two more models were formed from the model selected by the stepwise procedure in the case where the dependent variable was unsystematic risk Once again W/WO_c was added to the independent variables selected by the stepwise model to form one different model W/WO_a (instead of W/WO_c) was then added to the list of independent variables in the stepwise model to form yet another model This produced two models in which the dependent variable was unsystematic risk Using all four models and the techniques recommended by Belsley, Kuh and Welsch [1980], outliers were identified and excluded The hypotheses were then tested by reference to the significance of the coefficients of the W/WO_c and W/WO_a variables

To test H3 0_o, a stepwise regression was first run and two models were formed in which the independent variables were the variables that were selected by the stepwise regression, plus either the W/WO_c or W/WO_a variable Outliers were once again identified and excluded using the techniques recommended by Belsley, Kuh and Welsch [1980] The hypothesis was then tested by reference to the significance of the coefficients of the W/WO_c and W/WO_a variables

In summary, H1 20_o and H1 21_o were tested by testing the significance of the frequency and variability measures, and their interaction, jointly Hypotheses H1 00_o through H1 11_o were tested by performing independent significance tests of the frequency and variability measures, respectively Hypotheses H2 0_o, H2 1_o, and H3 0_o were tested by testing the significance of the W/WO_c and W/WO_a variables in models with the appropriate dependent variables

CHAPTER IV

RESULTS

After the variables had been estimated, one of the first steps taken was the running of a correlation analysis on all of the variables concerned with the study In this analysis, a significant (p value = 005 or less) but negative relationship was found between the W/WO variable and all three measures of risk Subsequent regressions also produced significant negative (α = 012 or less) coefficients for the W/WO variable when total or unsystematic risk was the dependent variable Since a positive relationship with all of the measures of risk was expected, an investigation of the possible causes of this anomaly was made

As discussed in the previous chapter, it was possible that growth could affect the relationship between the W/WO variable and the risk measures This possibility was the reason for the transformation of the W/WO variable to W/WO_c Besides growth, it also appeared that the asset size variable could adversely affect the relationship between W/WO and the measures of risk Asset size was positively correlated with W/WO and negatively correlated with risk, so collinearity between asset size and W/WO could account for the negative sign of the coefficient of W/WO To test for this, another variable, W/WO_a, was calculated for the years 1975-1988

$$W/WO_a = \frac{[\sigma^2((ACF_i - ACF_{i-1})/A_{i-1})]}{[\sigma^2((CFW_i - CFW_{i-1})/A_{i-1})]} \qquad (27)$$

where

ACF_i = actual cash flows for year i,
A_{i-1} = total assets for year i-1,
CFW_i = cash flows for year i with the effect of tax changes added back

By focusing on the year-to-year change in cash flows, this variable captures a measure of the relative variances (exclusive of growth) of the asset-size-adjusted cash flows with and without the effects of the tax changes W/WO_a was thus added to the models used in this investigation

After calculation of W/WO_a, the basic steps in the investigation were as follows

(1) Three stepwise regressions were run, one for each independent variable, or risk measure The variables available for selection by the stepwise procedure were leverage (L), dividend payout (D), earnings variance (E), industry concentration (C), asset size (A), average asset growth (G_i^a), average cash flow growth (G_i^c), the ratio of property, plant and equipment to total assets (P), and accounting beta (B) The variables selected by the stepwise procedure are given in Table I

(2) Using the variables selected by the stepwise procedure and the tax-change variables of interest, models to be used to identify and exclude outliers were formed The outliers excluded for each model are identified in Table VII of Appendix D

(3) After the outliers have been excluded, the resulting data sets and the models formulated in the preceding step were used to perform

the necessary regressions The variables used in each regression, the associated coefficients and the associated p values are given in Tables II through IV Collinearity diagnostics for these models were investigated and no problems with collinearity were discovered Collinearity diagnostics and a discussion of them are contained in Appendix E

(4) The null hypotheses were accepted or rejected based on the significance of the coefficients of the variables of interest

TABLE I

VARIABLES SELECTED BY THE STEPWISE PROCEDURE

DEPENDENT VARIABLE	INDEPENDENT VARIABLES SELECTED (In the order selected by the procedure)
TOTAL RISK	L, E, C, A, G_1^a, and B
SYSTEMATIC RISK	G_1^a, P, G_i^c, and E
UNSYSTEMATIC RISK	L, E, A, B, and C

The coefficients and associated p values of the variables in the four regressions in which total risk was the dependent variable are given in Table II A different tax-change variable was included in each of the four regressions included in Table II The p value of 0 8974 for the coefficient of the tax-change frequency variable (F) in Regression 1 did not provide any evidence that this variable was related to the dependent variable, total risk Regression 2 likewise provided no evidence of a relationship between the tax-change variance measure (V) and total risk Although the coefficient of the tax-change variance measure was positive in Regression 2, as expected, the p value of the tax-change variance measure (0 4570) did not indicate that a relationship between that variable and total risk exists

A joint test of the significance of the frequency (F) and variability (V) terms, along with their interaction term (F*V), was performed As described in the previous chapter, this involved using an F test to compare the variance in total risk left unexplained by a reduced model (one not containing F, V, or F*V) with the variance left unexplained by a full model (one containing F, V, and F*V) The p value for this test was 0 9601, which does not support the hypothesis of a joint relationship between F, V, F*V, and the dependent variable total risk

The evidence provided by regressions 3 and 4 indicate that there is a significant relationship between the total risk of a firm's stock and the effect of tax changes on the variability of the year to year growth in cash flows of the firm As explained previously, W/WO_a is the measure of the effect of the tax changes on the variance of cash flows, adjusted for asset size and cash flow growth The sign of the coefficient of this variable is positive, as expected, and the p value of 0 0809 gives weak support to the hypothesis that there is a relationship between total risk and the W/WO_a variable Regression 4 provides much stronger evidence that there is a relationship between total risk and the effect of tax changes on the variance of cash flows, adjusted only for growth (W/WO_c) The coefficient of the W/WO_c

TABLE II

REGRESSION RESULTS RISK MEASURE (DEPENDENT VARIABLE) = TOTAL RISK

Regression Number	1	2	3	4
N	64	67	64	67
R-square	0 7098 (0 0001)**	7109 (0 0001)**	7830 (0 0001)**	7318 (0 0001)**
Independent Variables	Variable Coefficients (p values are below the coefficients in parentheses)			
L	0 02653 (0 0001)**	0 02469 (0 0001)**	0 02377 (0 0001)**	0 02271 (0 0001)**
E	0 00714 (0 0001)**	0 00977 (0 0001)**	0 01548 (0 0001)**	0 01028 (0 0001)**
C	-0 00938 (0 0751)	-0 00896 (0 1219)	-0 01564 (0 0042)**	-0 01118 (0 0322)*
A	-0 00260 (0 0001)**	-0 00332 (0 0001)**	-0 00361 (0 0001)**	-0 00338 (0 0001)**
G_a	0 01333 (0 0246)*	0 01010 (0 1206)	0 01639 (0 0048)**	0 01004 (0 1161)
B	0 00018 (0 0929)	0 00033 (0 0034)**	0 00098 (0 0001)**	0 00033 (0 0021)**
F	-0 00006 (0 8974)			
V		0 24126 (0 4570)		
W/WO_a			0 02378 (0 0809)	
W/WO_c				0 00302 (0 0107)*
Intercept	0 02247 (0 0018)**	0 02767 (0 0002)**	0 00997 (0 4841)	0 02846 (0 0001)**

