AN EVALUATION OF THE IMPACT OF INDEXED BONDS ON THE FINANCIAL PERFORMANCE OF CORPORATE ISSUERS UNDER CONDITIONS OF INFLATION

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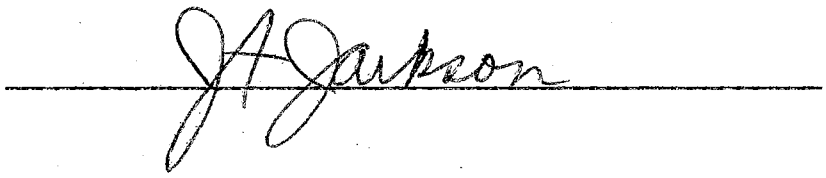
Scope and Method of Study: A simulation model which generates income statements and balance sheets was used to study the impact that both indexed and non-indexed debt would have on the financial performance of a hypothetical firm over a ten-year period. Thirty-six scenarios were developed in which the primary variables altered were the type of debt used in the firm's capital structure (bonds with indexed interest only, bonds with indexed principal only, bonds with indexed interest and principal, traditional long-term bonds, and short-term debt), and the direction of change in the inflation rate (increasing, decreasing, constant, or random). Income statements and balance sheets were generated for each scenario from which selected measures for three areas of financial performance were calculated: cash flow, profitability, and risk. Measures for the cash flow analysis included annual interest expense (indexed and non-indexed), principal repayment (with and without a sinking fund), and total cash flow (interest plus principal). A hypothetical price index was used to adjust indexed interest and/or principal. Measures for profitability analysis included return on investment, return on net worth, and net profit margin. Measures for risk analysis included coverage ratios (times interest earned and fixed charge coverage), debt ratios (total debt ÷ total assets and total debt ÷ net worth), and statistical measures (mean, variance, and standard deviation of earnings per share).

Findings and Conclusions: Traditional non-indexed bonds and those with only the interest indexed were consistently found to be the most beneficial debt instruments for the firm to use during any inflation conditions. The firm would naturally prefer to use traditional, fixed-rate debt (except during decreasing inflation when indexed interest bonds would decrease cash flow and increase profitability), but during rapidly rising inflation this option is not always available as investors will not lend funds for a fixed-return for the long-term. When indexing is chosen as an alternative source of funds, then bonds with only the interest indexed provide the most beneficial impact on all areas of financial performance. Bonds which include an indexed principal feature were found to significantly

increase the demand on the firm's cash, annually if a sinking fund is used and only at maturity if a sinking fund is not used. More default risk was added to the firm's capital structure using indexed principal bonds since the liability becomes larger each year during any inflation conditions as long as the inflation rate is greater than zero. Return on investment was the only area of profitability affected by these bonds. The exclusive use of short-term debt was found to be the least beneficial to the firm in all areas of performance under any inflation conditions. All findings and conclusions are subject to the constraints of the model.

ADVISOR'S APPROVAL 

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INTRODUCTION AND OVERVIEW OF PROBLEM

INTRODUCTION

An inflationary trend has developed during the past fifteen years not only in the United States, but throughout the world. Triple digit inflation has plagued such countries as Brazil, Chile and Argentina. In the United States the figures are not as staggering, but are nonetheless persistent. The consumer price index for all items has risen from 93.7 in March, 1965 to a level of 256.4 in November, 1980 (1967 = 100) for a total increase of 174 percent for the fifteen year period. In addition, the annual rate of increase has accelerated in recent years. This persistent inflationary trend has left an impression on the economic sectors in several areas: aggregate capital market structure, the traditional concept of risk, and corporate financial structure.

When investors purchase fixed-income securities, a premium for the anticipated rate of inflation is incorporated in the rate of return to be received over the life of the security. As inflation continues to rise from year to year, this inflation premium becomes more difficult to forecast, particularly for the longer-term securities. Investors' have realized a very low success rate in predicting the actual rate of inflation. When the actual inflation rate is greater than the inflation premium incorporated in nominal interest rates by investors, then the fixed return to the investor is eroded as real interest rates decline. Some

decline to the point of actually producing a negative return to the holder of fixed-income securities. In addition, inflation deteriorates the principal of a fixed-income security along with the real rate of return. So, as inflation persists, it becomes increasingly risky for investors in the capital market to hold long-term, fixed-income securities.

Consequently, the structure of the capital market is altered. Some of the weight traditionally attributed to long-term securities is shifted into the intermediate-term securities and primarily into the money market. Due to the continuing uncertainty surrounding inflation, investors in the capital market will no longer accept fixed-income securities of a long duration.

Traditionally, long-term securities have been viewed by the corporate issuer as involving less risk than shorter-term securities. Long-term interest payments are fixed and easier to budget as opposed to the fluctuating rates associated with short-term securities which must be renewed more often. Corporations do not run the risk of being unable to renew a loan when issuing long-term debt. Also, the use of long-term debt allows the corporation to defer the repayment of the principal until maturity when it can be paid back with cheaper dollars. So, as investors demand fewer long-term securities, corporations are forced into issuing shorter-term securities which involve an increased amount of risk in the traditional concept.

Forcing corporate issuers increasingly into short-term securities has resulted in several business trends regarding financial structure. First, in order to move towards an optimal financial structure, some long-term funds must be used. Since the firm cannot obtain these funds, it is exposed to risks which interfere with the optimization of its finan-

cial structure. Second, companies can no longer conform to the so-called "matching principle" where debt maturity is "matched" to the maturity of the assets which it is being used to finance. This increases the risk of investing in long-term assets since part of that permanent financing must come from short-term funds.

Third, inflation itself has caused additional problems in the area of capital asset investment. Not only has the interest cost of financing capital assets been increasing, but the principal cost of the asset has also been on the rise. These two factors combined with the uncertainty of short-term financing have hindered the rapid growth of capital asset investment and consequently, the productivity of the nation's corporations.

LONG-TERM FINANCING ALTERNATIVES

Several alternatives exist to enable the corporate issuer to cope with the changing maturity structure of the capital markets. One would be to raise new equity capital rather than going to the debt markets for funds. A second alternative would be to use more internal financing by retaining a larger percentage of earnings in the corporation and decrease the percentage payout to the stockholders. A third possibility would be to continue raising funds in the debt markets, but giving the investor some incentive to hold longer-term securities. One incentive which this paper suggests would be to index the interest and/or principal of the debt securities to some cost-of-living measure and, thereby, compensate the investor for any changes in the rate of inflation over the life of the security.

Indexation of securities has already been employed in some Latin American countries where inflation had reached triple-digit levels.

Although each country had its own objectives when the decision was made to allow the indexation of securities, one result has been common to all cases. Indexation of securities did aid in the re-establishment of a market for longer-term securities and restored some balance to the structure of the capital markets.

INDEXATION'S INFLUENCE ON TRADITIONAL MANAGEMENT POLICIES

Companies have traditionally had a tendency to move towards an optimal financial structure over time through target maturity combinations of short- and long-term debt. But, during periods of rapidly rising inflation companies become increasingly unable to use traditional long-term financing. Long-term, fixed-income securities are unpopular with investors or other suppliers of funds because of the risk of loss from the erosion of real rates of return. As a result, a company which chooses to borrow in the debt markets may either issue more and more short-term instruments, which are by nature indexed, or the company can move toward greater use of longer-term, indexed securities.

Indexation is not presented as a cure for inflation, but rather as a tool to ease the symptoms of inflation and to relieve some of the inequities brought on by inflation. However, indexation is not without its problems.

With changing inflation rates, the company that issues indexed securities would have to adjust its nominal interest payments several times over the life of the security. This produces a new dimension of uncertainty into the budgeting process, both in the short run and the long run. In addition, if the principal amount of the security is also indexed, then a question arises as to how sinking fund contributions and the callability

of the security should be handled. Even though indexation may serve to lengthen the maturities in the financial structure, the traditional view of risk associated with the longer maturities would need to be revised.

Dividend policies may also be affected by indexation. If the inflation rate was substantially high in any one year, or any number of years, then upward adjusted interest payments may diminish net income which might otherwise have been paid out to stockholders. This could also leave less capital for reinvestment purposes and asset allocation problems would arise.

Some legal barriers may pose a threat to the indexation of business contracts. Some legal questions that could arise might involve accounting methods for indexed securities and sinking funds, the taxation of real interest versus nominal interest, and usury limits on interest rates.

These problems associated with indexation will have various impacts on the corporate issuer of indexed securities. While it has been shown through experience that indexation can bring about increased demand for long-term securities, the variability of interest payments causes the long-term, indexed securities to take on some risks normally attributed to short-term securities. This alters the normal view of financial structure risk.

The management of cash flows would take on new dimensions as changes in nominal interest payments would need to be forecasted and budgeted. Fluctuating interest payments would also cause net income to vary more than usual with the inflation rate and, hence, affect profitability.

Fixed charges will vary over the life of the indexed debt making it difficult to forecast financial ratios such as times interest earned and fixed charge coverage. Increased uncertainty regarding these and other

variables may affect the valuation of the indexed securities by potential investors and/or the rating services. This valuation would, in part, be determined by the evaluator's expectations of future inflation rates. Ultimately, the indexation of securities can affect the overall valuation of the firm and, consequently, the wealth of the stockholders.

FACTORS THAT INFLUENCE THE USE OF INDEXATION

The extent to which indexation will be employed by corporations would be primarily dependent on the prevailing financial market conditions at the time the issuance of indexed securities is under consideration.

If the term structure of interest rates appears to be in an upward sloping yield curve, then corporations would be inclined to prefer the issuance of fixed-rate, long-term securities, while investors would need some type of incentive to induce them to commit their funds for an extended period of time. On the other hand, if the yield curve were downward sloping, then corporations would prefer to issue indexed securities because the interest payments could be adjusted downward over time. But, investors would prefer to lock in the higher interest rate in a fixed-rate security. A conflict is present between supply and demand of indexed securities.

Indexation is already present in some government policies, such as social security benefits and guaranteed cost-of-living wage increases. The private sector has also incorporated indexation in the form of wage agreements. The use of floating rate notes has surged since the 1974 recession.

Financial institutions have increased their use of indexed loans in recent years. The costs associated with time deposits have soared in the last two years, while institutions still carry assets on their

books which pay the low nominal rates which prevailed in the past. Many institutions may even be technically insolvent. To combat this situation, institutions have begun to issue indexed loans in order to lock in a real rate of return while the nominal rate would fluctuate with market conditions.

Other factors would influence the decision to index, such as, accounting methods for indexed interest and/or principal, sales growth rate, variability of profit margins, tax rate, and many others. The influence of these factors over the use of indexation will be more fully explored through the use of a simulation model.

METHODOLOGY

In order to study the impact of indexation on the corporate issuer, several approaches could be used. One could take the macro approach and study the aggregate impact of indexation on all firms in the economy. Combined sources and uses of funds statements along with the aggregate supply and demand for securities could be studied within the realm of the entire economy.

Another means to study the problem would be the micro approach; indexation's impact on an individual firm could be modeled. This firm would be constrained by several environmental factors such as the direction of the rate of change of inflation, the existing capital structure of the firm, the method of accounting for indexation, and so on.

The micro approach is the one which will be used. Specifically, a model will be developed which will allow the study of the interaction of several variables on selected financial performance measures of an individual firm.

Alternate research designs exist to perform the analysis. An empirical testing design could be used involving X number of companies, or a case study of selected companies' experiences could be developed. A third approach, and the one which will be used, would be to develop a pro forma balance sheet and income statement generator to study the impact of alternative scenarios on financial performance.

Many variables could be studied involving the use of indexation. Some of these include the impact of indexation on the stability of the economy, its impact on financial institutions, its affect on Federal tax policy, and the legal implications stemming from indexation. These are all viable issues, but will not be directly addressed through the model.

This study will evaluate the impact of the indexation of bonds on the financial performance of a hypothetical firm in the economy. Pro forma income statements and balance sheets will be generated under four different inflation assumptions and selected capital structures. From these accounting statements several measures of financial performance will be calculated and analyzed in three areas: cash flow, profitability, and risk.

Capital structures will consist of both non-indexed and indexed debt instruments. Non-indexed instruments will include short-term debt and traditional long-term bonds, while indexed debt will include bonds with only the interest indexed, bonds with only the principal indexed, and bonds with both the interest and principal indexed.

CHAPTER SUMMARIES

Chapter two will present a review of the literature concerning inflation and indexation in theory and application. Chapter three

examines the expected impact that the indexation of bonds would have on both the corporate borrower and the lender of funds. In chapter four, the simulation model itself is developed followed by the analysis of the data derived from the model and its impact on the borrower and the lender in chapter five. Finally, a summary of the analysis and recommendations appear in chapter six.

CHAPTER 2

A REVIEW OF INFLATION AND INDEXATION LITERATURE

Inflation has become incorporated into investors' expectations of the future state of the economy. Government attempts to control inflation have been unsuccessful as continuing budget deficits, an expanding money supply, and international inflationary pressures continue to fuel the domestic inflation rate. These inflationary expectations are built into the nominal rate of return demanded by savers on their investments in the form of an inflation premium. As long as savers correctly anticipate the actual inflation rate they will receive some real return on their investment. However, if inflation is underestimated, then the saver will experience a reduction in his expected real rate of return which could possibly even be negative. It is this unanticipated portion of inflation which causes inequities in the financial system.

RESULTS OF INFLATION

A prolonged inflation such as the United States is experiencing, brings with it certain inequities to the traditional financial system: a transference of wealth from savers to borrowers, a depressed incentive to save, and a distortion in the financial structure of corporate borrowers.

Inflation transfers wealth from savers to borrowers. Traditionally, borrowers benefit from inflation because they repay their fixed-rate

loans with cheaper dollars. This leaves little incentive for a saver to forego present consumption when the alternative is to invest his funds at a possible negative return in real terms. The saver is particularly averse to committing his funds for an extended period of time. Consequently, it is difficult for borrowers to obtain needed permanent funds for productive investment which, in turn, would contribute to growth of the gross national product.

An outgrowth of this affect is a distortion in the financial structure of corporate borrowers. An optimal financial structure would consist of some combination of equity, short-term debt, and long-term debt. Inflation tends to erode internal real profits (equity) forcing the corporate borrower to rely extensively on external debt funding. In the public debt market, those savers who do choose to lend their funds tend to prefer short-term investments in order to take advantage of rising interest rates to protect themselves against inflation. Consequently, corporate borrowers find it difficult to obtain long-term financing, a vital part of their optimal financial structure.

Traditionally, long-term assets have been financed by long-term debt in order to match asset and liability maturities. Financing those assets with short-term debt exposes the firm to additional risks. In a period of rising interest rates, short-term debt would continually be renewed at higher interest rates, increasing both the borrowing cost and the variability of future cash flows. There is also the risk that the debt may not be renewed at all during periods of tight money.

The move toward increased use of short-term debt has been evidenced during the present inflationary trend. The ratio of bonds outstanding to total bank loan and commercial paper has experienced an overall downtrend

from just above 2:1 in 1962 to just above 1:1 in mid-1980.[1] Companies who have wanted longer-term financing have had to settle for intermediate to short-term financing. For example, Southern Company, a holding company for four utilities, cut the maturity of a $100 million bond issue from 30 years to 10 years. Houston Lighting and Power Company made the same maturity cut on a $125 million issue. The City of Pittsburgh had to settle for $37 million of four year capital notes rather than a 20 year bond issue.[2]

Inflation, then, has caused a transference of wealth from savers to borrowers stifling the incentive to save. Corporations as borrowers should derive benefits from this distortion, but another factor prevents them from doing so. Corporations find it difficult to borrow long-term funds under inflationary conditions and cannot fill out their optimal financial structure. They must depend on shorter-term debt whose cost tends to rise every time it is renewed. This exposes the corporation to volatile financing costs and the risk that financing might not be available in the future after permanent assets have been acquired. Since corporations are limited to higher cost short-term borrowings, the benefit from inflation is substantially reduced.

INDEXATION AS ALTERNATIVE FINANCING

Given that inflation exists and will most likely continue to persist for some time, the corporation must deal with that state of nature in its borrowing activities. The corporation has two general alternatives when raising funds through debt issues: continue to rely primarily on short-term debt, or incorporate features into long-term debt which will make these securities more attractive to the investor.

Traditionally, attractive bond features have included such things as convertibility, mortgage claims, and sinking funds. But these features protected the bondholder primarily from default risk, not inflation risk. Inflation was dealt with by simply offering a higher fixed interest rate on the bond, but this does not protect the bondholder from an increase in the present inflation rate.

One feature which could be incorporated into bonds to induce the investor to commit his funds for an extended time is to index the bonds, i.e., to tie the bond interest and/or principal payments to a general price index. The purpose of indexation is "to eliminate the necessity for correctly anticipating the rate of inflation by making contractual arrangements which, by means of the indexing clause, stipulate real rates of return instead of nominal ones."[3]

Indexation has been found to perform two primary functions: it extended liability maturities which more closely matched the asset maturities, and it decreased the issuer's dependence on the commercial paper market.[4]

INDEXATION IS NOT A NEW CONCEPT

The concept of indexation dates back many centuries.[5] While the beginnings of indexation can be traced as far back as the seventeenth century, it received its first "official endorsement" in 1947 when "the legislature of colonial Massachusetts legalized the linking of debts to a broadly based measure of the cost of living . . ."[6] The concept of indexation continued through history and became known as the "tabular standard of value," a phrase coined by G. Poulett Scrope in 1833. A "stable purchasing power bond" was advocated by G. L. Bach and R. A.