* indicates significance at the 5 percent level
** indicates significance at the 1 percent level

variable was positive, as expected, and the corresponding p value was 0 0107

The results of the regressions in which the dependent variable was unsystematic risk are given in Table III For each regression (5 through 8) a different tax-change variable was included as an independent variable As the results for Regression 5 indicate, the coefficient of the tax-change frequency variable (F) was once again not significant The evidence from this study therefore does not support the hypothesis that there is a relationship between the frequency of tax changes and unsystematic risk The coefficient for the measure of tax-change variance (V) in Regression 6 was positive, as expected However, the p value for the coefficient of V in Regression 6 (0 3154) does not provide any evidence in support of the hypothesis that the variance of the tax-change measure is related to unsystematic risk The additional explanatory power of the F, V, and F*V variables on unsystematic risk was also tested using full and reduced models as described in the previous chapter, and found to be insignificant (p value = 0 8927)

Regressions 7 and 8 included the variables (W/WO_a and W/WO_c) that measure the effect of the tax changes on the variance of cash flows The p value of the W/WO_a coefficient in Regression 7 was 0 8136, so no evidence of a relationship between this variable and unsystematic risk was found in this study In Regression 8, the coefficient of the W/WO_c variable had a corresponding p value of 0 0062 The sign of this coefficient was, as expected, positive These results are strong evidence that when tax changes increase (decrease) the variance of the

TABLE III

REGRESSION RESULTS RISK MEASURE (DEPENDENT VARIABLE) = UNSYSTEMATIC RISK

Regression Number	5	6	7	8
N	63	66	65	66
R-square	0 7621 (0 0001)**	0 7220 (0 0001)**	0 6979 (0 0001)**	0 7469 (0 0001)**
Independent Variables	Variable Coefficients (p values are below the coefficients in parentheses)			
L	0 01726 (0 0001)**	0 02396 (0 0001)**	0 02228 (0 0001)**	0 02232 (0 0001)**
E	0 03852 (0 0001)**	0 01056 (0 0001)**	0 00961 (0 0001)**	0 01119 (0 0001)**
C	-0 00965 (0 0205)*	-0 01173 (0 0242)*	-0 01169 (0 0319)*	-0 01414 (0 0027)**
A	-0 00179 (0 0002)**	-0 00308 (0 0001)**	-0 00332 (0 0001)**	-0 00313 (0 0001)**
B	0 00011 (0 5016)	0 00051 (0 0027)**	0 00038 (0 0003)**	0 00052 (0 0012)**
F	-0 00010 (0 7811)			
V		0 28937 (0 3154)		
W/WO_a			-0 00288 (0 8136)	
W/WO_c				0 00288 (0 0062)**
INTERCEPT	0 01752 (0 0020)*	0 02621 (0 0001)**	0 03138 (0 0179)*	0 02705 (0 0001)**

* indicates significance at the 5 percent level
** indicates significance at the 1 percent level

growth in cash flows, the level of unsystematic risk is also increased (decreased)

Table IV contains the results of the regressions (9 and 10) in which systematic risk was the dependent variable It was hypothesized

TABLE IV

REGRESSION RESULTS RISK MEASURE (DEPENDENT VARIABLE) = SYSTEMATIC RISK

Regression Number	9	10
N	66	65
R-square	0 4075 (0 0001)**	0 4278 (0 0001)**
Independent Variables	Variable Coefficients (p values are below the coefficients in parentheses)	
E	0 09534 (0 0677)	0 15006 (0 2041)
G_a	1 19919 (0 0006)**	1 34950 (0 0002)**
G_c	0 15213 (0 0182)*	0 23904 (0 0018)**
P	-0 80695 (0 0005)**	-0 77031 (0 0006)**
W/WO_a	-0 35098 (0 6301)	
W/WO_c		-0 11396 (0 1383)
INTERCEPT	1 61385 (0 0342)*	1 29605 (0 0001)**

* indicates significance at 5 % level
** indicates significance at 1 % level

that as tax changes increased (decreased) the variance of cash flows, systematic risk should be increased (decreased) The results of Regressions 9 and 10 do not support this hypothesis The p value of the coefficient of the W/WO_a variable was 0 6301, indicating no support for the hypothesis The coefficient of the W/WO_c variable had a corresponding p value of 0 1383, which provided no indication of a relationship between W/WO_c and systematic risk

CHAPTER V

SUMMARY AND CONCLUSIONS

Overview

The frequency of the passage of new tax legislation in recent years has raised the possibility that the risk of firms most affected by these changes might have been affected. The purpose of this study was to attempt to determine if there is a relationship between (1) total and unsystematic risk and the frequency and/or the variability of the cash flow effects of these tax changes, and (2) total, unsystematic, and systematic risk and the effect of these tax changes on the variability of cash flows.

An investor who is not risk-neutral will want to adjust the stocks in his/her portfolios on the basis of their expected risk and return so that the expected risk and return of his/her entire portfolio maximizes the expected utility of the investor. A relationship between a history of tax changes and systematic risk would always be important to such an investor, since systematic risk cannot be diversified away. For the investor who is not fully diversified, a relationship between unsystematic risk and a history of tax changes would also be important, since unsystematic risk affects the total risk of a portfolio which is not fully diversified. In fact, as explained in Chapter II, fully diversified portfolios do not perform as well as Markowitz-Sharpe efficient portfolios, at least 20-25% of whose total risk is composed of unsystematic risk

Companies were selected and estimates of the cash-flow effects of some recent tax acts on these companies were computed These cash-flow effects were then used to calculate variables relating to (1) the frequency and variability of the cash-flow effects and (2) the impact of the cash-flow effects on the overall variability of cash flows In addition, variables for leverage, dividend payout, earnings variability, market concentration, asset size, growth, accounting beta, and property, plant and equipment as a percent of total assets were also computed

The stepwise regression procedure was used to select the variables to be included in the ultimate regression models, and outliers were then identified and excluded The appropriate tax-change variables were then added to the models arrived at using the stepwise procedure, and a final regression analysis was performed using the outlier-excluded data sets In general, the hypotheses were then tested by inspecting the p values associated with the tax-change variables

As the results in Table IV indicate, this study found no evidence indicating that there is a link between tax changes and systematic risk This study, therefore, does not support the proposition that investors attempting to estimate systematic risk should be concerned about the effects of tax changes There are several possible methodological shortcomings that might have resulted in the lack of significant findings in this area As explained in Chapter III, an indirect link between systematic risk and cash flow variability (and thus tax changes) was established, but a direct link could not be found It might be that the effects of this indirect link were not strong enough to be identified using the statistical techniques that were employed in this study

The cash-flow effects were of necessity estimated using the only information that was available, that is, financial statement information It may be that these estimates were not accurate enough for the anticipated effects to be detected by the statistical techniques employed in this study There is also no agreement in the literature as to the time period, if any exists, over which the measurement of systematic risk (beta) best specifies the "true" systematic risk The possibility therefore exists that systematic risk, as measured in this study, was misspecified

This study also found no evidence indicating a link between the frequency of tax changes and/or the variability of the tax-induced changes in cash flows and total or unsystematic risk Again, the process of estimating these variables might have introduced measurement errors that obscured the true effects of the tax changes For instance, estimation of the frequency variable involved an ad hoc determination of the point that separated "significant" tax change effects from those that were deemed to be insignificant As explained above, the calculated cash-flow effects of the tax changes were estimates based primarily on information contained in the financial statements, so these estimates might have also contributed to any measurement error contained in the frequency and variability measures

The results do indicate that there is a relationship between the effect of past tax changes on the variance of cash flows and both unsystematic and total risk Specifically, it was found that the effect of recent tax changes on the variance of cash flows (after adjusting for the effects of growth on the variance) was related to both unsystematic and total risk This research therefore provides support for the consideration of the effects of tax changes when unsystematic or total risk is being estimated