Musgrave[7] in the mid-twentieth century followed by endorsements from Richard Goode[8] and Peter Robson.[9] Indexation has since become known as monetary correction, the use of escalator clauses, adjustable rate debt, and other designations.

More recently, a strong advocate of indexation has been economist Milton Friedman.[10] He has spoken out in favor of indexation for government contracts, taxes, business contracts, and mortgages. It should be noted, however, that Professor Friedman has recently changed his views on indexation. While it does protect the real rate of return for the investor, Friedman now believes that "current methods of indexing make it more difficult, if not impossible, to combat inflation caused by external inflationary shocks."[11]

Indexation has enjoyed a long history. In recent years, as inflation has continued to accelerate, talk about indexation has also accelerated. But a change has occurred in that not only is indexation being discussed, it has been and is being applied to financial contracts in many countries including the United States.

FOREIGN APPLICATIONS OF INDEXATION

Indexation has been applied in varying degrees and for different purposes in several countries. G. Donald Jud has conducted a study in which he viewed the use of indexing in Brazil, Chile, Argentina, and Colombia. Comprehensive indexation was practiced in Brazil and Chile. The capital markets, tax system, labor market, and external sector were all indexed. In contrast, indexation was applied selectively to the financial markets and tax system in Argentina and to the foreign exchange market and the market for domestic savings in Colombia. Both Brazil and

Colombia were searching for rapid economic growth by indexing while Chile and Argentina were trying to find a method to combat prolonged inflation.

Despite these differences, Jud found some common conclusions regarding the capital markets and the length of maturity of financial instruments stemming from the use of indexation.

> In each of the countries surveyed, indexation was responsible for the elimination of some significant inflation-induced distortions in economic activity. When applied to capital markets, indexing eliminated much of the risk and uncertainty normally accruing to long-term creditors during inflation. As a result, it made creditors much more willing to lend funds for extended periods of time, thus acting to improve the functioning of long-term credit markets.[12]

So, indexation did help to maintain a market for long-term securities and provide issuers with an alternative financing form.

DOMESTIC APPLICATION OF INDEXATION

The United States' experience with indexation has been limited primarily to bank holding companies and mortgage companies, although a few non-financial firms have begun to use forms of indexation. The instruments have mainly been in the form of "floating rate" notes, rather than true indexed securities. Floating rates are linked to a single representative interest rate, such as 91-day Treasury Bills, rather than linked to a composite index of aggregate price changes.

In July, 1974, Citicorp issued one of the first floating rate notes. It carried a 15 year maturity and floated with the 91-day Treasury Bill rate. Several financial institutions followed Citicorp's lead including Chase Manhatton, Mellon National, Northwestern Mutual Life Mortgage and Realty Investment and others. In addition, some non-financial corpora-

tions including Standard Oil of Indiana and Tennessee Steel Forging Corporation also issued floating rate notes in that year. Issues were reportedly well received by investors and ranged in maturity from 7.5 years to 25 years.[13]

In the period following those first issues in 1974 and early 1975, the push for floating rates subsided. In recent years, though, as rising interest rates and threats of recession have once again gained momentum, the enthusiasm for floating rate notes has surged. Mortgage companies now offer a variety of financing plans including adjustable rate mortgages (ARM), variable rate mortgages (VRM), graduated payment mortgages (GPM), and others.[14] These forms of indexation are already present in the daily lives of Americans. In addition, in the corporate sector Pacific Gas and Electric Company is seeking regulatory approval to issue $75 million worth of 30-year bonds. "The interest rate on the loan would be pegged at 120% of the 10-year Treasury bond rate as long as that rate is between 9% and 18%. The rate would be reset at two-year intervals and would go no higher than 25% and no lower than 7%."[15] The main result of the indexing feature is that "P G & E gets to hang on to the money for 30 years--an unusually long period, considering that much of the new lending done these days is for 15 years or less."[16] Other implicit forms of indexation include indexed wages, indexed social security, indexed pensions and commodity contracts.[17]

Of course, not all experience with indexation has been successful. Indexation was declared illegal in Germany, Switzerland, and the Netherlands. It was abolished in Finland in 1968 and the indexation of mortgages was abandoned in Israel in 1967. "Experience in these countries indicated that indexing contributed to the inflationary spiral and imposed indeter-

minate liabilities on the government."[18] It should be added, though, that the governments of these countries are vastly different from that of the United States.

FACTORS THAT INFLUENCE THE USE OF INDEXATION

Indexation has been shown to preserve the demand for long-term securities and, consequently, to maintain the long-term debt portion of a corporation's financial structure. But there are other factors which influence the extent to which corporations will supply indexed securities.

Inflation Rates and the Term Structure of Interest Rates

A premium for the expected rate of inflation is built into the nominal rate of return demanded by the investor. If the investor expects inflation to rise, then he will demand a higher return on his investments to compensate for the decline in the value of the money to be paid him. However, the inflation rate is not easily predicted, so the investor is not likely to commit his funds for the long-term in order to avoid the unanticipated portion of inflation which causes the investor to suffer a devaluation in the return on the investment. As Baesel and Niger have stated, "whether borrowers or lenders gain or lose due to inflation depends upon the nominal rate agreed to, the realized inflation rate and their inflationary expectations when the contract was written. The high rate of inflation in recent years has resulted in the real interest rates on traditional, fixed-rate mortgages being substantially below the nominal, contract rate."[19]

If inflation is expected to increase, then the demand for indexed bonds should also increase because the bonds would protect the holder

from money devaluation. But, a corporation would be less likely to supply indexed bonds since the interest and/or principal payments would continue to be adjusted upward. In a study by Leviatan and Levhari regarding the risk of indexed bonds, they stated that "our fundamental result is that while growing inflationary uncertainty stimulates demand for linked (indexed) bonds it discourages at the same time the supply of those bonds."[20] There exists a basic conflict between the demand for and the supply of indexed bonds.

A corporate borrower would naturally prefer to issue fixed-rate securities at prevailing market rates if interest rates were expected to increase, but investors will not lend for the long-term. If the corporation is forced to borrow short-term, then it is implicitly issuing indexed securities anyway. The short-term debt would be rolled over periodically and re-issued at a higher interest rate each time just an indexed debt would be adjusted periodically. But, the risk of not being able to renew the debt would be absent with long-term indexed securities and the principal would not have to be repaid each year as with short-term debt.

Changes in Financial Institutions

Due to the nature of their assets and liabilities and the prolonged inflation, many financial institutions may presently be technically insolvent. Milton Friedman writes

> The current mortgages were mostly issued when inflation and therefore interest rates, were much lower than they are now. If the mortgages were revalued at current yields, that is, at the market prices for which they could be sold in a free secondary market, virtually every U.S. savings and loan association would be technically insolvent.[21]

For financial institutions, there would be a definite advantage for them to index both their assets and their liabilities.

> The mortgages on their books would be yielding, say, 5 percent plus the rate of inflation; they could afford to pay to their shareholders or depositors, say, 3 or 4 percent plus the rate of inflation. They, their borrowers, and their shareholders or depositors would be fully protected against changes in the rate of inflation. They would be assuming risks only with respect to the much smaller possible changes in the real rate of interest rather than in the money rate.[22]

Financial institutions have been the innovators in the area of variable rate loans. In fact, fixed-rate business loans are virtually non-existent from the larger institutions. If a business must borrow on a variable-rate basis from private sources, then it makes sense for them to borrow from the public in the same manner.

Influence of Indexed Rates on Security Valuation

An indexed security would naturally be evaluated differently than a non-indexed security. Indexation would eliminate a part of the financial risk inherent in traditional fixed-income securities. In return for this risk reduction, investors should accept a lower return from the indexed bonds, consequently lowering the borrowing cost to the issuing firm. Fischer pointed this out saying "since there is an evident demand for the hedge provided by such (indexed) bonds, they could be sold at a real interest rate below that on nominal bonds."[23]

Another factor the investor should be aware of is the movement of indexed bond prices in the secondary market. Due to the indexing feature the "market value of the indexed bond would be invariant with changed expectations of inflation, whereas that of the nonindexed bond would move inversely with the changes."[24] The indexed bonds would trade in a narrower range than nonindexed bonds since the interest rate would periodically be adjusted to prevailing market rates. Much of the speculation usually associated with bond trading would be eliminated. The risk of capital loss would be limited, but so would the opportunity for capital gain.

Indexed securities would also influence a rating agency's evaluation of the credit position of the firm. Interest payments would fluctuate each year causing ratios to be less predictable. Times interest earned and fixed charge coverage would be particularly affected making it difficult to judge the debt capacity of the firm.

To the stockholder, the use of indexed bonds may impact on the distribution of income in the firm. If a firm's revenues have not kept pace with inflation, then the burden of the indexed payments would increase and reduce profits. This, in turn, could have an effect on dividend disbursements and retained earnings. This may be viewed as an increase in risk by the stockholder and lower the value of the stock price. According to Cornell, "a rationally managed firm will issue indexed bonds only if its value could be increased by doing so."[25]

Legal Considerations

Some legal questions have arisen regarding the use of indexation. In 1974 Citicorp issued the first public floating rate notes and had to seek approval from the Federal Reserve Board. In the Board's statement to Congress, Vice Chairman George W. Mitchell stated

> . . . the Board believes its present statutory powers do not authorize us either to prevent a Citicorp-type of issue or to regulate its terms. The Board also believes that there are no legal grounds for objecting to the issue under the terms of the Bank Holding Company Act. In fact, the financing will improve the financial position of Citicorp. Indeed the structure of our entire financial system would be strengthened if the maturity profile of liabilities of financial institutions, and depository institutions in particular, were more nearly matched with the maturity profile of their assets.[26]

The Federal Home Loan Bank Board adopted a rule on April 23, 1981 allowing federal savings and loan associations and federal mutual savings banks "to peg a mortgage's interest rate to almost any public index of

interest rates and raise or lower the loan's monthly payments, principal or terms to reflect market gyrations."[27]

Another consideration is that of usury ceilings. This puts a limit on the extent to which interest rates on indexed loans could be raised. When principal is also indexed, then a determination must be made as to whether that is additional interest. In a case in Tennessee, a borrower refused to pay the indexed principal. Shelby County Chancery Court determined that "indexed principal was not additional interest and, as such, was not in violation of either state or Federal laws regarding usury, and was therefore collectable."[28]

A question of the tax treatment of indexed payments also arises. It has been suggested that "the income tax be changed to recognize new 'inflation-indexed debt instruments', with the result that payments made to a lender to compensate for inflation would be non-taxable in his hands and non-deductible by the borrower."[29] But, in the case of the floating rate notes issued by Citicorp and Chase Manhattan, both "were allowed to deduct the interest on their index bonds."[30]

Accounting Procedures

Some questions may arise concerning the proper reporting method to use when bonds are indexed. Bonds may be indexed in one of three ways: indexed interest only, indexed principal only, or indexed interest and principal. Apparently indexed interest payments have presented no real problems as variable-interest loans have been in existence for several years. The interest payments have been treated no differently than those of non-indexed bonds with the exception that a footnote disclosing the variable nature of the loan is included.[31]

However, policies regarding the indexed portion of principal have not been reviewed yet. Few loans contain an indexed principal feature to date, so the need for formal accounting procedures on the subject has not arisen. If inflation persists, the demand for indexed principal bonds may rise and so would the need for accounting guidelines.

When principal is indexed, the nominal amount of cash to be paid to the lender rises each year as long as the inflation rate is greater than zero. Should, then, the bond account be revalued each year for reporting purposes? If it is to be revalued, then with an increase in a liability there must be a corresponding increase in an asset account. What asset account would be used? Perhaps the bond account should not be revalued. Perhaps a footnote outlining the indexed nature and true liability of the bond would suffice.

If a sinking fund is used to retire the bonds, should the non-indexed and indexed portions of the sinking fund be divided or treated as a unit? How would an indexed sinking fund payment be charged against a bond account if it is not revalued each year? There are many questions which can be asked regarding this topic.

It has only been since 1979 that the issue of inflation has been formally addressed through Financial Accounting Standards Board Statement #33, "Financial Reporting and Changing Prices." Granted, the accounting problems faced by indexed bonds is not as complicated as the rules for revaluing assets set forth in FASB Statement #33. But, inflation accounting is used as an indicator of the effect of inflation on firms' operating results and financial position. It does not reflect cash obligations. The indexed portion of bonds, on the other hand, does reflect a contractual, cash obligation which must be met or the firm could be in default. For

this reason, the need for the formal review of accounting practices regarding indexed bonds must be met in the interest of fairness to the public.

SUMMARY

Speculation as to the impact that indexation would have on the economy has been presented for several centuries, but becomes more intense when inflation is prolonged. Many economic studies have been made about indexation's impact on capital formation, growth rates, term structure of interest rates, financial structure and debt policies, the growth of inflation, capital asset investment, and many more.

It has been established through studies and experience that the indexation of capital market instruments can preserve the demand for long-term securities and restore balance to the capital markets and a firm's optimal financial structure. However, some other factors influence the use of indexation also, such as accounting procedures, taxation, and the inflation rate. The issue to address next, then, is what impact would the use of indexed bonds have on a firm's financial performance.

CHAPTER 2 ENDNOTES

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CHAPTER 3

REVIEW OF EXPECTED IMPACT BY INDEXATION

Prolonged inflation has brought with it some distortions to the traditional view of borrowing and lending in the economic sectors. From a sources and uses viewpoint, there have been many changes for financial institutions in particular. The institutions' source of funds has traditionally been short- to intermediate-term in maturity, but also paid out a relatively low interest rate. With continuing inflation, though, new savings instruments have been designed which pay higher returns in order to compete with other higher-return securities such as Treasury Bills.

The use of these funds by financial institutions has traditionally gone to long-term, fixed-rate loans. Some of these loans are still being carried on the institution's books which pay substantially lower rates than those received in today's market. Consequently, many institutions are paying out much higher rates than they are receiving.

To protect themselves in the future from this occurrence, institutions have had to find ways to deal with this distortion. The needed protection has been found in variable-rate and indexed loans. The institution can continue to lend for the long-term, but is no longer limited to a fixed interest rate which may not be profitable in the future.[1] These variable-rate loans allow the institution to more closely match the cost of their sources to their benefits from their uses and become more profitable.

Corporations, on the other hand, have dealt with the problems brought on by inflation in a different manner. They, too, have seen the cost of their sources of funds rise as inflation persists. But, the uses of their funds may not provide a substantial return for several months, or several years. For this reason, it has traditionally been believed that the maturity of the firm's sources of funds should equal the maturity of the assets bought with the funds to avoid large payments in years when the asset may not be producing profitably yet.

But, lenders have refused to commit their funds for long periods of time in a fixed-rate security. So, firms have dealt with the problem by shortening the maturities of their securities. But this option does protect them from large principal payments and does not promote optimality in the firm's financial structure.

Another option available to the firm is to follow in the footsteps of the financial institutions and offer indexed bonds. The firms' private source of funds from the institutions is already indexed, so their public source could also be indexed. This should provide them with the longer-term maturities that they need for optimality.

But, indexed bonds would not only influence the area of optimality. It would have an impact on many other segments of the firm's performance. It would affect many of the traditional performance measures such as earnings per share, cash flows, financial structure ratios, and others.

Not only would indexation influence the borrowing firm's position, it would also impact on the lender's position who purchased the bond. The affects on both the borrower and the lender will be discussed as these affects will influence the demand for and supply of indexed bonds.

IMPACT OF INDEXATION ON THE LENDER

During the evaluation of an indexed bond for investment purposes, a lender of funds must be aware of the impact the index feature would have on his own financial position. This impact would involve both mechanical and conceptual factors for the lender's consideration. Mechanical factors include the variability of cash inflows, the recovery of principal, and the taxation of indexed interest and/or principal. Of a more conceptual nature, some areas of risk to the lender would be affected such as the transferability of the security and the default risk attached to the security.

Mechanically, the lender should realize that his income would vary from one adjustment period to the next. Traditionally, bond investors could count on a stable interest payment throughout the life of the bond. With indexed bonds, on the other hand, the investor can count on a stable real rate of return while the nominal interest payments will vary as inflation changes throughout the life of the indexed bond. The investor, then, exchanges a fluctuating and sometimes negative real rate of return but stable nominal interest payments for the stable real rate of return and fluctuating nominal interest payments of indexed bonds.

The lender should also be concerned with whether his principal would deteriorate or be recovered over time. The return on an investment in a fixed-rate bond would consist of a stable interest payment and the repayment of the principal, typically $1,000, at the end of the maturity of the bond. Inflation would have eroded that principal over the life of the bond and it would be worth much less than the $1,000 originally lent to the company.

When a bond is indexed, it may be done so in one of three general ways: indexed interest only, indexed principal only, or indexed interest and principal. If only the interest were indexed then the loan principal would suffer the same devaluation the principal of a fixed-rate bond would. But, if the principal were indexed then the lender would not suffer any loss of his principal as it would be adjusted for inflation. Therefore, with indexation, the bond principal may or may not be recovered without deterioration depending on the terms of the bond indenture.

Another mechanical aspect would be the manner in which the indexed bond is taxed. There has been a suggestion that rather than taxing the entire interest payment, only the real portion should be taxed. The partial exemption of the interest payments from taxation would most likely increase the demand for the indexed bonds, although presently, all of the payment is taxable. The question has also arisen as to whether the indexed portion of the principal should be treated as interest, although it has not been recognized as such yet.

Conceptually, indexation would modify the risk taken on by the bond investor. The behavior of the indexed bond in the secondary market may affect its degree of transferability to other investors. Since indexed bonds are periodically adjusted to the prevailing market rate, the price of those bonds should also migrate back to the face value as the market revalues the bond. Thus, the bond would trade in a narrower price range than a fixed-rate bond. The risk of capital loss would be reduced, but the opportunity for capital gain would also be reduced.

Indexation may also modify the amount of default risk incorporated in the bond. If interest payments are continually adjusted upward as in a period of rising inflation, then the payments may become too burdensome

for the issuer and increase his risk of default. Depending on the initial financial strength of the issuer, then, the investor may demand more collateral, a higher original coupon rate, or other restrictions to compensate him for accepting a higher default risk.

IMPACT OF INDEXATION ON THE BORROWER

The corporate borrower should examine the impact the indexation of his debt would have on his financial position. When bonds are indexed the corporate borrower would be obligated to pay inflation-adjusted interest payments and to repay the principal amount of the loan which may or may not be adjusted for inflation. This process would impact on some mechanical aspects of the firm's position such as the volatility of cash outflows, variability of earnings per share, and uncertainty regarding the repayment of indexed principal. The inclusion of indexed debt in the financial structure would also affect the firm's position conceptually, particularly in the areas of determination of the optimal financial structure and risk.

The cash outflows associated with indexed bonds would consist of interest payments and the principal repayment, either or both of which may be indexed. Indexed interest payments would be adjusted periodically to reflect a change in the inflation index. Due to these adjustments, the cash outflows of the borrower would be more volatile, therefore predicting future earnings flows would be more difficult for the firm who used indexed bonds.

This cash flow volatility would filter through the income statement and ultimately impact on earnings per share. A higher degree of variability in earnings per share may cause some variability in dividend

disbursements. Variability of earnings per share and dividends would directly affect shareholders' wealth, a prime concern of corporate management.

In regard to the repayment of the principal, the impact would be related to whether the principal was indexed or not. If it were not indexed, then the impact would be the same as that of fixed-rate debt. However, if the principal were indexed, then the firm would suffer some uncertainty as to what the principal payment would be in the future. This uncertainty may be reflected in planning for a single, lump sum payment at the maturity of the indexed bond, or in legal considerations regarding sinking fund contributions.

The indexation of the borrower's debt securities would also pose some conceptual problems. In particular, the firm would encounter difficulty in determining the optimal financial structure and the evaluation of the financial risk of the firm would be altered.

When an indexed debt instrument is included in the list of alternative debt sources of funds, the firm must decide whether to include that indexed instrument in its financial structure and, if so, to what extent. In a study by Agmon, Ofer, and Tamir, the authors found that "in the special case when the firm is faced by only two debt instruments and only one with variable debt repayments, the optimal debt portfolio will include the variable rate debt instrument, provided that $c > 0$[2] and that the bankruptcy costs are sufficiently large."[3] The authors concluded that in order for the firm to continue optimizing the financial structure "firms should search for and issue variable rate debt instruments with a payment schedule that has a positive covariance with the firm operating income."[4]

The issuance of indexed debt would also complicate the determination of the weighted average cost of capital for those firms which employ that measure. The after-tax cost of the indexed debt would change from one adjustment period to the next. Consequently, the cost of capital would also change. One alternative to deal with the problem would be to forecast the future expected inflation rates and use the average after-tax cost of the indexed debt over its life. But, no matter how the problem is handled, the indexed debt would introduce an added degree of uncertainty to the cost of capital calculation which, in turn, would increase the uncertainty dealt with in capital budgeting evaluations using discounted cash flow techniques.

Indexation would also make an impact on the risk of the issuing firm in several ways. First, it would directly influence the financial ratios which are typically used by investors, lenders, and independent rating agencies to evaluate a borrower's operations and financial position. More uncertainty would be introduced to forecasts of ratios such as times interest earned, fixed charge coverage, liquidity measures as long-term debt became a current liability, profitability measures, and so on. The evaluators would have a difficult task in judging future profitability due to the variability of earnings and the impact on the ratios. This variability may alter the credit ratings received by some firms who choose to use indexed debt.

Second, indexation may influence the firm's future borrowing capacity. If interest payments must continually be adjusted upward, then lenders may not wish to lend further funds for the fear of not recovering their investment. If they do choose to lend funds, the lenders may require extensive restrictive covenants be placed on the firm's operations as a

condition of the loan, while rising interest payments may impact on the firm's extent and ability to meet these restrictive covenants.

Lastly, indexation may impact on the firm's default risk. Interest and/or principal payments will fluctuate as inflation changes, while revenues and profits may not. If revenues lag behind inflation, then debt payments could push the firm closer to default.

Several facets of the firm's structure can be affected by the indexation of debt. The extent of the affectation would be related to the type of index the firm used and the manner in which interest and/or principal adjustments were to be made.

TYPES OF INDEXING

There are several ways that a bond can be indexed and the impact that indexation will have on a firm's performance will be largely dependent on the manner chosen. There are three general classifications that indexed bonds can fall into: indexed interest only, indexed principal only, or indexed interest and principal. Each classification will have a different impact on the firm.

Bonds with only the interest indexed would experience some variability in cash outflow due to the adjustment to interest payments each year. The amount of variability would be dependent on the magnitude of the rate of change in inflation and the way interest payments are indexed. According to Milton Friedman,[5] there are primarily two ways to index interest payments. The first way is to pay some specified real rate of return, say 4%, plus the rate of inflation each year. The other alternative is to pay some specified nominal rate, say 4%, times the ratio of the price index in the current year divided by the price index the year

the bond was issued. An example of these two alternatives appears in Table 3-1. Alternative one would present the firm with the greatest amount of variability of cash flow. In years of high inflation, the cash drain could be excessive. It should also be noted, however, that alternative one allows the cash payment to decline in years of decreasing inflation, while the cash payment in alternative two will always increase as long as the inflation rate is greater than zero. Indexed interest payments can be a benefit to the firm in the inflation rate is declining and alternative one is used, and the principal repayment would act just like that of a non-indexed bond.

TABLE 3-1

INDEXED INTEREST PAYMENTS FOR A HYPOTHETICAL BOND[1] USING TWO ALTERNATIVE ADJUSTMENT METHODS

End of Year	Hypothetical Price Index		Annual Interest Payments	
	Index[2]	Percent Change	Alternative 1	Alternative 2
1	110.00	10.0	$140.00	$44.00
2	115.00	4.5	85.00	46.00
3	125.00	8.0	120.00	50.00
4	130.00	4.0	80.00	52.00
5	142.00	9.2	132.00	56.80

[1] $1,000 five-year bond issued at beinning of year one at a real rate of 4 percent.

[2] Hypothetical price index = 100.00 at beginning of year one.

Issuing bonds with only the principal indexed would have different effects on the firm's performance. In this case, the interest payments would be fixed as with non-indexed bonds. But, the principal to be repaid to the lenders would increase each year with inflation as long as the inflation rate is greater than zero. If a sinking fund were used to

retire the debt, then the repayments would introduce some variability in cash flow just as indexed interest payments did. If the principal were totally repaid at maturity, the balloon payment could be quite large and cause an excessive cash drain on the firm in that one year. An example of the indexed principal repayments when using and not using a sinking fund is presented in Table 3-2.

TABLE 3-2

INDEXED PRINCIPAL REPAYMENTS FOR A HYPOTHETICAL BOND[1] WHEN USING AND NOT USING A SINKING FUND

End of Year	Hypothetical Price Index[2]		Indexed Principal Repayments	
	Index	Percent Change	With Sinking Fund[3]	Without Sinking Fund
1	110.00	10.0	$220.00	$ 0.00
2	115.00	4.5	230.00	0.00
3	125.00	8.0	250.00	0.00
4	130.00	4.0	260.00	0.00
5	142.00	9.2	284.00	1,420.00

[1]$1,000 five-year bond with indexed principal

[2]Hypothical price index = 100.00 at beginning of year one

[3]Twenty percent of original value bond principal retired each year

Bonds with both the interest and the principal indexed would combine the qualities of the first two types. Both the interest and the principal payments would be adjusted with inflation. Although, if inflation were decreasing, the interest payments would be adjusted downward while the principal value would continue to rise. It is apparent, then, that the impact of indexation is directly related to the direction of change of the inflation rate.

Another factor which helps to determine indexation's affects on firm performance is the index that is used to adjust the interest and/or principal payments. To be truly indexed, the interest and/or principal payments should be adjusted using some cost-of-living measure which tracks the prices of a variety of selected items. This measure could be the consumer price index, producer price index, or any number of other indices. The consumer price index is the most widely accepted measure, although some doubts have been raised as to its accuracy.

Some debts are not truly indexed, but instead are said to "float" with a single representative interest rate such as the rate on 91-day Treasury Bills. The adjustments made by following a single rate would not represent changes in an aggregate inflation rate and could present more volatility of interest and/or principal payments as the rate reacts to market forces.

The length of time between adjustments will also influence indexation's impact on the firm. Adjustments could be made quarterly, semi-annually, annually, or any other time interval the firm agrees on. But, the firm should be aware that the more often payments are adjusted, the more variable cash flows will be. If adjustments are made every five years, those payments can be planned on for five years, while adjustments that are made every six months will be more variable. However, the inflation rate will influence the decision regarding adjustment intervals. If inflation is decreasing, the firm may want to adjust payments more often to take advantage of the decline. On the other hand, during increasing inflation the adjustments could be delayed as long as possible to save on cash flow.

REMARKS

Indexation of bonds can affect both the lenders' and the borrowers' positions. These impacts are determined by many factors including the change in inflation, the extent to which the bond is indexed, the index used to make adjustments, and the time interval between adjustments. In the next chapter, a model will be developed by making assumptions about these factors to more closely study the impacts that indexation has on a firm's financial performance.

CHAPTER 3 ENDNOTES

[1]Institutions do not always continue to lend for the long-term. Some have developed so-called "balloon-note" mortgages which have a maturity of, say, three to five years and may be renewed at maturity. For a more complete discussion, with examples, of the new mortgages see, "Housing Yourself in the 80's: Can You Afford a Mortgage," Consumer Reports, (July, 1981), 400-405.

[2]Where c = the covariance between the operating income and the variable debt repayment. For an explanation of the complete model see T. Agmon, A. R. Ofer and A. Tamir's "Variable Rate Debt Instruments and Corporate Debt Policy," Journal of Finance (March, 1981), 113-125.

[3]Ibid., p. 215.

[4]Ibid., p. 215.

[5]Friedman, Milton, "Monetary Correction," in Herbert Giersh, et al. Essays on Inflation and Indexation. Washington, D.C.: American Enterprise Institute, 1974.

CHAPTER 4

MODEL CONSTRUCTION

In order to analyze the impact that various forms of debt instruments (indexed and non-indexed) have on selected areas of financial performance of the corporate issuer and the lender of the funds, an income statement and balance sheet generator model was designed. The type of debt and the inflation environment were the primary variables manipulated in a ten-year simulation of resulting income statements and balance sheets of a hypothetical firm. From these accounting statements, ratios and other measures were calculated to further study indexation's impact on selected areas of the firm's performance.

In this chapter, the construction of the model will be presented along with the thirty-six scenarios used in the analysis which follows in chapter five.

MODEL STRUCTURE

As stated previously, the model was to generate income statements and balance sheets in a ten-year simulation where several variables were controlled. First, several assumptions were developed to simplify the model and establish a foundation for the simulation. A list of these assumptions may be found in Table 4-1.

While some of these assumptions may be unrealistic, they do help to limit the study and focus attention on indexation's impact on the firm during inflation rather than some other variables.

TABLE 4-1

FOUNDATION ASSUMPTIONS USED TO DEVELOP A SIMULATION MODEL FOR A HYPOTHETICAL FIRM

1. Firm operates in an efficient market
2. Firm is in its first year of operations at beginning of simulation
3. Firm's operations are neither seasonal nor cyclical
4. One hundred shares of common stock are issued at the beginning of year one and no further common stock will be issued during the simulation
5. No dividends will be paid to common shareholders
6. Capital asset reinvestment will be equal to the year's depreciation expense plus a growth factor (this growth factor will be equal to the sales growth factor)
7. No trade credit is used by firm
8. Interest rates will consist of a riskless rate plus an inflation premium
9. A price index developed for use in this specific model will be used to adjust interest and/or principal payments when indexed bonds are used.
10. Income statements and balance sheets will reflect end of year figures
11. There are no limitations on indexed adjustments

A large number of variables which influence firm performance was available to be incorporated into the model. Identification of these variables may be found in Table 4-2A and 4-2B. Although many variables were available, not all were easily modeled or relevant to the study. Consequently, the list of factors was narrowed down to the following which were actually used in the simulation: direction of inflation rate of change, type of debt instrument used, nominal rate of sales growth, capital structure combinations, presence of a sinking fund, and the initial yield curve which determines original interest rates on debt instruments.

TABLE 4-2A

VARIABLES THAT INFLUENCE FIRM PERFORMANCE UNDER ALTERNATE CAPITAL STRUCTURES WHEN USING BONDS, INDEXED OR NON-INDEXED

1. Inflation rate
2. Nominal and/or real sales growth
3. Variability of profit margins
4. Applicable tax rate
5. Depreciation method
6. Growth of capital asset investment
7. Growth of internal financing sources
8. Dividend payout policy
9. Growth of external financing sources
10. Seasonality of cyclicality of firm (business risk)
11. Economic conditions
12. Market demand for bonds
13. Firm's credit rating
14. Firm's ability to meet any restrictive covenants associated with bonds
15. Accuracy of forecasts
16. Presence of sinking fund provision and manner in which it is to be carried out

TABLE 4-2B

VARIABLES THAT INFLUENCE FIRM PERFORMANCE THAT ARE UNIQUELY RELATED TO THE USE OF INDEXED BONDS

1. Choice of price index
2. Length of adjustment periods
3. Manner in which bond is indexed (interest only, principal only, interest and principal)
4. Any limitations on amount of index adjustments (caps)

Embodied in each of these factors is a subset of variables used in the simulation. The direction of inflation rate of change may be increasing, decreasing, constant, or random. Types of debt instruments include short-term, long-term non-indexed, long-term indexed interest only, long-term indexed principal only, or long-term indexed interest and principal. The nominal rate of sales growth may be high, medium, or low. The debt instruments may be combined in any number of ways. For example, the firm's capital structure may consist of 100% short-term debt, or 50% short-term debt and 50% any long-term instrument, or 100% any long-term instrument. Of course, there are many more combinations and a rational firm will search out the optimal combination. The firm may or may not employ a sinking fund and the initial yield curve may be upward sloping (short-term rates lower than long-term rates), downward sloping (short-term rates higher than long-term rates), or flat (short-term rates equal to long-term rates). Naturally, the yield curve may vary over the life of the debt, but the original yield curve will determine the original interest rates to be paid to lenders. These subsets can then be formed into many combinations for analysis as illustrated by Table 4-3.

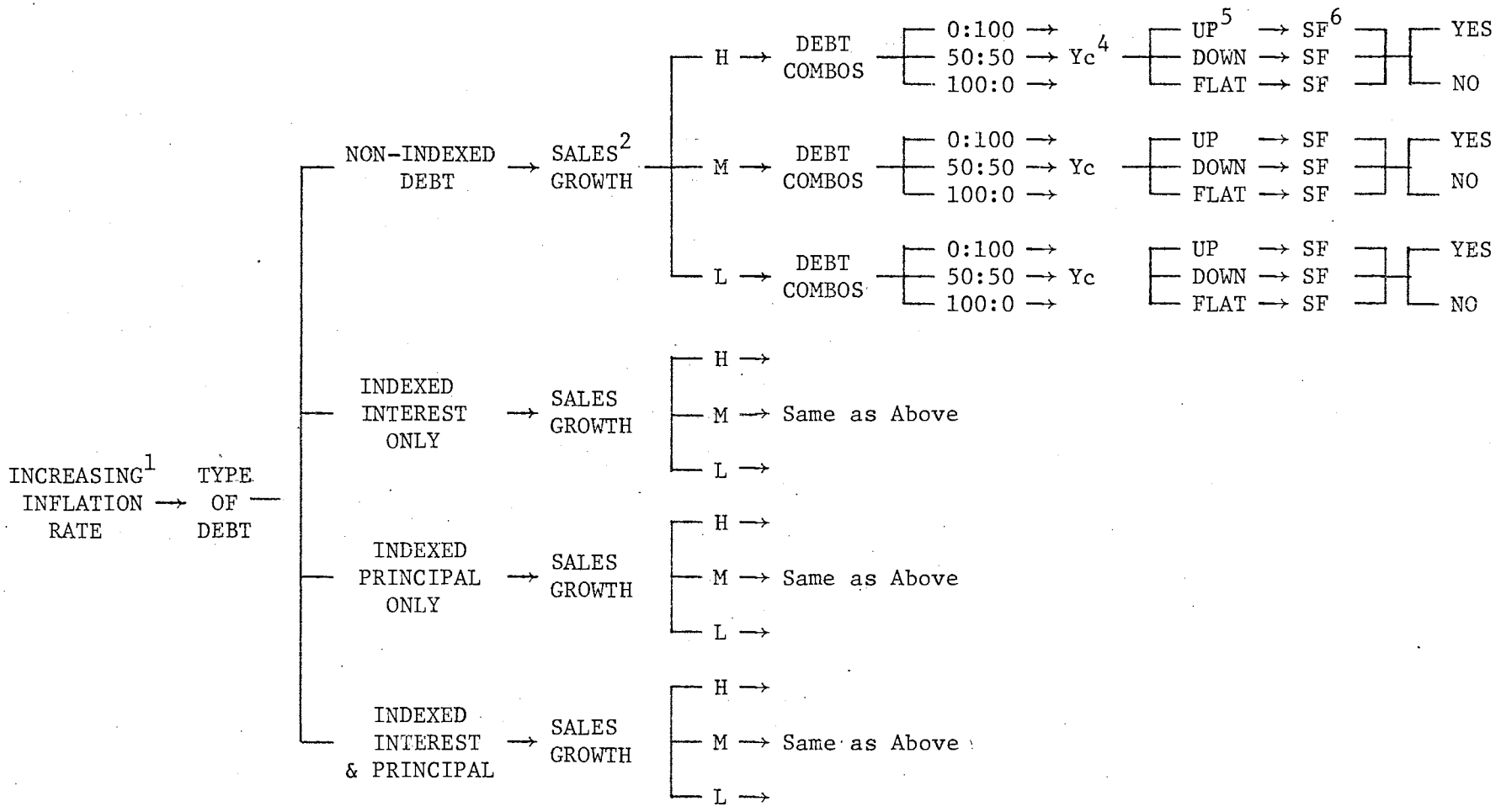
SCENARIO STRUCTURE

From the combinations illustrated in Table 4-3, thirty-six scenarios were chosen to analyze the effects that the different debt instruments have on the firm's performance. The scenarios are outlined in Table 4-4.