Significance

Since no relationship between tax changes and systematic risk was found, the relationship with total risk apparently is caused by the relationship with unsystematic risk (systematic risk and unsystematic risk being the determinants of total risk) The implication of the finding of a relationship is that investors who are concerned with the level of unsystematic risk in their portfolios (that is, investors with portfolios that are not fully diversified) might want to take into account the extent to which the stocks they are considering have been affected by tax changes in the past, as well as how they might be affected by tax changes in the future

Past tax changes might have had some effect on the unsystematic risk of a particular stock If an investor is basing an estimate of future unsystematic risk on a measure of past unsystematic risk, it might be appropriate to factor out the effect of past tax changes on past unsystematic risk when estimating future systematic risk When estimating future unsystematic risk, the investor might also want to consider the possible effect future tax changes might have

Furthermore, given the apparent relationship between tax changes and total and unsystematic risk, it is possible that investors, trying to reduce the risk of their portfolio, have invested in firms not subject to this "tax-change" risk It is not necessary that investors be aware of the source of the risk All that is needed is for the measured risk of the tax-change-effected firms to be higher than that of other firms If this shift in investing behavior has happened, then the effect of recent tax changes on the variability of a firms cash flows might have inadvertently affected the distribution of resources in the market This is important because, as stated by Manegold and Karlinsky [1988], policy makers need to be aware of the redistributive effects of tax law changes

If policy makers do not want to cause redistributive effects by increasing the risk of some firms more than others, then policy makers might consider making less drastic changes to the tax laws By so doing, they might be able to minimize the effect of the tax changes on the variability of the cash flows of firms, and thus on the total and unsystematic risk of firms

Limitations and Suggestions for Future Research

This study is subject to several limitations Because the sample size is relatively small, the results might not be generalizable to the larger population of stocks traded on the various exchanges Randomization during the sample selection process should have helped to offset the possible effects of having a relatively small sample, however Some groups of firms, such as banks and utilities, have been of necessity excluded from the sample The findings should not be generalized to these groups of firms without further research

A further limitation is that the uses of the tax-change information that are implied by the findings might not be practical from a cost/benefit perspective The computation of the tax-change cash flow effects was a time-consuming process The costs of computing these effects might be greater than the benefits of the additional information concerning unsystematic risk that can be had through knowledge of these effects

Several extensions of this research are possible An experimental market study in which the effects of a series of simulated tax changes over time are investigated can be performed Perhaps in a more controlled setting the expected relationship between tax changes and systematic risk can be detected The costs and benefits of using this tax-change information in investing decisions can be examined further As stated before, if the costs of obtaining this information outweigh the benefits of having it, the findings could be useless from an investing perspective Finally, research can be done on the probable redistributive effects of the additional unsystematic risk caused by these tax changes In other words, a study can address the issue of how much redistribution of resources in the economy has been caused by the tax-change-induced changes in unsystematic risk

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APPENDIXES

APPENDIX A

RECENT MAJOR TAX ACTS

Below is a listing of the major tax acts since 1968 and their more important corporate tax provisions

Tax Reform Act of 1969

* The investment tax credit was repealed
* The 10% minimum tax was enacted
* Percentage depletion reduced from 27 5 to 22 percent

Revenue Act of 1971

* The investment tax credit was reenacted
* Tax deferral provided for the export income of domestic international sales corporations (DISC's)

Tax Reduction Act of 1975

* Increased ITC percentage from 7% to 10%
* Increased the corporate surtax exemption from $25,000 to $50,000
* Extended the net operating loss carryback period

The Tax Reform Act of 1976

* Reductions in the rates of the lower corporate tax brackets
* Extension of the investment tax credit
* Longer carryover of net operating losses (from five to two years)
* Limitation on use of net operating losses in acquisitions of loss corporations
* Extension of the amortization period for construction interest and taxes

The Economic Recovery Tax Act of 1981

* Acceleration of depreciation deductions through introduction of the Accelerated Cost Recovery System (ACRS)
* Introduction of a 25% credit for incremental research and development expenditures
* Introduction of "safe harbor" leasing provisions
* Adoption of expanded credits for rehabilitated buildings
* Increase in investment tax credits for 3 and 5 year recovery property

The Tax Equity and Fiscal Responsibility Act of 1982

* Basis reduction for investment tax credit
* Reduction in percent of tax liability to be offset by investment tax credit
* Interest attributable to original issue discount must be recognized on a present value basis
* The benefits of safe-harbor leasing were scaled back

The Tax Reform Act of 1984

* Extension of the recovery period for real property
* Depreciation recapture on installment sales accelerated
* Reduction in the benefits of the 85% dividends-received deduction for corporations
* Reduction in the benefits of ACRS depreciation and the invest-

ment tax credit for "luxury" automobiles and "personal use" items

The Tax Reform Act of 1986

* Corporate tax rates decreased
* General Utilities doctrine repealed
* Investment tax credit repealed

APPENDIX B

COMPUTATION OF THE CASH FLOW EFFECTS OF THE TAX CHANGES

Because each tax act that has been enacted over the period in question has been unique, it was necessary to determine the tax liability effects of each tax act separately This section will specify the manner in which the tax liability effects of each general type of tax change on each company was estimated In general, the effects of each change was measured only for the year of change and the following two years, for a total of three years

<u>Corporate Minimum Tax</u>

For 1976 and later years the minimum tax rate was increased from 10% to 15% An approximation of the tax effect of this change was obtained from the information provided in the reconciliation between the statutory tax rate and the corporation's effective tax rate This reconciliation expresses the minimum tax in terms of a percentage of income before income taxes The product of this percentage and income before income taxes was treated as the amount of the minimum tax The tax effect of this change was then measured by multiplying one-third by the total minimum tax, as calculated above For 1986 and later years the corporate minimum tax rate was raised to 20% from 15% The total amount of the minimum tax was calculated as above, and the additional tax caused by the tax change was then found by multiplying the total minimum tax by one-fourth

<u>Depreciation</u>

Since 1980 there have been several changes to the depreciation rate structure In order to calculate the cash-flow effects of changes in the rates of depreciation it was necessary to have an estimate of what the depreciation on assets being purchased would have been under the old depreciation system Unfortunately, financial disclosures rarely contain the useful lives of the assets of the firm, and they do not typically break assets, depreciation, or accumulated depreciation down into real and personal property categories

Useful lives and the amounts of real versus personal property purchased were estimated in one of two ways When available, the depreciation schedules in the 10-K report were used for this purpose In these schedules asset purchases are usually classified as either real or personal, and the useful lives of the assets were approximated by dividing depreciation expense into the total amount of assets in each category

Where these depreciation schedules were not available, information about capital expenditures for the industry to which the firm belongs was obtained from the 1982 Census of Manufactures [U S Department of Commerce (1982)] for manufacturing firms, the 1982 Census of Wholesale Trade [U S Department of Commerce (1982)] for wholesale firms, the 1982 Census of Retail Trade [U S Department of Commerce (1982)] for retail firms, and the 1982 Census of Service Industries [U S Department of Commerce (1982)] for service firms These sources classify the capital expenditures in an industry as either real or personal property Depreciation is also categorized as pertaining to either real or personal property The useful lives of these assets was estimated by dividing the amount of real or personal property utilized in the industry by the amount of real or personal property depreciation, respectively This is similar to the method employed by Swenson [1987] The amount of real or personal property purchased by the firm was calculated by multiplying the firm's purchases of plant and equipment (from the Statement of Changes in Financial Position) by the respective industry ratios of real property expenditures to total capital outlays and personal property expenditures to total capital outlays