Some variables remain constant throughout all of the scenarios for simplicity. This also allows the analysis to be confined to the impact of financing forms rather than clouding the issue with other variable

TABLE 4-3

POSSIBLE COMBINATIONS OF SELECTED SIMULATION VARIABLES WHICH COULD BE USED TO ANALYZE INDEXATION'S IMPACT ON FINANCIAL PERFORMANCE UNDER VARIOUS INFLATION CONDITIONS



[1]The same combinations would exist for decreasing, constant, and random inflation assumptions

[2]May be high, medium, or low

[3]Capital structure combinations - ST/TD:LT/TD

[4]Initial yield curve

[5]Upward sloping, downward sloping, flat

effects. Constant variables include: nominal sales growth of 5% each year, net operating margin of 10% each year, tax rate of 50%, and the nominal value of all debt at issuance at the beginning of year one is $500 with earnings per share of $1 at the end of year one. All long-term bonds, indexed or non-indexed, have a maturity of ten years and annual interest payments. Short-term debt has a maturity of one year and is renewed each year for ten years at prevailing market interest rates. Interest rates on bonds and short-term debt are determined by the yield curve present at the beginning of year one. These rates presumably consist of some real rate plus an inflation premium. No attempt was made to maintain a consistent real rate of return among debt instruments or scenarios. When a sinking fund is used, ten percent of the original debt is retired each year. A summary of the interest rates assigned to the various debt instruments and the annual inflation rate for each economic condition is displayed in Tables 4-5, 4-6, 4-7, and 4-8.

EXAMPLE OF SCENARIOS

Two scenarios were chosen to illustrate the income statements and balance sheets which are generated by the simulation for the ten-year period. Both take place during increasing inflation conditions and utilize a sinking fund. The first, scenario 2, uses 100% long-term indexed interest only and can be found in Table 4-9. The second, scenario 4, uses 100% long-term indexed principal only and can be found in Table 4-10.

After the income statements and balance sheets for the thirty-six scenarios were generated, some ratios and other measures were calculated to identify the impact of the various debt forms on three general areas of financial performance: cash flow, profitability, and risk.

TABLE 4-4

OUTLINE OF VARIABLES INCLUDED IN MODEL
SCENARIOS USING 5% CONSTANT SALES GROWTH

SCENARIO NUMBER	DIRECTION OF INFLATION[1] RATE CHANGE				TYPE OF DEBT INSTRUMENT USED[2]					INITIAL YIELD CURVE			SINKING FUND	YEARLY[3] ACCTG ADJUST TO BOND ACCT.
	↑	↓	↔	↑↓	NI	I_i	I_p	I_{i+p}	ST	UP	DOWN	FLAT		
S_1	X				X					X			X	
S_2	X					X				X			X	
S_3	X						X			X			X	
S_4	X						X			X			X	X
S_5	X							X		X			X	
S_6	X							X		X			X	X
S_7	X								X	X				
S_8	X				X					X				
S_9	X							X		X				X
S_{10}		X			X						X		X	
S_{11}		X				X					X		X	
S_{12}		X					X				X		X	
S_{13}		X					X				X		X	X
S_{14}		X						X			X		X	
S_{15}		X						X			X		X	X
S_{16}		X							X		X			
S_{17}		X			X						X			
S_{18}		X						X			X			X
S_{19}			X		X							X	X	
S_{20}			X			X						X	X	
S_{21}			X				X					X	X	
S_{22}			X				X					X	X	X
S_{23}			X					X				X	X	
S_{24}			X					X				X	X	X
S_{25}			X						X			X		
S_{26}			X		X							X		
S_{27}			X					X				X		X
S_{28}				X	X					X			X	
S_{29}				X		X				X			X	
S_{30}				X			X			X			X	
S_{31}				X			X			X			X	X
S_{32}				X				X		X			X	
S_{33}				X				X		X			X	X
S_{34}				X					X	X				
S_{35}				X	X					X				
S_{36}				X				X		X				X

Explanation of variables

↑ =Increasing inflation rate
↓ =Decreasing inflation rate
↔=Constant inflation rate
↑↓=Random inflation rate
NI =Long-term non-indexed
I_i =Long-term indexed interest only
I_p =Long-term indexed principal only
I_{i+p}=Long-term indexed interest & principal
ST=Short-term debt

[1]For a list of numerical inflation rates and interest rates applied to various forms of debt, see Table 4-5, 4-6, 4-7, and 4-8

[2]Each scenario uses 100% of the debt instrument indicated, no short-term and long-term combinations

[3]Bond principal is adjusted each year for the price-level and carried on the books at the adjusted value

TABLE 4-5

ANNUAL PRICE INDEX USED TO ADJUST INDEXED PRINCIPAL PAYMENTS, AND THE INTEREST RATES ASSOCIATED WITH VARIOUS DEBT INSTRUMENTS UNDER INCREASING INFLATION CONDITIONS AND AN UPWARD SLOPING YIELD CURVE

END OF YEAR	PI*	% INFLATION RATE	NON-INDEXED	INDEXED INTEREST ONLY	INDEXED PRINCIPAL ONLY	INDEXED INTEREST & PRINCIPAL	SHORT-TERM DEBT
1	108.00	8%	13%	12%	12%	12%	10%
2	117.72	9	13	13	12	13	11
3	129.50	10	13	14	12	14	12
4	143.75	11	13	15	12	15	13
5	161.00	12	13	16	12	16	14
6	181.93	13	13	17	12	17	15
7	207.40	14	13	18	12	17	15
8	238.50	15	13	19	12	19	17
9	276.66	16	13	20	12	20	18
10	323.70	17	13	21	12	21	19

*All scenarios begin with a PI=100 at beginning of year one

TABLE 4-6

ANNUAL PRICE INDEX USED TO ADJUST INDEXED PRINCIPAL PAYMENTS, AND THE INTEREST RATES ASSOCIATED WITH VARIOUS DEBT INSTRUMENTS UNDER DECREASING INFLATION CONDITIONS AND A DOWNWARD SLOPING YIELD CURVE

END OF YEAR	PI*	% INFLATION RATE	NON-INDEXED	INDEXED INTEREST ONLY	INDEXED PRINCIPAL ONLY	INDEXED INTEREST & PRINCIPAL	SHORT-TERM DEBT
1	117.00	17%	21%	20%	20%	20%	23%
2	135.72	16	21	19	20	19	22
3	156.08	15	21	18	20	18	21
4	177.93	14	21	17	20	17	20
5	201.06	13	21	16	20	16	19
6	225.19	12	21	15	20	15	18
7	249.96	11	21	14	20	14	17
8	274.95	10	21	13	20	13	16
9	299.70	9	21	12	20	12	15
10	323.67	8	21	11	20	11	14

*All scenarios begin with PI=100 at beginning of year one

TABLE 4-7

ANNUAL PRICE INDEX USED TO ADJUST INDEXED PRINCIPAL PAYMENTS, AND THE INTEREST RATES ASSOCIATED WITH THE VARIOUS DEBT INSTRUMENTS UNDER CONSTANT INFLATION CONDITIONS AND A FLAT YIELD CURVE

END OF YEAR	PI*	% INFLATION RATE	NON-INDEXED	INDEXED INTEREST ONLY	INDEXED PRINCIPAL ONLY	INDEXED INTEREST & PRINCIPAL	SHORT-TERM DEBT
1	110.00	10%	12%	12%	12%	12%	12%
2	122.10	10	12	12	12	12	12
3	134.20	10	12	12	12	12	12
4	147.60	10	12	12	12	12	12
5	162.40	10	12	12	12	12	12
6	178.60	10	12	12	12	12	12
7	196.50	10	12	12	12	12	12
8	216.10	10	12	12	12	12	12
9	237.70	10	12	12	12	12	12
10	261.50	10	12	12	12	12	12

*All scenarios begin with PI=100 at beginning of year one

TABLE 4-8

ANNUAL PRICE INDEX USED TO ADJUST INDEXED PRINCIPAL PAYMENTS, AND THE INTEREST RATES ASSOCIATED WITH THE VARIOUS DEBT INSTRUMENTS UNDER RANDOM INFLATION CONDITIONS AND A DOWNWARD SLOPING YIELD CURVE

END OF YEAR	PI*	% INFLATION RATE	NON-INDEXED	INDEXED INTEREST ONLY	INDEXED PRINCIPAL ONLY	INDEXED INTEREST & PRINCIPAL	SHORT-TERM DEBT
1	107.00	7%	11%	10%	10%	10%	12%
2	112.35	5	11	8	10	8	10
3	124.70	11	11	14	10	14	16
4	140.90	13	11	16	10	16	18
5	156.40	11	11	14	10	14	16
6	172.00	10	11	13	10	13	15
7	185.80	8	11	11	10	11	13
8	206.20	11	11	14	10	14	16
9	235.00	14	11	17	10	17	19
10	270.30	15	11	18	10	18	20

*All scenarios begin with PI=100 at beginning of year one

TABLE 4-9

SIMULATED END OF YEAR INCOME STATEMENT AND BALANCE SHEET FOR S_2 WHICH USES 100% LONG-TERM BONDS WITH ONLY THE INTEREST INDEXED AND A SINKING FUND UNDER CONDITIONS OF INCREASING INFLATION

END OF YEAR / INCOME STATEMENT	1	2	3	4	5	6	7	8	9	10
NET SALES (5% growth)	$2600.00	$2730.00	$2866.50	$3009.80	$3160.30	$3318.30	$3484.20	$3658.50	$3841.40	$4033.50
COSTS (90% of sales)	2340.00	2437.00	2599.85	2708.82	2844.27	2986.47	3135.78	3292.65	3457.26	3630.15
EARNINGS BEFORE INTEREST & TAXES	$ 260.00	$ 273.00	$ 286.65	$ 300.98	$ 316.03	$ 331.83	$ 348.42	$ 365.85	$ 384.14	$ 403.35
SHORT-TERM INTEREST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LONG-TERM INTEREST	60.00	58.50	56.00	52.50	48.00	42.50	36.00	28.50	20.00	10.50
EARNINGS BEFORE TAXES	$ 200.00	$ 214.50	$ 280.65	$ 248.48	$ 268.03	$ 239.33	$ 312.42	$ 337.35	$ 364.14	$ 392.85
TAXES (50%)	100.00	107.25	115.33	124.24	134.02	144.67	156.21	168.68	182.07	196.43
EARNINGS AVAILABLE TO COMMON SHARE-HOLDERS	$ 100.00	$ 107.25	$ 115.32	$ 124.24	$ 134.01	$ 144.66	$ 156.21	$ 168.67	$ 182.07	$ 196.42
EARNINGS PER SHARE	$1.00	$1.07	$1.15	$1.24	$1.34	$1.45	$1.56	$1.69	$1.82	$1.96
BALANCE SHEET										
ASSETS										
TOTAL ASSETS	$1000.00	$1057.25	$1122.57	$1196.81	$1280.82	$1375.48	$1481.69	$1600.39	$1732.43	$1878.85
LIABILITIES AND NET WORTH										
SHORT-TERM DEBT	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
BONDS	450.00	400.00	350.00	300.00	250.00	200.00	150.00	100.00	50.00	0.00
COMMONSTOCK (100 shares)	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
RETAINED EARNINGS	100.00	207.25	322.57	446.81	580.82	725.48	881.69	1050.36	1232.43	1428.85
TOTAL LIABILITIES AND NET WORTH	$1000.00	$1057.25	$1122.57	$1196.81	$1280.82	$1375.48	$1481.69	$1600.39	$1732.43	$1878.85

TABLE 4-10

SIMULATED END OF YEAR INCOME STATEMENT AND BALANCE SHEET FOR S_4 WHICH USES 100% LONG-TERM BONDS WITH ONLY THE PRINCIPAL INDEXED AND A SINKING FUND UNDER CONDITIONS OF INCREASING INFLATION

YEARS / INCOME STATEMENT	1	2	3	4	5	6	7	8	9	10
NET SALES (5% growth)	$2600.00	$2730.00	$2866.50	$3009.80	$3160.30	$3318.30	$3484.20	$3658.50	$3841.40	$4033.50
COSTS (90% of sales)	2340.00	2437.00	2599.65	2708.82	2844.27	2986.47	3135.78	3292.65	3457.26	3630.15
EARNINGS BEFORE INTEREST & TAXES	$ 260.00	$ 273.00	$ 286.65	$ 300.98	$ 316.03	$ 331.83	$ 348.42	$ 365.85	$ 384.14	$ 403.35
SHORT-TERM INTEREST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LONG-TERM INTEREST	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.00
EARNINGS BEFORE TAXES	$ 200.00	$ 219.00	$ 238.65	$ 258.98	$ 280.03	$ 301.83	$ 324.42	$ 347.85	$ 372.14	$ 397.35
TAXES (50%)	100.00	109.50	119.33	129.49	140.02	150.92	162.21	173.93	186.07	198.68
EARNINGS AVAILABLE TO COMMON SHARE-HOLDERS	$ 100.00	$ 109.50	$ 119.32	$ 129.49	$ 140.01	$ 150.91	$ 162.21	$ 173.92	$ 186.07	$ 198.67
EARNINGS PER SHARE	$1.00	$1.09	$1.19	$1.29	$1.40	$1.51	$1.62	$1.74	$1.86	$1.99
BALANCE SHEET										
ASSETS										
TOTAL ASSETS	$1036.00	$1130.38	$1232.07	$1339.57	$1450.84	$1563.11	$1672.56	$1773.88	$1859.78	$1920.12
LIABILITIES AND NET WORTH										
SHORT-TERM DEBT	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
BONDS*	486.00	470.88	453.25	431.25	402.50	363.86	311.10	238.50	138.33	0.00
COMMON STOCK (100 shares)	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
RETAINED EARNINGS	100.00	209.50	328.82	458.32	598.34	749.25	911.46	1085.38	1271.45	1470.12
TOTAL LIABILITIES AND NET WORTH	$1036.00	$1130.38	$1232.07	$1339.57	$1450.84	$1563.11	$1672.56	$1773.88	$1859.78	$1920.12

*The bond account is adjusted for inflation each year by the following formula: $NI_n(PI_n) - SFNI_n(PI_n)$ = Residual Value to be Carried in Bond Account, where NI = Value that would be in bond account before sinking fund is subtracted if it were not indexed; SFNI = Non-indexed sinking fund value; n = current year; and PI = price index for the year

EXAMPLE: Year 1 $500(1.08)-50(1.08) = \$486.00$

Year 2 $450(1.1772)-50(1.1772) = \$470.88$

CHAPTER 5

PRESENTATION OF DATA AND ANALYSIS

The indexation of debt introduces some effects on the firm's position which have not previously been examined. The magnitude of these effects is dependent on many factors. One of the most important of these factors is the direction and degree of change in the rate of inflation. The data collected from the simulation allows one to examine the interaction of indexation and financial performance under four inflationary conditions. The data are summarized in this section using three areas of financial performance: cash flow, profitability, and risk. The effects of indexation on these areas will be considered from both the borrower's and the lender's perspectives.

CASH FLOW ANALYSIS

Some debt instruments may impose a greater strain on the firm's cash position than others. Continued use of short-term debt requires large principal payments each period along with the necessary interest payments while use of long-term bonds allows gradual retirement of the principal, or full payment of principal at maturity. While indexed bonds may be long-term, the impact of the indexing feature is dependent on the inflation rate. The interest and/or principal may continue to be increased if inflation is rising over time. With any debt, if the cash strain becomes too great then the firm may have to liquidate some assets, or

could ultimately face bankruptcy. Excessive debt payments also tie up funds which could be used for more productive investment.

Three variables were chosen to represent debt's effect on cash flows under different inflation conditions: annual interest expense, principal repayment using and not using a sinking fund, and the total annual cash flow (interest plus principal). A summary of the cash flow data appears in Tables 5-1, 5-2, 5-3, and 5-4.

Borrower Perspective

Under no inflation assumption was it beneficial to use only short-term debt. Even though in some cases (decreasing inflation and random inflation) the nominal interest payments declined, the requirement of full principal repayment each year was a much greater cash flow burden in comparison to other financing methods. Many times during periods of rising inflation, firms are forced into relying on short-term debt when investors will not lend for long periods of time. But, indexing can be a more affordable alternative. Indexing, even in its most expensive form for each inflation condition, is much cheaper than the exclusive use of short-term debt when considering the constant need for refunding.

Regarding interest expense, it is apparent from the tables that short-term debt is implicitly indexed. By comparing the interest expense for short-term debt (S_7, S_{16}, S_{25}, S_{34}) with that of bonds with indexed interest and principal with no sinking fund (S_9, S_{18}, S_{27}, S_{36}), one can see that the magnitude of change is the same for both instruments. Interest expense rises and falls along with the inflation rate for both. Only the real rate of return associated with each debt is different. But, while the interest payments mechanically act the same, the gradual retirement or

TABLE 5-1

COMPARISON OF INTEREST EXPENSE, PRINCIPAL REPAYMENT USING AND NOT USING A SINKING FUND, AND THE TOTAL CASH FLOW (INTEREST + PRINCIPAL) ARISING FROM THE USE OF BONDS UNDER CONDITIONS OF INCREASING INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Interest Expense

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	10
S_1	65.00	58.50	52.00	45.50	39.00	32.50	26.00	19.50	13.00	6.
S_2	60.00	58.50	56.00	52.50	48.00	42.50	36.00	28.50	20.00	10.
S_3	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.
S_4	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.
S_5	60.00	58.50	56.00	52.50	48.00	42.50	36.00	28.50	20.00	10.
S_6	60.00	58.50	56.00	52.50	48.00	42.50	36.00	28.50	20.00	10.
S_7	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.
S_8	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.
S_9	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	105.

Principal Repayment

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	10
S_1	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.
S_2	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.
S_3	54.00	58.86	64.75	71.88	80.50	90.97	103.70	119.25	138.33	161.
S_4	54.00	58.86	64.75	71.88	80.50	90.97	103.70	119.25	138.33	161.
S_5	54.00	58.86	64.75	71.88	80.50	90.97	103.70	119.25	138.33	161.
S_6	54.00	58.86	64.75	71.88	80.50	90.97	103.70	119.25	138.33	161.
S_7	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.
S_8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	500.
S_9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1618.

TABLE 5-1 CONTINUED

Total Cash Flow

YEARS / SCENARIO	1	2	3	4	5	6	7	8	9	10
S_1	115.00	108.50	102.00	95.50	89.00	82.50	76.00	69.50	63.00	56.
S_2	110.00	108.50	106.00	102.50	98.00	92.50	86.00	78.50	70.00	60.
S_3	114.00	112.86	112.75	113.88	116.50	120.97	127.70	137.25	150.33	167.
S_4	114.00	112.86	112.75	113.88	116.50	120.97	127.70	137.25	150.33	167.
S_5	114.00	117.36	120.75	124.38	128.50	133.47	139.70	147.75	158.33	172.
S_6	114.00	117.36	120.75	124.38	128.50	133.47	139.70	147.75	158.33	172.
S_7	550.00	555.00	560.00	565.00	570.00	575.00	580.00	585.00	590.00	595.
S_8	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.
S_9	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	1723.

TABLE 5-2

COMPARISON OF INTEREST EXPENSE, PRINCIPAL REPAYMENT USING AND NOT USING A SINKING FUND, AND THE TOTAL CASH FLOW (INTEREST + PRINCIPAL) ARISING FROM THE USE OF BONDS UNDER CONDITIONS OF DECREASING INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Interest Expense

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	105.00	94.50	84.00	73.50	63.00	52.50	42.00	31.50	21.00	10.5
S_{11}	100.00	85.50	72.00	59.50	48.00	37.50	28.00	19.50	12.00	5.5
S_{12}	100.00	90.00	80.00	70.00	60.00	50.00	40.00	30.00	20.00	10.0
S_{13}	100.00	90.00	80.00	70.00	60.00	50.00	40.00	30.00	20.00	10.0
S_{14}	100.00	85.50	72.00	59.50	48.00	37.50	28.00	19.50	12.00	5.5
S_{15}	100.00	85.50	72.00	59.50	48.00	37.50	28.00	19.50	12.00	5.5
S_{16}	115.00	110.00	105.00	100.00	95.00	90.00	85.00	80.00	75.00	70.0
S_{17}	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.0
S_{18}	100.00	95.00	90.00	85.00	80.00	75.00	70.00	65.00	60.00	55.0

Principal Repayment

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.0
S_{11}	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.0
S_{12}	58.50	67.86	78.04	88.97	100.53	112.60	124.98	137.48	149.85	161.8
S_{13}	58.50	67.86	78.04	88.97	100.53	112.60	124.98	137.48	149.85	161.8
S_{14}	58.50	67.86	78.04	88.97	100.53	112.60	124.98	137.48	149.85	161.8
S_{15}	58.50	67.86	78.04	88.97	100.53	112.60	124.98	137.48	149.85	161.8
S_{16}	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.0
S_{17}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	500.0
S_{18}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1618.3

TABLE 5-2 CONTINUED

Total Cash Flow

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	155.00	144.50	134.00	123.50	113.00	102.50	92.00	81.50	71.00	60.5
S_{11}	150.00	135.50	122.00	109.50	98.00	87.50	78.00	69.50	62.00	55.5
S_{12}	158.50	157.56	158.04	158.96	160.52	162.60	165.00	167.48	169.84	171.8
S_{13}	158.50	157.56	158.04	158.96	160.52	162.60	165.00	167.48	169.84	171.8
S_{14}	158.50	153.36	150.04	148.46	148.52	150.10	153.00	156.98	161.84	167.3
S_{15}	158.50	153.36	150.04	148.46	148.52	150.10	153.00	156.98	161.84	167.3
S_{16}	615.00	610.00	605.00	600.00	595.00	590.00	585.00	580.00	575.00	570.0
S_{17}	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	605.0
S_{18}	100.00	95.00	90.00	85.00	80.00	75.00	70.00	65.00	60.00	1673.3

TABLE 5-3

COMPARISON OF INTEREST EXPENSE, PRINCIPAL REPAYMENT USING AND NOT USING A SINKING FUND, AND THE TOTAL CASH FLOW (INTEREST + PRINCIAPL) ARISING FROM THE USE OF BONDS UNDER CONDITIONS OF CONSTANT INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Interest Expense

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.(
S_{20}	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.(
S_{21}	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.(
S_{22}	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.(
S_{23}	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.(
S_{24}	60.00	54.00	48.00	42.00	36.00	30.00	24.00	18.00	12.00	6.(
S_{25}	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.(
S_{26}	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.(
S_{27}	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.(

Principal Repayment

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.(
S_{20}	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.(
S_{21}	55.00	61.05	67.10	73.80	81.20	89.30	98.25	108.05	118.85	130.1
S_{22}	55.00	61.05	67.10	73.80	81.20	89.30	98.25	108.05	118.85	130.1
S_{23}	55.00	61.05	67.10	73.80	81.20	89.30	98.25	108.05	118.85	130.1
S_{24}	55.00	61.05	67.10	73.80	81.20	89.30	98.25	108.05	118.85	130.1
S_{25}	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.(
S_{26}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	500.(
S_{27}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1307.5

TABLE 5-3 CONTINUED

Total Cash Flow

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	110.00	104.00	98.00	92.00	86.00	80.00	74.00	68.00	62.00	56.(
S_{20}	110.00	104.00	98.00	92.00	86.00	80.00	74.00	68.00	62.00	56.(
S_{21}	115.00	115.05	115.10	115.80	117.20	119.30	122.25	126.05	130.85	136.7
S_{22}	115.00	115.05	115.10	115.80	117.20	119.30	122.25	126.05	130.85	136.7
S_{23}	115.00	115.05	115.10	115.80	117.20	119.30	122.25	126.05	130.85	136.7
S_{24}	115.00	115.05	115.10	115.80	117.20	119.30	122.25	126.05	130.85	136.7
S_{25}	560.00	560.00	560.00	560.00	560.00	560.00	560.00	560.00	560.00	560.(
S_{26}	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	560.(
S_{27}	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	1367.5

TABLE 5-4

COMPARISON OF INTEREST EXPENSE, PRINCIPAL REPAYMENT USING AND NOT USING A SINKING FUND, AND THE TOTAL CASH FLOW (INTEREST + PRINCIPAL) ARISING FROM THE USE OF BONDS UNDER CONDITIONS OF RANDOM INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Interest Expense

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	55.00	49.50	44.00	38.50	33.00	27.50	22.00	16.50	11.00	5.
S_{29}	50.00	36.00	56.00	56.00	42.00	32.50	22.00	21.00	17.00	9.
S_{30}	50.00	45.00	40.00	35.00	30.00	25.00	20.00	15.00	10.00	5.
S_{31}	50.00	45.00	40.00	35.00	30.00	25.00	20.00	15.00	10.00	5.
S_{32}	50.00	36.00	56.00	56.00	42.00	32.50	22.00	21.00	17.00	9.
S_{33}	50.00	36.00	56.00	56.00	42.00	32.50	22.00	21.00	17.00	9.
S_{34}	60.00	50.00	80.00	90.00	80.00	75.00	65.00	80.00	95.00	100.
S_{35}	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.
S_{36}	50.00	40.00	70.00	80.00	70.00	65.00	55.00	70.00	85.00	90.

Principal Repayment

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.
S_{29}	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.
S_{30}	53.50	56.18	62.35	70.45	78.20	86.00	92.90	103.10	117.50	135.
S_{31}	53.50	56.18	62.35	70.45	78.20	86.00	92.90	103.10	117.50	135.
S_{32}	53.50	56.18	62.35	70.45	78.20	86.00	92.90	103.10	117.50	135.
S_{33}	53.50	56.18	62.35	70.45	78.20	86.00	92.90	103.10	117.50	135.
S_{34}	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.
S_{35}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	500.
S_{36}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1351.

TABLE 5-4 CONTINUED

Total Cash Flow

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	105.00	99.50	94.00	88.50	83.00	77.50	72.00	66.50	61.00	55.5
S_{29}	100.00	86.00	106.00	106.00	92.00	82.50	72.00	71.00	67.00	59.(
S_{30}	103.50	101.16	102.36	105.44	108.20	111.00	112.92	118.12	127.52	140.1
S_{31}	103.50	101.16	102.36	105.44	108.20	111.00	112.92	118.12	127.52	140.1
S_{32}	103.50	92.16	118.36	126.44	120.20	118.50	114.92	124.12	134.52	144.1
S_{33}	103.50	92.16	118.36	126.44	120.20	118.50	114.92	124.12	134.52	144.1
S_{34}	560.00	550.00	580.00	590.00	580.00	575.00	565.00	580.00	595.00	600.(
S_{35}	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	555.(
S_{36}	50.00	40.00	70.00	80.00	70.00	65.00	55.00	70.00	85.00	1441.5

single balloon payment of the principal at maturity rather than full payment each year reduces the annual cash flow from indexed bonds compared to that of short-term debt.

Interest expense also changes the same way for non-indexed bonds (S_1, S_{10}, S_{19}, S_{28}) and bonds with only the principal indexed (S_3, S_4, S_{12}, S_{13}, S_{20}, S_{21}, S_{29}, S_{30}). Both carry a constant nominal interest rate whose real return may be positive or negative over the bond's life. But the indexing feature causes a large divergence between the two when the principal repayment is taken into consideration.

In all cases the indexation of principal causes a much more dramatic increase in the total cash flow than indexing only the interest. Even when inflation is declining, the index used to adjust principal payments is still increasing, although at a decreasing rate. Even though nominal interest payments may be adjusted up or down, principal repayment will always be adjusted upward as long as inflation exists. When a firm needs to issue some form of indexed bonds, it should avoid indexing the principal if possible.

As predicted, during increasing inflation (Table 5-1) the traditional non-indexed long-term bonds (S_1) are the most beneficial instrument for the firm to issue. However, lenders may not be willing to buy these bonds since they would eventually receive a negative real return on the investment. Rather than going into the short-term debt market, the firm could issue indexed bonds. The question arises, then, as to what extent the bonds should be indexed. The general trend indicated by the simulation was that indexing only the interest (S_2) is less costly than indexing only the principal (S_3, S_4) which is less costly than indexing both the interest and the principal (S_5, S_6). Obviously, when inflation

is increasing interest payments would be adjusted upward as would sinking fund payments. Combining these increases would naturally be more costly than indexing either one separately.

On the other hand, in the case of decreasing inflation (Table 5-2) indexing the interest can be the cheaper form of long-term financing (S_{11}). When both the interest and the principal are indexed (S_{14}, S_{15}), the downward adjusted interest payments help to offset the growing cash demand of the sinking fund making it less expensive than issuing bonds with only the principal indexed (S_{12}, S_{13}).

During constant inflation (Table 5-3), the firm would not need to index interest expense. All instruments would provide the same interest expense whether indexed or not. The only impact that indexing could have on the firm is if the principal were indexed (S_{21}, S_{22}, S_{23}, S_{24}). This would increase the total cash outflow considerably.

Under random inflation (Table 5-4), it is apparent that indexing can work both for and against the firm. The firm benefits when inflation decreases and suffers when inflation increases suddenly. This is best illustrated between years one, two, and three. Also, indexed interest expense and sinking fund payments are more volatile increasing the firm's dependence on forecasting accuracy.

If the firm is forced to index, then, it would prefer to index only the interest as indexed principal considerably increases the total annual cash flow. A sinking fund appears beneficial for cash flow purposes, but would depend on the firm's cash needs and future earnings ability. At no time should the firm rely exclusively on short-term debt.

Lender Perspective

While short-term debt is least beneficial to the borrowing firm, it presents the most benefit to the lender. The short payback period allows the lender to preserve the principal and reinvest it at prevailing rates. Although these rates may be lower than the rate previously invested at, the lender retains his liquidity.

Another way to preserve his principal is to demand bonds with indexed principal. The lender would always prefer a bond with indexed principal whether inflation is increasing, decreasing, or constant in order to preserve the value of his investment. This is the primary benefit he can receive from indexing, although it is least beneficial to the firm. The lender should be careful to choose a firm which has the earnings potential to cover large cash outflows.

The lender would be most likely to demand indexed bonds when inflation is increasing and least likely to demand them when inflation is decreasing. This is the opposite trend from the firm's desires. Although, as illustrated by random inflation, immediate trends may indicate decreasing inflation, but over time that trend could change and cause indexing to be more beneficial to the lender than originally anticipated.

PROFITABILITY ANALYSIS

The cash outflow from a debt instrument of any kind has a direct impact on the firm's net income. Hence, those instruments which presented a benefit to the firm from the cash flow perspective should also have beneficial impacts from the profitability perspective. Three ratios were used to represent debt's impact on profitability: return on investment, return on net worth, and net profit margin. The ratios are summarized in Tables 5-5, 5-6, 5-7, and 5-8.

Borrower Perspective

One of the most notable observations about the impact on profitability is related to the indexation of principal and the accounting revaluation of the bond principal account. When the bond liability account is revalued, that entry must be offset by some increase in an asset account raising the total asset figure used to calculate return on investment and other ratios. This result can be seen in any scenario involving indexed principal and the revaluation feature (S_4, S_6, S_{13}, S_{15}, S_{22}, S_{24}, S_{31}, and S_{33}). While revaluing the bond account depresses return on investment, the revalued account is a more accurate representation of the firm's true liability. However, the revaluation only affects those ratios with total debt or total assets as a numerator or denominator. The return on net worth and net profit margin were the same as those indexed principal bonds with no accounting adjustment (S_3, S_5, S_{12}, S_{14}, S_{21}, S_{23}, S_{30}, and S_{32}).

It should be noted that even though sinking funds, indexed or non-indexed, do not have a direct impact on net income, they would appear in a sources and uses of funds statement and have a direct impact on cash flow. They also have an indirect impact on profitability through the decline of the bond principal account and offsetting asset account entries.