For the 1981 change to ACRS, the "no-change" depreciation was calculated using the useful lives and property classifications estimated above and assuming 150% declining balance depreciation The depreciation after the change was estimated by using the 5-year property rates for personal property and the 15-year rates for real property The effect of the changes in depreciation rates for real property after 1981 were measured by multiplying the change in rates by the amounts of outlays for real and personal property, calculated as explained above

Investment Tax Credit

The investment tax credit (ITC) was enacted in 1962, and repealed temporarily from October 10, 1966 until March 10, 1967 and from April 18, 1969 until August 16, 1971 The ITC rate was increased from 7% to 10% in 1975, and the ITC was eventually repealed in the Tax Reform Act of 1986 For companies using the flow-through method of accounting for ITC, its impact on cash flow is best approximated with the use of the reconciliation between the statutory tax rate and the corporation's effective tax rate This reconciliation generally expresses ITC in terms of a percentage of income before income taxes This percentage can be multiplied by income before income taxes, and the product will be the amount of the ITC A more convenient method of obtaining this value is to use the data item for ITC provided on the Compustat data base This was the source used in this study whenever possible

For firms that use the deferral method of accounting for ITC, a separate approximation was be made by using the amount of purchases of personal property calculated as described in the section on depreciation changes, above These outlays for personal property were treated as that year's amount of purchases of qualified investment property, and multiplying that amount by the appropriate percentage gave and estimate of the cash flow effect of ITC in that year

In the years following the change in the ITC rate in 1975, the tax effect of the change was approximated by multiplying the total ITC, as computed above, by 30% (the rate increased from 7% to 10%) In the years following 1986 in which the ITC was repealed, the cash flow effect of <u>not</u> having the ITC was calculated in a manner similar to the calculation of ITC under the deferral method, above

<u>Research and Development Credit</u>

In 1981 a 25% credit for increases in research and development was created An approximation of the tax effect of this change was obtained from the reconciliation percentage

<u>Tax Rate Changes</u>

In 1979 the maximum corporate tax rate was reduced to 46% from 48% In 1987 the maximum corporate rate was reduced from 46% to 40%, and the next year it was reduced to 34% The cash flow effect of these decreases in rates was determined by multiplying the change in rates by an estimate of taxable income This estimate was obtained by adding back to (subtracting from) net income the deferred tax provision (credit) divided by the prevailing maximum tax rate in the year the provision was calculated

APPENDIX C

SUMMARY STATISTICS FOR THE VARIABLES INVESTIGATED

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
SYS RISK	68	1 19167647	0 36272809	0 27040000	2 13100000
TOT RISK	68	0 01318088	0 00962162	0 00310000	0 04650000
UNSYS RISK	68	0 00922353	0 00884947	0 00160000	0 04130000
L	68	0 46391471	0 19186158	0 06220000	1 11540000
D	68	0 94794412	4 36758718	-0 19690000	35 79790000
E	68	0 18848382	0 71387605	0 00290000	5 40610000
C	68	0 87358971	0 15040115	0 48770000	1 00000000
A	68	6 52159559	1 52549641	3 65240000	11 15700000
F	68	3 73529412	1 70703240	1 00000000	7 00000000
V	68	0 00213250	0 01016697	0 00003000	0 08244000
F * V	68	0 01371074	0 07122652	0 00004000	0 57708000
W/WO	68	1 21744926	0 26353285	0 88646000	2 06122000
G_1^a	68	0 13694118	0 11073808	-0 05800000	0 67900000
G_1^c	68	0 22930882	0 58590039	-1 20500000	3 42300000
P	68	0 35914706	0 17376174	0 14500000	0 84000000
W/WO_a	68	0 98516765	0 06004420	0 77520000	1 10550000
W/WO_c	68	0 98750000	1 44326493	0 00710000	11 65780000
B	68	0 57990588	9 56651713	-54 63220000	50 01730000

L = leverage
D = dividend payout ratio
E = earnings variability
C = market concentration
A = asset size
F = frequency of tax changes
V = variability of cash flow effects of tax changes
W/WO = the ratio of the variance of the firm's cash flows with the effects of the tax changes to the variance of the firm's cash flows without the effects of the tax changes
W/WO_a = W/WO adjusted for the effects of cash flow growth and asset size
W/WO_c = W/WO adjusted for the effects of cash flow growth
G_1^a = growth in assets
G_1^c = growth in cash flows
P = the ratio of property, plant and equipment to total assets
B = accounting beta