Under any inflation condition, those instruments which have no sinking fund resulted in the lowest profitability ratios. Net income feels the full impact of interest expense since the total debt is outstanding for the entire ten-year period. Return on investment is most severely affected by scenarios using bonds with indexed interest and principal with no sinking fund (S_9, S_{18}, S_{27}, S_{36}). Although, the range of ROI values is

TABLE 5-5

COMPARISON OF RETURN ON INVESTMENT, RETURN ON EQUITY, AND NET PROFIT MARGIN UNDER CONDITIONS OF INCREASING INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Return on Investment (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_1	10.00	10.37	10.63	10.75	10.87	10.88	10.83	10.73	10.60	10.4
S_2	10.00	10.12	10.27	10.38	10.46	10.52	10.54	10.54	10.51	10.4
S_3	10.00	10.34	10.57	10.72	10.78	10.79	10.73	10.63	10.50	10.3
S_4	9.65	9.69	9.69	9.66	9.65	9.66	9.70	9.80	10.00	10.3
S_5	10.00	10.12	10.27	10.38	10.46	10.52	10.54	10.54	10.51	10.4
S_6	9.65	9.51	9.41	9.35	9.35	9.40	9.51	9.70	9.99	10.4
S_7	10.00	9.40	8.90	8.48	8.12	7.81	7.54	7.16	7.11	6.9
S_8	10.00	9.64	9.31	9.01	8.74	8.51	8.28	8.08	7.89	9.4
S_9	10.00	8.72	7.96	7.32	6.75	6.25	5.79	5.37	4.97	9.1

Return on Equity (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_1	18.18	16.67	15.41	14.35	13.46	12.70	12.02	11.43	10.91	10.4
S_2	18.18	16.32	14.94	13.87	13.01	12.31	11.74	11.24	10.82	10.4
S_3	18.18	16.62	15.34	14.26	13.36	12.59	11.92	11.33	10.81	10.3
S_4	18.18	16.62	13.59	13.14	13.36	12.59	11.92	11.33	10.11	10.3
S_5	18.18	16.32	14.94	13.87	13.01	12.31	11.74	11.24	10.82	10.4
S_6	18.18	16.32	14.94	13.87	13.01	12.31	11.74	11.24	10.82	10.4
S_7	20.00	17.18	15.15	13.62	12.43	11.48	10.71	10.08	9.55	9.1
S_8	20.00	17.59	15.77	14.37	13.27	12.35	11.60	10.96	10.41	9.9
S_9	20.00	17.21	15.21	13.70	12.51	11.57	9.26	10.17	9.64	9.1

TABLE 5-5 CONTINUED

Net Profit Margin (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	10
S_1	3.77	3.95	4.11	4.26	4.39	4.52	4.63	4.74	4.83	4.
S_2	3.85	3.93	4.02	4.13	4.24	4.36	4.48	4.61	4.74	4.
S_3	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_4	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_5	3.85	3.93	4.02	4.13	4.24	4.36	4.48	4.61	4.74	4.
S_6	3.85	3.93	4.02	4.13	4.24	4.36	4.48	4.61	4.74	4.
S_7	4.00	3.96	3.91	3.88	3.85	3.82	3.81	3.79	3.78	3.
S_8	3.77	3.83	3.89	3.94	3.99	4.04	4.09	4.13	4.17	4.
S_9	3.85	3.81	3.78	3.76	3.73	3.72	3.71	3.70	3.70	3.

TABLE 5-6

COMPARISON OF RETURN ON INVESTMENT, RETURN ON EQUITY, AND NET PROFIT MARGIN UNDER CONDITIONS OF DECREASING INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Return on Investment (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1(
S_{10}	10.00	10.62	11.07	11.37	11.55	11.60	11.57	11.47	11.32	11.
S_{11}	10.00	10.78	11.31	11.62	11.76	11.76	11.64	11.46	11.22	10.
S_{12}	10.00	10.60	11.03	11.30	11.46	11.52	11.49	11.39	11.23	11.
S_{13}	9.29	9.33	9.40	9.50	9.63	9.82	10.05	10.33	10.67	11.
S_{14}	10.00	10.78	11.31	11.62	11.76	11.76	11.64	11.46	11.22	10.
S_{15}	9.29	9.52	9.70	9.86	10.01	10.19	10.38	10.61	10.87	11.
S_{16}	10.00	9.90	9.84	9.71	9.55	9.38	9.20	9.02	8.84	8.
S_{17}	10.00	9.72	9.45	9.21	8.98	8.76	8.56	8.37	8.19	8.
S_{18}	9.22	8.54	7.97	7.49	7.08	6.74	6.45	6.21	6.00	10.

Return on Equity (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1(
S_{10}	18.18	17.05	15.99	15.06	14.22	13.46	12.79	12.18	11.62	11.
S_{11}	18.18	17.28	16.29	15.34	14.45	13.61	12.84	12.15	11.52	10.
S_{12}	18.18	17.00	15.93	14.97	14.13	13.37	12.69	12.08	11.55	11.
S_{13}	18.18	17.00	15.93	14.97	14.13	13.37	12.69	12.08	11.55	11.
S_{14}	18.18	17.33	16.44	15.54	14.69	13.87	13.11	12.41	11.76	11.
S_{15}	18.18	17.33	16.44	15.54	14.69	13.87	13.11	12.41	11.76	11.
S_{16}	20.00	18.09	16.57	15.33	14.29	14.68	12.65	12.00	11.42	10.
S_{17}	20.00	17.73	15.99	14.64	13.56	12.67	11.92	11.29	10.74	8.
S_{18}	20.00	18.03	16.49	15.23	14.19	13.31	12.55	11.89	11.32	10.

TABLE 5-6 CONTINUED

Net Profit Margin (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1C
S_{10}	3.28	3.52	3.75	3.96	4.15	4.33	4.49	4.63	4.77	4.
S_{11}	3.33	3.64	3.91	4.14	4.34	4.51	4.69	4.77	4.87	4.
S_{12}	3.33	3.57	3.79	3.99	4.18	4.35	4.50	4.65	4.77	4.
S_{13}	3.33	3.57	3.79	3.99	4.18	4.35	4.50	4.65	4.77	4.
S_{14}	3.33	3.64	3.91	4.14	4.34	4.51	4.69	4.77	4.87	4.
S_{15}	3.33	3.64	3.91	4.14	4.34	4.51	4.69	4.77	4.87	4.
S_{16}	3.17	3.34	3.49	3.63	3.76	3.88	3.99	4.10	4.19	4.
S_{17}	3.28	3.36	3.44	3.51	3.58	3.65	3.72	3.78	3.84	3.
S_{18}	3.33	3.49	3.64	3.78	3.90	4.02	4.13	4.23	4.32	4.

TABLE 5-7

COMPARISON OF RETURN ON INVESTMENT, RETURN ON EQUITY, AND NET PROFIT MARGIN UNDER CONDITIONS OF CONSTANT INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Return on Investment (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1(
S_{19}	10.00	10.34	10.58	10.72	10.79	10.79	10.74	10.64	10.51	10.
S_{20}	10.00	10.34	10.58	10.72	10.79	10.79	10.74	10.64	10.51	10.
S_{21}	10.00	10.34	10.58	10.72	10.79	10.79	10.74	10.64	10.51	10.
S_{22}	9.57	9.54	9.56	9.59	9.63	9.70	9.80	9.93	10.11	10.
S_{23}	10.00	10.34	10.58	10.72	10.79	10.79	10.74	10.64	10.51	10.
S_{24}	9.57	9.54	9.56	9.59	9.63	9.70	9.80	9.93	10.11	10.
S_{25}	10.00	9.63	9.30	8.99	8.72	8.47	8.25	8.04	7.86	7.
S_{26}	10.00	9.63	9.29	8.99	8.72	8.47	8.25	8.04	7.86	9.
S_{27}	9.52	8.75	8.15	7.64	7.19	6.81	6.46	6.16	5.89	9.

Return on Equity (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1(
S_{19}	18.18	16.62	15.34	14.28	13.37	12.60	11.92	11.34	10.81	10.
S_{20}	18.18	16.62	15.34	14.28	13.37	12.60	11.92	11.34	10.81	10.
S_{21}	18.18	16.62	15.34	14.28	13.37	12.60	11.92	11.34	10.81	10.
S_{22}	18.18	16.62	15.34	14.28	13.37	12.60	11.92	11.34	10.81	10.
S_{23}	18.18	16.62	15.34	14.28	13.37	12.60	11.92	11.34	10.81	10.
S_{24}	18.18	16.62	15.34	14.28	13.37	12.60	11.92	11.34	10.81	10.
S_{25}	20.00	17.57	15.76	14.34	13.23	12.31	11.56	10.92	10.37	9.
S_{26}	20.00	17.57	15.74	14.34	13.23	12.31	11.56	10.92	10.37	9.
S_{27}	20.00	17.57	15.76	14.34	13.23	12.31	11.56	10.92	10.37	9.

TABLE 5-7 CONTINUED

Net Profit Margin (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1(
S_{19}	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_{20}	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_{21}	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_{22}	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_{23}	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_{24}	3.85	4.01	4.16	4.30	4.43	4.55	4.66	4.75	4.84	4.
S_{25}	3.85	3.90	3.95	4.00	4.05	4.10	4.14	4.18	4.22	4.
S_{26}	3.85	3.90	3.95	4.00	4.05	4.10	4.14	4.18	4.22	4.
S_{27}	3.85	3.90	3.95	4.00	4.05	4.10	4.14	4.18	4.22	4.

TABLE 5-8

COMPARISON OF RETURN ON INVESTMENT, RETURN ON EQUITY, AND NET PROFIT MARGIN UNDER CONDITIONS OF RANDOM INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Return on Investment (%)

Years / CENARIO	1	2	3	4	5	6	7	8	9	1C
S_{28}	10.00	10.30	10.52	10.64	10.69	10.70	10.64	10.53	10.41	10.
S_{29}	10.00	10.65	9.78	9.81	10.30	10.50	10.65	10.43	10.29	10.
S_{30}	10.00	10.27	10.46	10.57	10.61	10.59	10.54	10.43	10.31	10.
S_{31}	9.70	9.81	9.71	9.59	9.56	9.60	9.70	9.79	9.92	10.
S_{32}	10.00	10.65	9.78	9.81	10.30	10.50	10.65	10.43	10.29	10.
S_{33}	9.69	10.18	9.08	8.90	9.28	9.50	9.79	9.77	9.90	10.
S_{34}	10.00	10.03	8.51	7.99	8.21	8.20	8.30	7.72	7.25	7.
S_{35}	10.00	9.62	9.27	8.97	8.69	8.44	8.22	8.01	7.82	9.
S_{36}	9.66	9.48	7.68	6.88	6.81	6.61	6.57	5.93	5.35	9.

Return on Equity (%)

YEARS / CENARIO	1	2	3	4	5	6	7	8	9	1C
S_{28}	18.18	16.56	15.26	14.17	13.26	12.49	11.82	11.23	10.71	10.
S_{29}	18.18	17.08	14.21	13.13	12.84	12.32	11.86	11.14	10.60	10.
S_{30}	18.18	16.53	15.18	14.07	13.17	12.39	11.71	11.13	10.61	10.
S_{31}	18.18	16.53	15.18	14.07	13.17	12.39	11.71	11.13	10.61	10.
S_{32}	18.18	17.08	14.21	13.13	12.84	12.32	11.86	11.14	10.60	10.
S_{33}	18.18	17.08	14.21	13.13	12.84	12.32	11.86	11.14	10.60	10.
S_{34}	20.00	18.25	14.47	12.88	12.60	12.05	11.73	10.59	9.67	9.
S_{35}	20.00	17.56	15.73	14.31	13.18	12.27	11.51	10.87	10.33	9.
S_{36}	20.00	18.21	14.40	12.80	12.51	11.96	11.65	10.49	9.57	9.

TABLE 5-8 CONTINUED

Net Profit Margin (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	3.92	4.08	4.22	4.35	4.47	4.58	4.68	4.77	4.85	4.9
S_{29}	4.00	4.31	3.98	4.03	4.31	4.49	4.67	4.69	4.77	4.8
S_{30}	4.00	4.14	4.27	4.40	4.51	4.61	4.70	4.79	4.87	4.9
S_{31}	4.00	4.14	4.27	4.40	4.51	4.61	4.70	4.79	4.87	4.9
S_{32}	4.00	4.31	3.98	4.03	4.31	4.49	4.67	4.69	4.77	4.8
S_{33}	4.00	4.31	3.98	4.03	4.31	4.49	4.67	4.69	4.77	4.8
S_{34}	3.85	4.08	3.61	3.50	3.73	3.87	4.07	3.91	3.67	3.7
S_{35}	3.92	3.97	4.02	4.07	4.11	4.16	4.20	4.23	4.27	4.3
S_{36}	4.00	4.24	3.73	3.62	3.85	3.98	4.18	4.01	3.85	3.8

widest under increasing inflation and the range is narrowest under decreasing inflation. At no time was the exclusive use of short-term debt a benefit to the firm under the assumptions used for scenario construction.

As expected, the most beneficial cash flow scenarios are also the most beneficial profitability scenarios. During increasing inflation (Table 5-5), non-indexed bonds (S_1) provide the highest return figures with the exception of the net profit margin. The net profit margins for bonds with only the principal indexed (S_3 and S_4) are slightly higher. For both instruments interest expense is fixed, but the indexed principal bonds were issued at a coupon rate 1% below that of the non-indexed bonds due to the assumption that the inclusion of the indexed principal feature should induce the lender to accept a lower coupon rate on the bond than that of a traditional bond. As the principal is retired through the sinking fund, the profit margins for the two bond types converge to the point of near equality by maturity.

Under decreasing inflation (Table 5-6), the largest profitability figures are found using bonds with only the interest indexed (S_{11}) as expected. As interest expense is adjusted downward, net income rises more rapidly than with other instruments.

Using constant inflation (Table 5-7), once again there are only two things that impact on profitability: indexed principal with an accounting adjustment (S_{22}, S_{24}) which affects only ROI, and the absence of a sinking fund (S_{25}, S_{26}, S_{27}). Those instruments which do not have a sinking fund impact on profitability the same way, so it does not matter which instrument is chosen. One exception, the principal revaluation in S_{27} does depress ROI to a greater extent than short-term debt (S_{25}), or non-indexed bonds (S_{26}).

Random inflation (Table 5-8) points out the increased volatility of the ratios resulting from indexation. While returns for non-indexed bonds (S_{28}, S_{35}) and for bonds with only the principal indexed and no revaluation (S_{30}) may increase or decrease steady due to fixed interest payments, other scenario returns experience a much closer relationship to changes in the inflation rate.

Lender Perspective

While a lender would prefer an indexed bond, under some inflation conditions these bonds may have ill effects on the firm's profitability. Consequently, if the lender does not feel the firm has the earnings potential to cover the indexed interest and/or principal, he may limit his purchase of indexed bonds to those firms with the highest credit ratings. On the other hand, the lender may simply view that firm as a riskier investment and demand a higher return from the bonds than other firms.

RISK ANALYSIS

Of particular interest to lenders, investors, and rating agencies is the perception of risk associated with the issuance of debt. In some cases, indexed bonds may increase the lender's perception of risk and cause the lender to prefer more stringent protective covenants, or to expect a higher return for the purchase of the bond.

Risk analysis has been divided into three sections: coverage ratios (times interest earned and fixed charge coverage), debt ratios (total debt ÷ total assets and total debt ÷ net worth), and statistical measures (mean, variance, and standard deviation of earnings per share). Each section is discussed separately.

Borrower Perspective

Coverage Ratios. The coverage ratios are summarized in Tables 5-9, 5-10, 5-11, and 5-12. During times of increasing inflation (Table 5-9), the first six scenarios begin with the same times interest earned ratios. But, the ratios for non-indexed bonds (S_1) and bonds with only the principal indexed (S_3, S_4) increase at a much faster rate than those for bonds with indexed interest only (S_2) and indexed interest and principal (S_5, S_6). When the interest expense is indexed, it continues to be adjusted upward and reduces the times interest earned more and more each year. Looking at the scenarios with no sinking fund, the times interest earned for short-term debt (S_7) and bonds with indexed interest and principal (S_9) both decline over the period more closely illustrating the effects of increasing nominal interest payments. On the other hand, the times interest earned for non-indexed bonds (S_8) increases over the years as sales increase and interest payments remain stable.

The fixed charge coverage, defined as earnings before interest and taxes divided by interest plus the sinking fund, displays a different effect. Those scenarios with indexed principal (S_3, S_4, S_5, S_6) have a much lower fixed charge coverage than either non-indexed bonds (S_1) or bonds with indexed interest only (S_2). During increasing inflation, bonds with both interest and principal indexed (S_5, S_6) have the lowest fixed charge coverage since both variables are adjusted upward each year.

During decreasing inflation (Table 5-10), the opposite effect is found in times interest earned. While the first six scenarios (S_{10} through S_{15}) still begin with the same ratio, those using bonds with interest indexed (S_{11}, S_{14}, S_{15}) increase much more than those with non-indexed bonds (S_{10}) or bonds with only the principal indexed (S_{12}, S_{13}).

TABLE 5-9

COMPARISON OF TIMES INTEREST EARNED AND FIXED CHARGE COVERAGE RATIOS UNDER INCREASING INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Times Interest Earned

YEARS / NARIO	1	2	3	4	5	6	7	8	9	10
S_1	4.08	4.76	5.62	6.74	8.26	10.41	13.66	19.12	30.12	63.25
S_2	4.33	4.67	5.12	5.73	6.58	7.81	9.68	12.84	19.21	38.41
S_3	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_4	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_5	4.33	4.67	5.12	5.73	6.58	7.81	9.68	12.84	19.21	38.41
S_6	4.33	4.67	5.12	5.73	6.58	7.81	9.68	12.84	19.21	38.41
S_7	5.00	4.77	4.59	4.45	4.34	4.25	4.19	4.14	4.10	4.08
S_8	4.08	4.28	4.49	4.72	4.96	5.20	5.46	5.74	6.02	6.32
S_9	4.33	4.20	4.10	4.01	3.95	3.90	3.87	3.85	3.84	3.84

Fixed Charge Coverage

YEARS / NARIO	1	2	3	4	5	6	7	8	9	10
S_1	2.30	2.56	2.86	3.20	3.62	4.10	4.67	5.37	6.21	7.28
S_2	2.36	2.52	2.70	2.94	3.22	3.59	4.05	4.66	5.49	6.67
S_3	2.28	2.42	2.54	2.64	2.71	2.74	2.73	2.67	2.55	2.40
S_4	2.28	2.42	2.54	2.64	2.71	2.74	2.73	2.67	2.55	2.40
S_5	2.28	2.33	2.37	2.42	2.46	2.49	2.49	2.48	2.43	2.34
S_6	2.28	2.33	2.37	2.42	2.46	2.49	2.49	2.48	2.43	2.34
S_7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

= Not Applicable

TABLE 5-10

COMPARISON OF TIMES INTEREST EARNED AND FIXED CHARGE COVERAGE RATIOS UNDER DECREASING INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Times Interest Earned

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	2.90	3.39	4.00	4.80	5.88	7.41	9.73	13.62	21.46	45.0(
S_{11}	3.00	3.68	4.59	5.84	7.60	10.20	14.36	21.65	36.94	84.6
S_{12}	3.00	3.50	4.13	4.96	6.08	7.66	10.05	14.07	22.16	46.5
S_{13}	3.00	3.50	4.13	4.96	6.08	7.66	10.05	14.07	22.16	46.5
S_{14}	3.00	3.68	4.59	5.84	7.60	10.20	14.36	21.65	36.94	84.6
S_{15}	3.00	3.68	4.59	5.84	7.60	10.20	14.36	21.65	36.94	84.6
S_{16}	2.74	3.01	3.31	3.65	4.03	4.47	4.97	5.54	6.21	6.9
S_{17}	2.90	3.05	3.20	3.36	3.53	3.71	3.89	4.09	4.29	4.5
S_{18}	3.00	3.32	3.67	4.08	4.56	5.11	5.74	6.49	7.39	8.4(

Fixed Charge Coverage

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	1.97	2.22	2.51	2.86	3.28	3.80	4.43	5.27	6.35	7.8
S_{11}	2.00	2.32	2.70	3.17	3.72	4.38	5.15	6.07	7.15	8.3
S_{12}	1.89	2.00	2.09	2.18	2.27	2.35	2.44	2.52	2.61	2.5
S_{13}	1.89	2.00	2.09	2.18	2.27	2.35	2.44	2.52	2.61	2.5
S_{14}	1.89	2.05	2.20	2.34	2.46	2.55	2.63	2.69	2.67	2.7
S_{15}	1.89	2.05	2.20	2.34	2.46	2.55	2.63	2.69	2.67	2.7
S_{16}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_{17}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_{18}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

= Not Applicable

TABLE 5-11

COMPARISON OF TIMES INTEREST EARNED AND FIXED CHARGE COVERAGE RATIOS UNDER CONSTANT INFLATION AND SELECTED CAPITAL STRUCTURE SCENARIOS

Times Interest Earned

YEARS / NARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_{20}	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_{21}	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_{22}	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_{23}	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_{24}	4.33	5.06	5.97	7.17	8.78	11.06	14.52	20.32	32.01	67.22
S_{25}	4.33	4.55	4.78	5.02	5.27	5.53	5.81	6.10	6.40	6.72
S_{26}	4.33	4.55	4.78	5.02	5.27	5.53	5.81	6.10	6.40	6.72
S_{27}	4.33	4.55	4.78	5.02	5.27	5.53	5.81	6.10	6.40	6.72

Fixed Charge Coverage

YEARS / NARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	2.36	2.63	2.93	3.27	3.67	4.15	4.71	5.38	6.20	7.20
S_{20}	2.36	2.63	2.93	3.27	3.67	4.15	4.71	5.38	6.20	7.20
S_{21}	2.26	2.37	2.49	2.60	2.70	2.78	2.85	2.90	2.94	2.95
S_{22}	2.26	2.37	2.49	2.60	2.70	2.78	2.85	2.90	2.94	2.95
S_{23}	2.26	2.37	2.49	2.60	2.70	2.78	2.85	2.90	2.94	2.95
S_{24}	2.26	2.37	2.49	2.60	2.70	2.78	2.85	2.90	2.94	2.95
S_{25}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_{26}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_{27}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

= Not Applicable

TABLE 5-12

COMPARISON OF TIMES INTEREST EARNED AND FIXED CHARGE COVERAGE RATIOS UNDER RANDOM INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Times Interest Earned

YEARS / NARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	4.64	5.41	6.39	7.67	9.39	11.83	15.53	21.75	34.25	71.93
S_{29}	5.00	7.29	4.92	5.17	7.24	9.82	15.23	16.75	21.73	43.09
S_{30}	5.00	5.83	6.89	8.27	10.13	12.76	16.75	23.45	36.94	77.56
S_{31}	5.00	5.83	6.89	8.27	10.13	12.76	16.75	23.45	36.94	77.56
S_{32}	5.00	7.29	4.92	5.17	7.24	9.82	15.23	16.75	21.73	43.09
S_{33}	5.00	7.29	4.92	5.17	7.24	9.82	15.23	16.75	21.73	43.09
S_{34}	4.33	5.46	3.58	3.34	3.95	4.42	5.36	4.57	4.04	4.03
S_{35}	4.64	4.87	5.11	5.37	5.53	5.92	6.21	6.52	6.85	7.19
S_{36}	5.00	6.56	3.94	3.62	4.34	4.91	6.09	5.03	4.35	4.31

Fixed Charge Coverage

YEARS / NARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	2.43	2.69	2.99	3.34	3.73	4.20	4.75	5.40	6.18	7.13
S_{29}	2.50	3.05	2.60	2.73	3.30	3.87	4.65	4.95	5.51	6.57
S_{30}	2.42	2.59	2.69	2.75	2.81	2.87	2.97	2.98	2.90	2.77
S_{31}	2.42	2.59	2.69	2.75	2.81	2.87	2.97	2.98	2.90	2.77
S_{32}	2.42	2.85	2.33	2.29	2.53	2.69	2.92	2.83	2.75	2.69
S_{33}	2.42	2.85	2.33	2.29	2.53	2.69	2.92	2.83	2.75	2.69
S_{34}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_{35}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S_{36}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

= Not Applicable

Indexed interest payments are continually adjusted downward raising times interest earned. When no sinking fund is used, the same effect results. While times interest earned for short-term debt (S_{16}), non-indexed bonds (S_{17}), and bonds with indexed interest and principal (S_{18}) all increase. But, S_{16} and particularly S_{18} increase much more rapidly than S_{17}.

When the sinking fund is taken into account as a fixed charge, the same effect is seen. Bonds with indexed interest only (S_{11}) cover the charges by a wider margin than non-indexed bonds (S_{10}) or bonds with indexed principal only (S_{12}, S_{13}). An interesting note, indexing both the interest and the principal provides better fixed charge coverage than indexing only the principal. The decreasing interest payments apparently offset the increasing principal repayments and help to slightly improve coverage.

When inflation is constant (Table 5-11), all debt instruments that use a sinking fund provide the same interest coverage. Those scenarios using bonds with indexed principal (S_{21}, S_{22}, S_{23}, S_{24}) provide the same fixed charge coverage, but less than those with a non-indexed sinking fund (S_{19}, S_{20}). In all cases, the scenarios with no sinking fund (S_{26}, S_{27}) provide higher coverage each year than the other scenarios, but a large balloon payment would be due at maturity.

The main thrust from examining the case with random inflation (Table 5-12) is that when bonds are indexed, coverage ratios can be much more volatile. This increases the outsider's view of risk since coverage is unpredictable. In this case, inflation rose more than it fell putting bonds with indexed interest at a disadvantage. Inflation could have moved the opposite way making the same bonds more beneficial to the firm.

Debt Ratios. A summary of the debt ratios is presented in Tables 5-13, 5-14, 5-15, and 5-16. In all cases, the inclusion of a sinking fund speeds up the reduction in both total debt to total assets and total debt to net worth ratios. This leaves more room for additional use of debt sooner. If debt ratios are held too high, lenders are reluctant to invest additional funds with a firm which already has a lot of debt obligations.

Also common to all inflation situations is the effect of revaluing the principal bond account when principal is indexed (S_4, S_6, S_{13}, S_{22}, S_{24}, S_{31}, S_{33}). Revaluing the bond account keeps debt ratios much higher than those with indexed principal and no revaluation (S_3, S_5, S_{12}, S_{14}, S_{21}, S_{23}, S_{30}, S_{32}). Those scenarios with no revaluation give off a sense of false protection. The true value of the underlying obligations is much greater than is being displayed.

The effects of the revaluation are best represented by bonds with indexed interest and principal with no sinking fund (S_9, S_{18}, S_{27}, S_{36}). Creditors prefer a large equity base to protect themselves against the possible bankruptcy of the firm. Indexing principal greatly reduces this equity cushion, with or without a sinking fund. The lender's perception of risk would be increased due to the indexation of principal.

Statistical Measures. The statistical measures are summarized in Table 5-17. Those scenarios with a sinking fund consistently provided the higher average earnings per share and the larger variances and standard deviations. One should be aware that the sinking fund does not directly impact the net income, but as the principal is retired there is less and less total interest to be paid out, whether indexed or non-indexed. Consequently, owners would prefer a sinking fund feature be offered with the debt in order to hold up the earnings per share.

TABLE 5-13

COMPARISON OF DEBT RATIOS UNDER INCREASING INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Total Debt to Total Assets (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_1	45.00	37.74	30.97	24.79	19.20	14.23	9.87	6.07	2.80	0.(
S_2	45.00	37.84	31.19	25.06	19.52	14.55	10.12	6.25	2.89	0.(
S_3	45.00	37.77	31.00	24.83	19.26	14.29	9.93	6.12	2.82	0.(
S_4	46.91	41.67	36.79	32.21	27.74	23.28	18.60	13.44	7.44	0.(
S_5	45.00	37.84	31.19	25.06	19.52	14.55	10.12	6.25	2.89	0.(
S_6	46.90	41.74	36.97	32.47	28.09	23.64	18.93	13.71	7.60	0.(
S_7	50.00	45.29	41.29	37.76	34.72	31.99	29.59	27.43	25.47	23.7
S_8	50.00	45.21	40.98	37.29	34.04	31.13	28.56	26.25	24.18	0.(
S_9	54.00	49.38	47.61	46.55	46.05	46.03	46.44	47.23	48.41	0.(

Total Debt to Net Worth (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_1	81.81	60.70	44.93	32.97	23.76	16.61	10.96	6.47	2.88	0.(
S_2	81.81	60.88	45.34	33.48	24.27	17.02	11.27	6.67	2.97	0.(
S_3	81.81	60.70	44.99	33.04	23.85	16.68	11.02	6.51	2.91	0.(
S_4	88.36	71.45	58.26	47.49	38.41	30.35	22.86	15.54	8.04	0.(
S_5	81.81	60.88	45.34	33.48	24.27	17.02	11.27	6.67	2.97	0.(
S_6	88.36	71.67	58.71	48.13	39.08	30.97	23.37	15.90	8.22	0.(
S_7	100.00	82.78	70.32	60.68	53.19	47.08	42.02	37.79	34.18	31.(
S_8	100.00	82.51	69.44	59.45	51.60	45.21	39.97	35.59	31.89	0.(
S_9	108.00	97.45	90.94	87.12	85.37	85.33	74.34	89.56	98.89	0.(

TABLE 5-14

COMPARISON OF DEBT RATIOS UNDER DECREASING INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Total Debt to Total Assets (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	45.00	37.63	30.73	24.41	18.75	13.78	9.47	5.77	2.63	0.0
S_{11}	45.00	37.55	30.59	24.23	18.57	13.61	9.34	5.69	2.60	0.0
S_{12}	45.00	37.66	30.78	24.47	18.83	13.84	9.52	5.81	2.65	0.0
S_{13}	48.93	45.05	40.95	36.56	31.79	26.55	20.82	14.49	7.56	0.0
S_{14}	45.00	37.66	30.78	24.47	18.83	13.84	9.52	5.81	2.65	0.0
S_{15}	48.93	45.05	40.95	36.56	31.79	26.55	20.82	14.49	7.56	0.0
S_{16}	50.00	45.05	40.62	36.68	33.18	30.05	27.29	24.84	22.63	20.6
S_{17}	50.00	45.17	40.88	37.12	33.78	30.83	28.18	25.83	23.71	0.0
S_{18}	53.92	52.69	51.65	50.81	50.04	49.30	48.57	47.78	46.95	0.0

Total Debt to Net Worth (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{10}	81.81	60.42	44.36	32.33	23.11	15.99	10.46	6.12	2.71	0.0
S_{11}	81.81	60.24	44.08	31.98	22.81	15.76	10.30	6.04	2.67	0.0
S_{12}	81.81	60.42	44.47	32.40	23.19	16.06	12.24	6.17	2.73	0.0
S_{13}	95.73	82.01	69.41	57.64	46.63	36.17	26.29	16.95	8.18	0.0
S_{14}	81.81	60.42	44.47	32.40	23.19	16.06	12.24	6.17	2.73	0.0
S_{15}	95.73	82.01	69.41	57.64	46.63	36.17	26.29	16.95	8.18	0.0
S_{16}	100.00	81.97	68.40	57.94	49.65	42.99	37.54	33.05	29.26	26.0
S_{17}	100.00	82.37	69.16	59.03	51.02	44.56	39.25	34.82	31.07	0.0
S_{18}	117.00	111.00	107.00	103.00	100.00	97.32	94.40	91.53	88.46	0.0

TABLE 5-15

COMPARISON OF DEBT RATIOS UNDER CONSTANT INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Total Debt to Total Assets (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	45.00	37.77	31.03	24.83	19.26	14.30	9.93	6.12	2.82	0.(
S_{20}	45.00	37.77	31.03	24.83	19.26	14.30	9.93	6.12	2.82	0.(
S_{21}	45.00	37.77	31.03	24.83	19.26	14.30	9.93	6.12	2.82	0.(
S_{22}	47.37	42.54	37.64	32.78	27.92	22.96	17.80	12.34	6.46	0.(
S_{23}	45.00	37.77	31.03	24.83	19.26	14.30	9.93	6.12	2.82	0.(
S_{24}	47.37	42.54	37.64	32.78	27.92	22.96	17.80	12.34	6.46	0.(
S_{25}	50.00	45.21	41.02	37.31	34.06	31.17	28.60	26.30	24.24	22.
S_{26}	50.00	45.18	40.98	37.31	34.06	31.17	28.60	26.30	24.24	0.(
S_{27}	52.38	50.16	48.24	46.77	45.62	44.72	44.04	43.51	43.19	0.(

Total Debt to Net Worth (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{19}	81.81	60.70	44.99	33.04	23.88	16.69	11.02	6.52	2.91	0.(
S_{20}	81.81	60.70	44.99	33.04	23.88	16.69	11.02	6.52	2.91	0.(
S_{21}	81.81	60.70	44.99	33.04	23.88	16.69	11.02	6.52	2.91	0.(
S_{22}	90.00	74.11	60.37	48.82	38.78	29.82	21.66	14.09	6.91	0.(
S_{23}	81.81	60.70	44.99	33.04	23.88	16.69	11.02	6.52	2.91	0.(
S_{24}	90.00	74.11	60.37	48.82	38.78	29.82	21.66	14.09	6.91	0.(
S_{25}	100.00	82.51	69.54	59.52	51.65	45.29	40.06	35.69	31.99	28.3
S_{26}	100.00	82.51	69.54	59.52	51.65	45.29	40.06	35.69	31.99	0.(
S_{27}	110.00	100.74	93.32	87.86	83.88	80.89	78.73	77.09	76.04	0.(

TABLE 5-16

COMPARISON OF DEBT RATIOS UNDER RANDOM INFLATION CONDITIONS AND SELECTED CAPITAL STRUCTURE SCENARIOS

Total Debt to Total Assets (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	45.00	37.77	31.06	24.88	19.32	14.35	9.98	6.15	2.85	0.
S_{29}	45.00	37.63	31.17	25.21	19.67	14.66	10.20	6.31	2.92	0.
S_{30}	45.00	37.77	31.06	24.92	19.36	14.41	10.03	6.20	2.87	0.
S_{31}	46.70	40.56	35.98	31.88	27.30	22.45	17.16	11.99	6.49	0.
S_{32}	45.00	37.63	31.17	25.21	19.67	14.66	10.20	6.31	2.92	0.
S_{33}	46.70	40.38	36.10	32.22	27.71	22.81	17.43	12.19	6.60	0.
S_{34}	50.00	45.00	41.19	37.88	34.77	31.93	29.27	27.01	25.06	23.
S_{35}	50.00	45.21	41.02	37.34	34.08	31.21	28.65	26.36	24.30	0.
S_{36}	51.69	47.89	46.63	46.26	45.54	44.72	43.57	43.43	44.16	0.