APPENDIX D

THE SAMPLE COMPANIES AND THE CALCULATED VARIABLES

TABLE V

THE SAMPLE COMPANIES AND THE CALCULATED VARIABLES

OBS	NAME	DNUM	CNUM	SYS	TOT	UNSYS	L	D	E	C	A	F	V	F*V	W/WO	Ga	Gc	P	W/WOa	W/WOc	B
1	AILEEN	2253	008878	0 27	0 025	0 024	0 28	0 00	0 13	0 87	3 65	6	0 00078	0 00467	0 97	-0 06	0 09	0 39	1 01	0 29	-0 04
2	AMERICA	2761	024763	0 93	0 007	0 004	0 31	0 40	0 03	0 84	4 90	6	0 00028	0 00166	1 60	0 11	0 10	0 37	0 95	0 88	0 11
3	AMERICA	3590	029609	0 77	0 015	0 013	0 39	35 80	0 16	0 95	4 65	4	0 00014	0 00058	0 97	0 01	0 77	0 51	1 11	1 56	-0 33
4	AMP INC	3678	031897	1 42	0 009	0 003	0 30	0 41	0 01	1 00	7 53	2	0 00007	0 00014	1 40	0 12	0 15	0 41	0 98	0 77	4 41
5	AMOCO C	2911	031905	0 61	0 003	0 002	0 35	0 52	0 04	0 49	10 16	5	0 00063	0 00316	1 82	0 09	-0 01	0 72	0 95	0 57	0 08
6	ANACOMP	3861	032375	1 75	0 032	0 024	0 96	0 00	0 09	0 99	5 73	5	0 00054	0 00271	0 99	0 68	-0 50	0 15	1 01	0 31	0 57
7	ARTRA G	3960	043147	1 56	0 024	0 017	0 80	-0 06	0 17	1 00	5 12	3	0 00083	0 00250	0 92	0 26	0 42	0 19	0 93	1 30	-0 26
8	BAUSCH	3851	071707	1 13	0 006	0 002	0 39	0 34	0 01	1 00	6 75	3	0 00005	0 00015	1 25	0 12	0 26	0 23	0 98	0 88	1 53
9	BORMAN'	5411	099855	0 66	0 042	0 041	1 02	-0 09	0 35	0 79	4 93	7	0 01122	0 07851	1 05	0 02	-0 45	0 51	1 02	1 99	-0 24
10	BROWN G	3140	115657	0 96	0 006	0 003	0 44	0 41	0 10	0 91	6 52	2	0 00014	0 00028	1 29	0 06	0 09	0 21	1 01	0 88	-0 80
11	CARTER	5311	146227	1 28	0 013	0 008	0 72	5 93	0 05	0 86	7 58	2	0 00061	0 00122	1 07	0 08	0 12	0 39	1 00	0 81	-1 17
12	CHARTER	5172	161177	1 77	0 046	0 038	0 42	-0 01	2 55	0 95	6 16	5	0 00097	0 00484	0 99	0 07	0 69	0 16	1 01	0 27	-3 50
13	CHESAPE	2621	165159	1 25	0 008	0 003	0 47	0 33	0 03	0 52	6 34	6	0 00170	0 01018	1 57	0 13	0 10	0 72	0 78	0 41	0 69
14	COACHME	3716	189873	1 42	0 017	0 011	0 36	0 65	0 03	1 00	4 88	2	0 00032	0 00063	1 02	0 21	0 81	0 24	1 04	0 03	0 05
15	COMDISC	7377	200336	2 13	0 025	0 013	0 60	0 11	0 09	1 00	7 63	4	0 00546	0 02184	1 00	0 49	3 42	0 52	0 98	3 78	0 62
16	COMMERC	5051	201723	1 04	0 008	0 005	0 46	0 19	0 03	0 92	5 69	6	0 00038	0 00231	1 40	0 06	0 10	0 22	1 00	0 94	0 17
17	CORE IN	3825	218675	1 06	0 006	0 003	0 27	0 62	0 01	0 77	4 92	2	0 00004	0 00008	0 98	0 11	0 09	0 19	1 02	0 82	-0 05
18	CUMMINS	3510	231021	1 51	0 012	0 006	0 48	1 71	0 15	1 00	7 53	6	0 00214	0 01284	1 06	0 08	0 44	0 42	0 98	0 41	-1 53
19	DALLAS	3442	234569	0 80	0 008	0 006	0 51	1 84	0 06	1 00	5 46	2	0 00003	0 00006	0 99	0 09	0 05	0 23	1 02	1 01	-0 15
20	DATA GE	3570	237688	1 49	0 014	0 008	0 44	0 00	0 08	0 87	7 04	2	0 00013	0 00026	1 15	0 25	0 20	0 26	1 10	1 07	-2 40
21	DONALDS	3564	257651	1 47	0 011	0 005	0 38	0 26	0 02	1 00	5 19	3	0 00010	0 00030	1 25	0 08	0 32	0 36	1 01	0 30	0 20
22	E-SYSTE	3812	269157	1 23	0 008	0 004	0 29	0 25	0 01	0 95	6 38	1	0 00004	0 00004	1 32	0 15	0 19	0 28	1 02	0 97	1 18
23	EKCO GR	3460	282636	1 19	0 027	0 023	0 55	0 00	0 07	0 94	5 09	1	0 00004	0 00004	0 99	0 17	-1 21	0 16	1 00	1 15	0 07
24	ETHYL C	2800	297659	1 40	0 009	0 004	0 34	0 25	0 02	0 77	7 78	5	0 00141	0 00707	1 27	0 19	0 05	0 37	0 86	0 78	3 32
25	EXXON C	2911	302290	0 76	0 003	0 001	0 30	0 52	0 03	0 49	11 16	5	0 00126	0 00629	1 61	0 06	0 05	0 67	0 91	0 80	8 90
26	FABRI-C	5940	302846	0 90	0 012	0 010	0 48	0 72	0 08	1 00	4 77	3	0 00015	0 00045	1 03	0 14	0 03	0 22	1 00	0 92	-0 09
27	FEDERAL	3714	313549	1 18	0 007	0 003	0 43	0 55	0 04	0 63	6 60	3	0 00032	0 00097	1 92	0 07	0 02	0 40	0 95	0 88	0 11
28	FLORIDA	4011	340632	1 10	0 007	0 003	0 06	0 07	0 01	0 67	6 19	4	0 00019	0 00076	1 08	0 12	0 23	0 73	0 99	0 92	0 24
29	FLUOR C	1600	343861	1 28	0 011	0 007	0 46	-0 20	0 22	0 94	7 89	3	0 00036	0 00107	0 89	0 18	-0 27	0 50	0 95	0 53	-1 90
30	FUQUA I	7384	361028	1 30	0 008	0 003	0 58	0 08	0 02	1 00	6 60	5	0 00015	0 00073	1 08	0 10	0 00	0 18	1 02	0 79	1 19
31	GENCORP	3760	368682	1 17	0 012	0 008	0 60	0 19	0 09	0 94	7 45	6	0 00052	0 00312	1 13	0 00	0 47	0 35	1 01	0 40	3 82
32	HARLAND	2780	412693	1 07	0 006	0 002	0 16	0 34	0 01	1 00	5 31	3	0 00004	0 00011	1 38	0 21	0 22	0 41	1 09	0 74	0 96
33	HEILIG-	5712	422893	1 52	0 012	0 005	0 64	0 22	0 02	1 00	5 89	2	0 00005	0 00011	1 22	0 20	0 23	0 18	0 91	0 82	0 28
34	HEWLETT	3570	428236	1 37	0 009	0 004	0 30	0 09	0 00	0 87	8 79	2	0 00006	0 00012	1 28	0 19	0 18	0 34	0 95	0 91	12 32
35	ILLINOI	3089	452308	1 51	0 009	0 003	0 38	0 23	0 02	0 89	6 90	3	0 00017	0 00050	0 93	0 18	0 14	0 26	1 09	1 20	2 27
36	INTL BU	3570	459200	0 86	0 004	0 001	0 30	0 45	0 01	0 87	10 97	2	0 00029	0 00057	1 41	0 13	0 10	0 42	1 06	0 84	50 02
37	INTL MU	2040	460043	0 80	0 005	0 003	0 49	0 48	0 03	0 99	6 49	4	0 00018	0 00073	1 17	0 07	0 20	0 30	1 05	0 52	0 14
38	JOHNSON	3822	478366	0 95	0 006	0 003	0 49	0 41	0 02	1 00	7 40	5	0 00031	0 00155	1 57	0 22	0 40	0 33	0 92	0 95	1 37
39	KIMBERL	2621	494368	0 79	0 005	0 003	0 39	0 39	0 01	0 52	8 22	5	0 00047	0 00234	1 89	0 09	0 12	0 60	0 89	0 69	3 61

TABLE V (Continued)

OBS	NAME	DNUM	CNUM	SYS	TOT	UNSYS	L	D	E	C	A	F	V	F*V	W/WO	Ga	Gc	P	W/WOa	W/WOc	B
40	LTV COR	3312	502210	1 48	0 031	0 025	0 38	0 00	5 41	0 72	8 72	4	0 00357	0 01428	1 08	0 10	0 52	0 47	1 07	0 11	-54 63
41	LOWE'S	5211	548661	1 38	0 010	0 005	0 44	0 25	0 02	1 00	6 82	2	0 00004	0 00007	1 14	0 15	0 16	0 37	1 08	0 98	1 12
42	MEREDIT	2721	589433	1 15	0 007	0 003	0 24	0 22	0 01	1 00	6 30	4	0 00010	0 00042	1 30	0 12	0 16	0 21	1 00	0 90	0 54
43	MOHASCO	2510	608030	1 59	0 025	0 018	0 50	0 31	0 07	0 87	6 04	3	0 00034	0 00103	0 99	0 04	2 01	0 36	0 91	0 60	-0 24
44	MUNSING	2340	626320	1 40	0 018	0 012	0 59	0 00	0 35	1 00	4 39	2	0 00008	0 00016	0 99	0 04	0 28	0 20	1 00	0 84	-0 27
45	NALCO C	2890	629853	1 32	0 007	0 002	0 26	0 60	0 01	0 85	6 46	3	0 00006	0 00017	1 54	0 12	0 12	0 42	0 99	0 80	0 76
46	PS GROU	5172	693624	0 73	0 008	0 006	0 62	0 20	0 15	0 95	6 78	7	0 08244	0 57705	1 42	0 10	0 42	0 63	0 95	0 01	0 74
47	PHILLIP	2320	718592	1 15	0 012	0 008	0 48	0 15	0 01	0 94	5 64	2	0 00013	0 00025	1 16	0 04	0 42	0 16	0 95	0 93	0 41
48	QUANEX	3312	747620	1 37	0 029	0 023	0 57	0 06	0 17	0 72	5 65	3	0 00008	0 00024	0 94	0 13	-0 89	0 53	0 98	3 17	0 26
49	RALSTON	2040	751277	0 75	0 004	0 002	0 61	0 24	0 01	0 99	8 12	4	0 00028	0 00112	1 54	0 09	0 15	0 50	0 93	0 61	7 85
50	RECOGNI	7373	756231	1 83	0 024	0 015	0 48	0 00	0 09	0 85	5 37	2	0 00041	0 00082	1 08	0 12	-0 19	0 18	1 00	0 51	-0 06
51	RYMER F	2013	783771	1 63	0 019	0 012	0 68	0 00	0 11	1 00	4 93	2	0 00079	0 00158	1 03	0 18	-0 49	0 15	0 99	0 61	0 41
52	SAVIN C	5040	805176	0 71	0 038	0 037	1 12	0 00	0 45	1 00	5 42	4	0 00102	0 00407	0 94	0 15	0 00	0 23	0 90	2 04	0 58
53	SCIENTI	3663	808655	1 42	0 013	0 008	0 25	0 18	0 05	0 94	5 67	1	0 00004	0 00004	1 16	0 24	0 51	0 18	0 98	0 38	0 40
54	SCOTTY'	5211	810623	0 92	0 006	0 003	0 36	0 46	0 02	1 00	5 59	3	0 00014	0 00042	1 41	0 15	0 15	0 47	0 98	0 89	0 14
55	SOUTHWE	4512	844741	1 12	0 009	0 005	0 38	0 09	0 04	0 59	6 93	7	0 00409	0 02866	2 06	0 37	0 31	0 84	0 99	0 02	0 45
56	SUN ELE	3825	866713	1 79	0 019	0 010	0 54	0 00	0 08	0 77	5 06	2	0 00005	0 00011	0 94	0 10	-0 16	0 18	0 99	0 23	-0 12
57	SUN CO	2911	866762	0 60	0 006	0 004	0 40	0 81	0 04	0 49	9 37	7	0 00110	0 00768	1 18	0 07	0 08	0 64	1 02	0 77	-14 92
58	TITAN C	7373	888266	1 62	0 017	0 010	0 39	0 00	0 17	0 85	4 39	5	0 00021	0 00103	0 97	0 01	0 76	0 15	1 01	0 27	-0 22
59	TONKA C	3944	890278	1 51	0 019	0 013	0 65	0 06	0 13	0 92	6 05	6	0 00026	0 00154	1 18	0 37	1 64	0 23	0 99	11 66	-0 30
60	TYLER C	2851	902182	0 92	0 007	0 004	0 62	2 11	0 04	0 84	6 15	4	0 00013	0 00053	1 08	0 07	-0 03	0 32	1 00	0 72	0 02
61	USG COR	3270	903293	1 55	0 013	0 007	0 71	2 26	0 05	1 00	7 52	5	0 00055	0 00275	1 37	0 07	0 14	0 58	0 94	0 82	2 15
62	USAIR G	4512	911905	1 05	0 007	0 003	0 45	0 03	0 03	0 59	8 09	7	0 01527	0 10688	1 46	0 26	0 18	0 67	0 87	0 42	3 24
63	UNIVERS	5150	913456	0 79	0 004	0 002	0 43	0 36	0 01	1 00	6 55	2	0 00005	0 00011	1 07	0 14	0 26	0 24	1 01	0 86	0 75
64	WARNER	3652	934436	1 21	0 009	0 005	0 55	0 42	0 18	1 00	8 09	3	0 00010	0 00029	0 99	0 12	-0 02	0 16	1 00	0 85	5 33
65	WEIS MA	5411	948849	0 70	0 005	0 003	0 13	0 26	0 01	0 79	6 18	3	0 00006	0 00019	1 30	0 15	0 14	0 30	0 86	0 68	1 15
66	WHITEHA	3721	965010	1 34	0 013	0 008	0 11	0 00	0 07	0 93	4 36	4	0 00014	0 00056	1 06	0 11	0 28	0 30	1 03	0 78	-0 21
67	WINN-DI	5411	974280	0 76	0 004	0 002	0 45	0 62	0 01	0 79	7 20	2	0 00018	0 00035	1 37	0 11	0 10	0 38	0 93	0 79	0 47
68	ZAYRE C	5651	989195	1 58	0 016	0 009	0 56	0 36	0 12	0 89	7 40	6	0 00072	0 00432	1 08	0 11	0 22	0 33	1 00	0 84	-2 10

TABLE VI

DISTRIBUTION OF SAMPLE COMPANIES BY SIC CODE

SIC Code Range	# of Firms	SIC Code Range	# of Firms	SIC Code Range	# of Firms
1600 - 1700	1	3100 - 3200	1	4500 - 4600	2
2000 - 2100	3	3200 - 3300	1	5000 - 5100	2
2200 - 2300	1	3300 - 3400	2	5100 - 5200	3
2300 - 2400	2	3400 - 3500	2	5200 - 5300	2
2500 - 2600	1	3500 - 3600	6	5300 - 5400	1
2600 - 2700	2	3600 - 3700	3	5400 - 5500	3
2700 - 2800	3	3700 - 3800	4	5600 - 5700	1
2800 - 2900	3	3800 - 3900	6	5700 - 5800	1
2900 - 3000	3	3900 - 4000	2	5900 - 6000	1
3000 - 3100	3	4000 - 4100	1	7300 - 7400	4

TABLE VII

EXCLUDED OUTLIERS

Model Number	Dependent Variable	Tax-Change Variable	Outliers Excluded (See Table V for information corresponding to outlier number)
1	Total Risk	Frequency (F)	1,12,23,46
2	Total Risk	Variability (V)	46
3	Total Risk	W/WO_a	13,36,43,57
4	Total Risk	W/WO_c	59
5	Unsystematic Risk	Frequency (F)	1,12,23,40,36
6	Unsystematic Risk	Variability (V)	46,36
7	Unsystematic Risk	W/WO_a	9,13,57
8	Unsystematic Risk	W/WO_c	36,59
9	Systematic Risk	W/WO_a	13,65
10	Systematic Risk	W/WO_c	59

APPENDIX E

CORRELATION ANALYSIS

CORRELATION ANALYSIS -- ALL VARIABLES AND ALL OBSERVATIONS INCLUDED

	SYS RSK	TOT RSK	UNS RSK	L	D	E	C
SYS RSK	1						
TOT RSK	0 37849*	1					
UNS RSK	0 16257	0 97392*	1				
L	0 13427	0 53995*	0 54513*	1			
D	-0 15431	-0 00989	0 0276	-0 02042	1		
E	0 17345	0 46158*	0 45546*	0 01189	-0 02526	1	
C	0 26988**	0 17632	0 12646	0 24831**	0 06592	-0 07099	1
A	-0 13392	-0 37309*	-0 37101*	-0 11364	-0 11828	0 11371	-0 41859*
F	-0 23035***	0 08066	0 13518	0 16616	0 00298	0 07417	-0 36775*
V	-0 16239	-0 00967	0 02476	0 15379	-0 03431	0 02795	-0 01174
F * V	-0 17498	-0 02084	0 01653	0 14843	-0 03304	0 01212	-0 01209
W/WO	-0 3337*	-0 53717*	-0 49201*	-0 28761**	-0 11002	-0 15574	-0 49336*
G_1^a	0 42095*	0 14547	0 04839	0 20772***	-0 16974	-0 08072	0 11263
G_1^c	0 31719*	0 07269	-0 0167	-0 07106	0 10615	0 09129	0 15259
P	-0 33631*	-0 25294**	-0 19453	-0 17845	0 12253	-0 00137	-0 6472 *
W/WO_a	0 07333	0 17242	0 1677	-0 05172	0 24438**	0 18156	0 37998*
W/WO_c	0 12582	0 18265	0 16346	0 22551***	0 03539	-0 069	0 07782
B	-0 13928	-0 30013**	-0 28952**	-0 04621	-0 00866	-0 67819*	0 11117