Total Debt to Net Worth (%)

YEARS / ENARIO	1	2	3	4	5	6	7	8	9	10
S_{28}	81.81	60.70	45.05	33.11	23.95	16.76	11.09	6.56	2.93	0.
S_{29}	81.81	60.33	45.28	33.75	24.51	17.20	11.36	6.73	3.01	0.
S_{30}	81.81	60.79	45.10	33.22	24.04	16.85	11.15	6.61	2.95	0.
S_{31}	87.55	68.30	56.24	46.81	37.60	28.98	20.72	13.63	6.94	0.
S_{32}	81.81	60.33	45.28	33.75	24.51	17.20	11.36	6.73	3.01	0.
S_{33}	87.55	67.78	56.46	47.55	38.33	29.58	21.11	13.89	7.07	0.
S_{34}	100.00	81.83	70.03	61.05	53.36	46.90	41.39	37.04	33.44	30.
S_{35}	100.00	82.51	69.54	59.59	51.71	45.37	40.16	35.79	32.09	0.
S_{36}	107.00	91.94	87.32	36.12	83.64	80.98	77.29	76.77	79.12	0.

TABLE 5-17

COMPARISON OF VARIANCE, STANDARD DEVIATION AND THE MEAN OF EARNINGS PER SHARE UNDER SELECTED INFLATIONARY CONDITIONS AND CAPITAL STRUCTURE SCENARIOS

INCREASING INFLATION	σ^2	σ	$\overline{EPS}$	DECREASING INFLATION	σ^2	σ	$\overline{EPS}$
S_1	.1067	.3267	1.48	S_{10}	.1750	.4183	1.63
S_2	.0955	.3089	1.43	S_{11}	.1718	.4145	1.65
S_3	.0985	.3138	1.47	S_{12}	.1672	.4089	1.61
S_4	.0985	.3138	1.47	S_{13}	.1672	.4089	1.61
S_5	.0955	.3090	1.43	S_{14}	.1718	.4145	1.65
S_6	.0955	.3090	1.43	S_{15}	.1718	.4145	1.65
S_7	.0216	.1471	1.29	S_{16}	.1220	.3492	1.52
S_8	.0547	.2339	1.34	S_{17}	.0727	.2696	1.39
S_9	.0245	.1565	1.22	S_{18}	.1119	.3345	1.50

CONSTANT INFLATION	σ^2	σ	$\overline{EPS}$	RANDOM INFLATION	σ^2	σ	$\overline{EPS}$
S_{19}	.1001	.3163	1.47	S_{28}	.0925	.3041	1.45
S_{20}	.1001	.3163	1.47	S_{29}	.0843	.2903	1.40
S_{21}	.1001	.3163	1.47	S_{30}	.0809	.2845	1.43
S_{22}	.1001	.3163	1.47	S_{31}	.0809	.2845	1.43
S_{23}	.1001	.3163	1.47	S_{32}	.0843	.2903	1.40
S_{24}	.1001	.3163	1.47	S_{33}	.0843	.2903	1.40
S_{25}	.0530	.2303	1.33	S_{34}	.0338	.1838	1.24
S_{26}	.0530	.2303	1.33	S_{35}	.0504	.2245	1.33
S_{27}	.0530	.2303	1.33	S_{36}	.0310	.1760	1.24

All debt instruments provided higher earnings per share when inflation was assumed to be decreasing. Those bonds with indexed interest (S_{11}, S_{14}, S_{15}) provided the highest earnings per share as interest expense would be indexed downward each year raising net income. During increasing inflation on the other hand, the non-indexed bonds (S_1) resulted in the highest earnings per share just as they provided the least total cash flow and the greatest profitability.

Under constant inflation it makes no difference which type of debt was used as long as a sinking fund was a part of the package. This occurs primarily due to the flat yield curve assumption in conjunction with constant rates of inflation.

The results from random inflation show non-indexed bonds being the most advantageous in terms of earnings per share. However, a larger sample of random inflation situations should be analyzed to get a better picture of the variability associated with randomness.

The variability measures show those scenarios with no sinking fund as having the least volatility. But, earnings per share is also considerably lower in those scenarios. The demand on net income by the interest expense is much greater from these instruments thereby causing earnings per share to grow much less than it does using other instruments. Consequently, variability is lower due to low growth. Also, these measures only take into account the impact of interest payments and not total cash flow.

Lender Perspective

The lender is primarily interested in whether the firm has the earnings potential to provide the promised return (indexed or non-indexed, interest

and principal) at the time agreed upon. The lender should be aware that indexed bonds can put a greater strain on the firm under some inflation conditions, which in turn increases the firm's risk of bankruptcy.

If inflation is increasing, the firm will not be able to cover indexed interest payments as well as non-indexed payments. However, this does not necessarily mean that the firm will not be able to meet its obligations, only that it will not be able to cover them as many times with the same earnings figure. If sales are increasing more rapidly than inflation, then the indexed payments would not be any problem.

Lenders would prefer to preserve their principal through indexing, but bonds with indexed principal are of the greatest risk to the firm. Coverage ratios are reduced and debt ratios are greatly increased. But, the real risk would be dependent on the firm itself. Just because coverage ratios are reduced does not mean that the firm will go bankrupt tomorrow.

Lenders may demand higher returns if the risk appears great, but they are already receiving protection from the devaluation of their interest and/or principal. They may demand a higher real rate of return, or simply choose another firm to invest in.

Many bond contracts include numerous restrictive covenants. Those that pertain to minimum ratio requirements may need to be altered by the lender. One can see from the coverage and debt ratios examined here that each type of debt used can have unique impacts on ratios. In years when inflation is high, if ratio minimums are also high, the firm could go into default without being in irreversible trouble. So, the lender (or trustee) should be aware of the inherent volatility of traditional measures stemming from the use of indexation.

CHAPTER 6

SUMMARY AND RECOMMENDATIONS

SUMMARY

The impact of nine different debt instruments on the financial performance of a hypothetical firm has been examined under four inflationary economic conditions. The scenarios have been ranked from most to least beneficial to the borrowing corporation under each inflation assumption in Table 6-1.

Generally, a scenario which provides the most beneficial total cash flow is consistently the best alternative regarding the other variables. For example, during increasing inflation, non-indexed bonds (S_1) cost the least in total cash outflow. They are also the most beneficial in all other areas except net profit margin and times interest earned. In these two areas the bonds with indexed principal (S_3, S_4) are slightly superior. But, as discussed previously, these bonds have a fixed interest expense like the non-indexed and were issued at a slightly lower coupon rate which accounts for the higher ranking in net profit margin and times interest earned. The indexed principal bonds rank much lower in other areas, particularly total cash flow. Non-indexed bonds rank last in terms of variability, but provide the highest average earnings per share. Had the variability of total cash flow been taken into account, these results might have been different. Also, these values are calculated

TABLE 6-1

SUMMARY OF SCENARIO RESULTS FOR EACH PERFORMANCE MEASURE RANKED FROM MOST TO LEAST BENEFICIAL* TO BORROWING CORPORATION UNDER FOUR INFLATION ASSUMPTIONS

INFLATION RATE / PERFORMANCE MEASURE	INCREASING INFLATION	DECREASING INFLATION
TOTAL CASH FLOW	S_1, S_2, S_8, [S_3, S_4], [S_5, S_6], S_9, S_7	S_{11}, S_{10}, S_{17}, [S_{12}, S_{13}], [S_{14}, S_{15}], S_{18}, S_{16}
RETURN ON INVESTMENT	S_1, S_3, [S_2, S_5], S_4, S_6, S_8, S_7, S_9	S_{14}, S_{11}, S_{10}, S_{12}, S_{15}, S_{13}, S_{16}, S_{17}, S_{18}
RETURN ON NET WORTH	S_1, [S_3, S_4], [S_2, S_5, S_6], S_8, S_9, S_7	[S_{14}, S_{15}], S_{11}, S_{10}, [S_{12}, S_{13}], S_{16}, S_{18}, S_{17}
NET PROFIT MARGIN	[S_3, S_4], S_1, [S_2, S_5, S_6], S_8, S_7, S_9	[S_{11}, S_{14}, S_{15}], [S_{12}, S_{13}], S_{10}, S_{18}, S_{16}, S_{17}
TIMES INTEREST EARNED	[S_3, S_4], S_1, [S_2, S_5, S_6], S_8, S_7, S_9	[S_{11}, S_{14}, S_{15}], [S_{12}, S_{13}], S_{10}, S_{18}, S_{16}, S_{17}
FIXED CHARGE COVERAGE	S_1, S_2, [S_3, S_4], [S_5, S_6]	S_{11}, S_{10}, [S_{14}, S_{15}], [S_{12}, S_{13}]
TOTAL DEBT ÷ TOTAL ASSETS	S_1, S_3, [S_2, S_5], S_4, S_6, S_8, S_7, S_9	S_{11}, S_{10}, [S_{12}, S_{14}], [S_{13}, S_{15}], S_{16}, S_{17}, S_{18}
TOTAL DEBT ÷ NET WORTH	S_1, S_3, [S_2, S_5], S_4, S_6, S_8, S_7, S_9	S_{11}, S_{10}, [S_{12}, S_{14}], [S_{13}, S_{15}], S_{16}, S_{17}, S_{18}
VARIANCE OF EPS	S_7, S_9, S_8, [S_2, S_5, S_6], [S_3, S_4], S_1	S_{17}, S_{18}, S_{16}, [S_{12}, S_{13}], [S_{11}, S_{14}, S_{15}], S_{10}
STANDARD DEVIATION EPS	S_7, S_9, S_8, [S_2, S_5, S_6], [S_3, S_4], S_1	S_{17}, S_{18}, S_{16}, [S_{12}, S_{13}], [S_{11}, S_{14}, S_{15}], S_{10}
MEAN OF EPS	S_1, [S_3, S_4], [S_2, S_5, S_6], S_8, S_7, S_9	[S_{11}, S_{14}, S_{15}], S_{10}, [S_{12}, S_{13}], S_{16}, S_{18}, S_{17}

INFLATION RATE / PERFORMANCE MEASURE	CONSTANT INFLATION	RANDOM INFLATION
TOTAL CASH FLOW	[S_{19}, S_{20}], S_{26}, [S_{21}, S_{22}, S_{23}, S_{24}], S_{27}, S_{25}	S_{28}, S_{35}, S_{29}, [S_{30}, S_{31}], [S_{32}, S_{33}], S_{36}, S_{34}
RETURN ON INVESTMENT	[S_{19}, S_{20}, S_{21}, S_{23}], [S_{22}, S_{24}], [S_{25}, S_{26}], S_{27}	S_{28}, S_{30}, [S_{29}, S_{32}], S_{31}, S_{33}, S_{35}, S_{34}, S_{36}
RETURN ON NET WORTH	[S_{19}, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}], [S_{25}, S_{26}, S_{27}]	S_{28}, [S_{30}, S_{31}], [S_{29}, S_{32}, S_{33}], S_{35}, S_{34}, S_{36}
NET PROFIT MARGIN	[S_{19}, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}], [S_{25}, S_{26}, S_{27}]	[S_{30}, S_{31}], S_{28}, [S_{29}, S_{32}, S_{33}], S_{35}, S_{36}, S_{34}
TIMES INTEREST EARNED	[S_{19}, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}], [S_{25}, S_{26}, S_{27}]	[S_{30}, S_{31}], S_{28}, [S_{29}, S_{32}, S_{33}], S_{35}, S_{36}, S_{34}
FIXED CHARGE COVERAGE	[S_{19}, S_{20}], [S_{21}, S_{22}, S_{23}, S_{24}]	S_{28}, S_{29}, [S_{30}, S_{31}], [S_{32}, S_{33}]
TOTAL DEBT ÷ TOTAL ASSETS	[S_{19}, S_{20}, S_{21}, S_{23}], [S_{22}, S_{24}], [S_{25}, S_{26}], S_{27}	S_{28}, S_{30}, [S_{29}, S_{32}], S_{31}, S_{33}, S_{35}, S_{34}, S_{36}
TOTAL DEBT ÷ NET WORTH	[S_{19}, S_{20}, S_{21}, S_{23}], [S_{22}, S_{24}], [S_{25}, S_{26}], S_{27}	S_{28}, S_{30}, [S_{29}, S_{32}], S_{31}, S_{33}, S_{35}, S_{34}, S_{36}
VARIANCE OF EPS	[S_{25}, S_{26}, S_{27}], [S_{19}, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}]	S_{36}, S_{34}, S_{35}, [S_{30}, S_{31}], [S_{29}, S_{32}, S_{33}], S_{28}
STANDARD DEVIATION EPS	[S_{25}, S_{26}, S_{27}], [S_{19}, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}]	S_{36}, S_{34}, S_{35}, [S_{30}, S_{31}], [S_{29}, S_{32}, S_{33}], S_{28}
MEAN OF EPS	[$_{19}$, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}], [S_{25}, S_{26}, S_{27}]	S_{28}, [S_{30}, S_{31}], [S_{29}, S_{32}, S_{33}], S_{35}, S_{34}, S_{36}

*Scenarios appearing in brackets have identical values within each category

for cases in which 100% of the debt used was of one type. If combinations of debt forms had been used, the variability of earnings per share might have taken on a different picture.

The effects of revaluing the bond principal account are apparent as those scenarios with the adjustment (S_4, S_6, S_{14}, S_{16}, S_{22}, S_{24}, S_{31}, S_{33}) rank behind those without the adjustment (S_3, S_5, S_{13}, S_{15}, S_{21}, S_{23}, S_{30}, S_{32}) in the variables of return on investment and both debt ratios. It should also be noted that indexation of principal disallows the traditional benefit of deferring payment in order to repay the loan with cheaper dollars. The principal is adjusted when repaid and, so, has the same value that it did when it was borrowed.

Those scenarios with no sinking fund (S_7, S_8, S_9, S_{16}, S_{17}, S_{18}, S_{25}, S_{26}, S_{27}, S_{34}, S_{35}, S_{36}) are consistently the least beneficial to the firm in all areas under any inflation assumption. These instruments require more annual interest which depresses net income and affects all areas of performance.

Non-indexed bonds (S_1, S_{10}, S_{19}, S_{28}) are continually ranked first or second under any inflation condition. There is no doubt that traditional debt best serves the corporation's needs in most circumstances. But, this alternative may not always be available. It is noteworthy, then, that scenarios using bonds with only the interest indexed (S_2, S_{11}, S_{20}, S_{29}) are also consistently ranked as most beneficial to the firm. In fact, during decreasing inflation, indexed interest bonds rank highest even above non-indexed bonds. So, in some cases, indexing can actually be better than traditional bonds.

Under constant inflation it is evident that indexing provides no benefit to the firm as most ratios are equal for scenarios with sinking

funds (S_{19}, S_{20}, S_{21}, S_{22}, S_{23}, S_{24}) and for those without a sinking fund (S_{25}, S_{26}, S_{27}). The indexation of principal is the only variable that causes any difference in measures and it does not benefit the firm, only the lender.

Short-term debt is always found in the bottom of the rankings. The high cash flows depress net income and, consequently, earnings per share. It entails the highest cash flow, highest risk and lowest profitability. Although, this does not mean that no short-term debt should be used, only that it should not be relied on exclusively given the assumptions of this model.

LIMITATIONS OF THE MODEL

The simulation model used was not intended to be all inclusive, but only to explore some of the impacts on performance related to indexed bonds. Only the extreme cases have been explored where 100% of the debt financing used by the firm was of one form. Naturally, a typical firm uses combinations of short-term and long-term debt which make up the firm's optimal debt structure.

Other variables could be altered also to examine indexation's impact under other circumstances. Here, sales growth has increased steadily by the same rate each year. In future studies, sales growth might be random and sometimes negative to get a more realistic picture. Profit margins, tax rates, and other variables could also be changed.

More scenarios should be done using random inflation situations. Using only one greatly limits the study of potential variability and volatility of indexed interest and/or principal payments and their impact on financial performance measures.

Some of the assumptions used also limit the impact of the study. For example, it was assumed that actual inflation was equal to expected inflation. In the real world this is obviously not true, or one would not need indexing. He would have perfect forecasting capabilities. Also, it was assumed that interest rates were made up only by a riskless rate and an inflation premium. Both the risk premium and maturity adjustment have been assumed away. Had they been included, the analysis might have changed.

The flat yield curve assumption during constant inflation influenced those scenarios considerably. Many ratios were equivalent among the scenarios primarily due to this assumption.

Despite the many limitations of the model, it does simulate the general trends associated with indexation in its purest form. It allows the identification of some basic effects that firms should consider when examining the alternative of including indexed bonds in their capital structure.

RECOMMENDATIONS FOR FURTHER RESEARCH

There are many areas of activity which indexed bonds can play a role and have some influence. Many studies have already been done regarding indexation's impact on aggregate variables such as capital formation, market interest rates, and the growth of inflation itself. There is still a variety of studies which could be done.

The impact of indexation on firm credit ratings and security valuation could be explored. The response of the price of the indexed security to market fluctuations and the demand for the indexed security could be studied.

Other variables besides the inflation rate and the type of debt used could be altered in a micro model such as the one used. Sales growth, profit margins, debt structure, and dividend payments are but a few of the variables which could change the analysis of indexation's impact on stockholders' wealth, price/earnings ratios, demand for firm's other securities (debt or equity) and many more areas.

The possibility for study is endless, but one thing is certain. If inflation continues to rise, there will be more and more demand for indexed securities. The majority of private loans are already indexed and it is just a matter of time before the public sector demands the same protection. In any event, the corporation needs to be aware of the costs and the benefits associated with the use of indexation.

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