	A	F	V	F * V	W/WO	G_1^a
F	0 17104	1				
V	0 05128	0 33598*	1			
F * V	0 04433	0 33567*	0 99944*	1		
W/WO	0 43099*	0 28417**	0 11292	0 11794	1	
G_1^a	0 04877	-0 01556	-0 00674	-0 01673	0 0182	1
G_1^c	0 04927	0 11683	0 06267	0 0441	-0 06309	0 20809***
P	0 4911*	0 51434*	0 27869**	0 27488**	0 55424*	-0 04705
W/WO_a	-0 19947	-0 21703***	-0 11651	-0 11573	-0 42027*	-0 0544
W/WO_c	-0 05289	0 10111	-0 07451	-0 07855	-0 10762	0 3083 **
B	0 17457	-0 13556	-0 02303	-0 0119	0 18273	0 04101

	G_i^c	P	W/WO_a	W/WO_c
P	0 06126	1		
W/WO_a	-0 0194	-0 30385**	1	
W/WO_c	0 35424*	-0 07116	0 03104	1
B	-0 06985	-0 0145	-0 10889	0 03323

* indicates significance at 1 percent level
** indicates significance at 5 percent level
*** indicates significance at 10 percent level

APPENDIX F

COLLINEARITY ANALYSIS

The following collinearity diagnostics were generated using the COLLIN option for the REG procedure in the SAS statistical analysis software   This option is based on work by Belsley, Kuh, and Welsch [1980]   The diagnostic procedure is as follows   The condition numbers are first investigated to see if any are above 20 or 30 in magnitude If there are, then the proportion of each variable's total variance corresponding to the eigenvalues associated with these condition numbers are investigated   If any two or more of these variance proportions are greater than 0 5, then there is a good chance that the coefficients and/or measured significance of these variables have been affected by collinearity between or among them

For example, in the diagnostics for Regression 1, there is one condition number greater than 20   There are three variance proportions greater than 0 5, so collinearity might be a factor in the coefficients and measured significance of the intercept, the industry concentration (C), and the asset size (A) variables   The diagnostics indicate that only one of the tax-change variables, W/WO_a, has any problem with collinearity   It is apparently collinear with the intercept in every model in which it appears   The most likely explanation for this is that the values of W/WO_a are grouped very closely together, making no one particular coefficient (or slope) greatly preferable to any other from a least-squares perspective   There is apparent collinearity because the slope determines the intercept, so as the slope increases (decreases), the intercept decreases (increases)

The summary statistics in Appendix C lend weight to this conclusion because they indicate that W/WO_a has a mean of 0 98517, and a standard deviation of only 0 060044   Moreover, the range of the variable is only from 0 7752 to 1 1055 It should be pointed out that the passable (α = 0 08) significance of the coefficient of W/WO_a in Regression 3 is probably not due to collinearity with the intercept Collinearity can sometimes cause an insignificant variable to appear significant by making the coefficient appear much larger than it really is (one of the characteristics of collinearity is its effect on the stability of the coefficients of the collinear variables) Since the coefficient is the numerator of the t-statistic, this makes the t-statistic larger than it should be, and the corresponding "significance" appears better than it should be However, as the results of Regression 3 show, the coefficient of W/WO_a does not appear to be unusually large compared to the coefficient of W/WO_a in the other regressions

TABLE VIII

COLLINEARITY DIAGNOSTICS FOR REGRESSION 1

	EIGENVALUE	CONDITION NUMBER	VAR PROP INTERCEP	VARIANCE PROPORTION F	L	E	C
1	5 427634	1 000000	0 0003	0 0035	0 0037	0 0009	0 0006
2	1 671392	1 802047	0 0000	0 0000	0 0000	0 1027	0 0000
3	0 331399	4 046969	0 0005	0 0062	0 0003	0 0910	0 0005
4	0 278832	4 411986	0 0002	0 0493	0 0094	0 5068	0 0001
5	0 141661	6 189843	0 0007	0 4280	0 2187	0 0087	0 0204
6	0 108994	7 056753	0 0084	0 1059	0 5476	0 0778	0 0190
7	0 034632	12 518937	0 0017	0 2966	0 2142	0 1566	0 1582
8	0 0054572	31 536904	0 9883	0 1104	0 0061	0 0556	0 8011

TABLE VIII (Continued)

	VARIANCE PROPORTION		
	A	G_1[a]	B
1	0 0010	0 0087	0 0000
2	0 0000	0 0007	0 1112
3	0 0054	0 7611	0 1117
4	0 0005	0 1795	0 4100
5	0 0067	0 0452	0 0175
6	0 0351	0 0001	0 1084
7	0 4502	0 0000	0 1469
8	0 5011	0 0047	0 0942

TABLE IX

COLLINEARITY DIAGNOSTICS FOR REGRESSION 2

		CONDITION	VARIANCE PROPORTION				
	EIGENVALUE	NUMBER	INTERCEP	V	L	E	C
1	4 775910	1 000000	0 0004	0 0068	0 0047	0 0019	0 0007
2	1 641854	1 705535	0 0000	0 0100	0 0001	0 1143	0 0001
3	0 800728	2 442224	0 0002	0 7498	0 0002	0 0083	0 0008
4	0 354913	3 668319	0 0003	0 0075	0 0001	0 2847	0 0003
5	0 268304	4 219046	0 0014	0 0184	0 0292	0 4053	0 0020
6	0 109339	6 609079	0 0055	0 0233	0 7110	0 0672	0 0003
7	0 043142	10 521449	0 0076	0 1144	0 2491	0 0234	0 1885
8	0 0058090	28 673372	0 9846	0 0700	0 0057	0 0949	0 8074

TABLE IX (Continued)

	VARIANCE PROPORTION		
	A	G_i^a	B
1	0 0014	0 0112	0 0000
2	0 0001	0 0015	0 1350
3	0 0004	0 0003	0 0085
4	0 0042	0 4262	0 3251
5	0 0006	0 5382	0 2961
6	0 0752	0 0017	0 0690
7	0 3164	0 0002	0 0246
8	0 6017	0 0207	0 1416

TABLE X

COLLINEARITY DIAGNOSTICS FOR REGRESSION 3

	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION		
			INTERCEP	W/WO_a	L
1	5 567835	1 000000	0 0001	0 0001	0 0038
2	1 816733	1 750643	0 0000	0 0000	0 0001
3	0 333480	4 086091	0 0002	0 0002	0 0018
4	0 122315	6 746873	0 0004	0 0004	0 8015
5	0 106737	7 222463	0 0004	0 0007	0 0516
6	0 043460	11 318692	0 0002	0 0015	0 1093
7	0 0084420	25 681541	0 0423	0 0572	0 0126
8	0 0009968	74 736068	0 9565	0 9399	0 0194

TABLE X (Continued)

NUMBER	VARIANCE PROPORTION E	C	A	G_1[a]	B
1	0 0006	0 0005	0 0010	0 0081	0 0000
2	0 0441	0 0000	0 0000	0 0013	0 0516
3	0 0023	0 0014	0 0027	0 9119	0 0088
4	0 0308	0 0001	0 0373	0 0311	0 0336
5	0 7181	0 0050	0 0024	0 0145	0 6863
6	0 1659	0 1155	0 3966	0 0164	0 1296
7	0 0372	0 8641	0 4014	0 0146	0 0580
8	0 0009	0 0136	0 1586	0 0022	0 0321

TABLE XI

COLLINEARITY DIAGNOSTICS FOR REGRESSION 4

NUMBER	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCEP	W/WO_c	L
1	5 300096	1 000000	0 0003	0 0082	0 0040
2	1 631558	1 802356	0 0000	0 0013	0 0000
3	0 358280	3 846189	0 0005	0 0456	0 0000
4	0 308147	4 147274	0 0001	0 3501	0 0077
5	0 238439	4 714693	0 0032	0 5375	0 0177
6	0 108515	6 988702	0 0050	0 0555	0 8164
7	0 048704	10 431813	0 0042	0 0000	0 1540
8	0 0062612	29 094674	0 9867	0 0019	0 0001

TABLE XI (Continued)

NUMBER	VARIANCE PROPORTION E	C	A	G_1[a]	B
1	0 0012	0 0007	0 0011	0 0092	0 0001
2	0 1242	0 0000	0 0000	0 0006	0 1381
3	0 3077	0 0009	0 0060	0 3007	0 3574
4	0 0753	0 0001	0 0003	0 5934	0 0817
5	0 3397	0 0060	0 0057	0 0838	0 2012
6	0 0348	0 0009	0 0572	0 0002	0 0556
7	0 0407	0 2063	0 2951	0 0014	0 0267
8	0 0766	0 7851	0 6345	0 0106	0 1394

TABLE XII

COLLINEARITY DIAGNOSTICS FOR REGRESSION 5

	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCP	W/WO_a	E	G_1[a]	G_1[c]	P
1	3 815509	1 000000	0 0001	0 0002	0 0069	0 0186	0 0146	0 0100
2	0 933293	2 021935	0 0000	0 0000	0 8339	0 0120	0 0485	0 0020
3	0 797615	2 187155	0 0001	0 0001	0 0795	0 0027	0 8643	0 0046
4	0 329900	3 400834	0 0002	0 0002	0 0367	0 8370	0 0605	0 0929
5	0 122483	5 581348	0 0033	0 0043	0 0095	0 1221	0 0112	0 7983
6	0 0012006	56 373742	0 9963	0 9952	0 0334	0 0077	0 0008	0 0922

TABLE XIII

COLLINEARITY DIAGNOSTICS FOR REGRESSION 6

	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCEP	W/WO_c	E	$G_1{}^a$	$G_1{}^c$	P
1	3 709050	1 000000	0 0065	0 0145	0 0086	0 0195	0 0165	0 0105
2	0 911520	2 017197	0 0006	0 0021	0 8181	0 0147	0 0239	0 0053
3	0 759083	2 210480	0 0078	0 0015	0 0639	0 0075	0 7477	0 0078
4	0 325010	3 378181	0 0124	0 0039	0 0092	0 7897	0 0010	0 1455
5	0 228169	4 031842	0 0004	0 7311	0 0007	0 0836	0 1169	0 1723
6	0 067168	7 431072	0 9724	0 2469	0 0996	0 0850	0 0941	0 6587

TABLE XIV

COLLINEARITY DIAGNOSTICS FOR REGRESSION 7

NUMBER	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCEP	F	L
1	5 261040	1 000000	0 0003	0 0039	0 0026
2	0 998975	2 294872	0 0000	0 0004	0 0005
3	0 492972	3 266816	0 0007	0 0124	0 0026
4	0 141098	6 106256	0 0029	0 6015	0 0138
5	0 064430	9 036331	0 0080	0 0023	0 9034
6	0 035968	12 094162	0 0011	0 3038	0 0448
7	0 0055168	30 880970	0 9870	0 0757	0 0322

TABLE XIV (Contınued)

NUMBER	VARIANCE PROPORTION E	C	A	B
1	0 0064	0 0006	0 0009	0 001
2	0 0293	0 0000	0 0002	0 725
3	0 4514	0 0008	0 0046	0 146
4	0 0124	0 0299	0 0001	0 034
5	0 4589	0 0064	0 0307	0 0012
6	0 0243	0 1654	0 4412	0 0315
7	0 0174	0 7969	0 5224	0 0587

TABLE XV

COLLINEARITY DIAGNOSTICS FOR REGRESSION 8

NUMBER	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCEP	V	L
1	4 122785	1 000000	0 0005	0 0097	0 0064
2	1 772462	1 525130	0 0001	0 0036	0 0008
3	0 805700	2 262084	0 0002	0 7784	0 0001
4	0 137727	5 471232	0 0002	0 0010	0 0238
5	0 111838	6 071559	0 0053	0 0247	0 7112
6	0 043455	9 740422	0 0088	0 1211	0 2486
7	0 0060333	26 140643	0 9850	0 0614	0 0090

TABLE XV (Contınued)

NUMBER	VARIANCE PROPORTION E	C	A	B
1	0 0021	0 0010	0 0020	0 0003
2	0 0572	0 0002	0 0001	0 0727
3	0 0027	0 0008	0 0004	0 0036
4	0 8560	0 0000	0 0003	0 8498
5	0 0272	0 0002	0 0829	0 0149
6	0 0001	0 1946	0 3323	0 0021
7	0 0548	0 8033	0 5820	0 0565

TABLE XVI

COLLINEARITY DIAGNOSTICS FOR REGRESSION 9

NUMBER	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCEP	W/WO_a	L
1	4 910910	1 000000	0 0001	0 0001	0 0043
2	1 631571	1 734914	0 0000	0 0000	0 0000
3	0 298278	4 057611	0 0000	0 0000	0 0157
4	0 106924	6 777098	0 0011	0 0014	0 8020
5	0 043522	10 622549	0 0003	0 0023	0 0685
6	0 0076585	25 322585	0 0504	0 0703	0 0709
7	0 0011380	65 690896	0 9481	0 9259	0 0385

TABLE XVI (Continued)

NUMBER	VARIANCE PROPORTION E	C	A	B
1	0 0014	0 0006	0 0012	0 0001
2	0 1033	0 0000	0 0000	0 1226
3	0 5882	0 0005	0 0024	0 5513
4	0 0588	0 0010	0 0256	0 0679
5	0 1147	0 1082	0 3969	0 1191
6	0 0300	0 8792	0 4255	0 0953
7	0 1035	0 0104	0 1485	0 0437

TABLE XVII

COLLINEARITY DIAGNOSTICS FOR REGRESSION 10

NUMBER	EIGENVALUE	CONDITION NUMBER	VARIANCE PROPORTION INTERCEP	W/WO_c	L
1	4 630824	1 000000	0 0004	0 0109	0 0053
2	1 793263	1 606968	0 0000	0 0026	0 0002
3	0 274436	4 107795	0 0020	0 8943	0 0013
4	0 135724	5 841183	0 0010	0 0216	0 0009
5	0 109931	6 490374	0 0042	0 0696	0 8472
6	0 049378	9 684208	0 0053	0 0000	0 1447
7	0 0064448	26 805508	0 9871	0 0010	0 0005

TABLE XVII (Continued)

NUMBER	VARIANCE PROPORTION E	C	A	B
1	0 0011	0 0009	0 0016	0 0001
2	0 0608	0 0000	0 0000	0 0731
3	0 0026	0 0037	0 0101	0 0233
4	0 8927	0 0004	0 0013	0 8526
5	0 0003	0 0006	0 0606	0 0004
6	0 0012	0 2117	0 3059	0 0010
7	0 0414	0 7827	0 6205	0 0496

VITA

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