REAL ESTATE PORTFOLIO DIVERSIFICATION

BY

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ABSTRACT

This thesis examines the potential benefits of diversification in real estate. By calculating a set of returns for apartment blocks in Vancouver, British Columbia, two issues of diversification are dealt with: the potential of diversifying within real estate, and the benefits of including real estate in mixed-asset portfolios.

To examine the potential of diversifying within real estate, the study looks at the relative proportions of systematic and unsystematic risk of real estate. Also, the paper investigates the rate at which variations of returns for randomly selected portfolios are reduced as a function of the number of properties in a portfolio.

To investigate the benefits of including real estate in mixed-asset portfolios, two types of efficient portfolios are constructed: one that hedges against inflation, and the other that is mean-variance efficient. By selecting these two types of efficient portfolios, the paper considers two major investment objectives of investors: (1) that their portfolio provides a return to combat inflation; (2) that their portfolio have minimum risk for a given expected rate of return.

The findings of the study show that portfolios consisting solely of real estate(of one property type in one local market) are not well diversified. The investigation found that only 29 percent of total risk is unsystematic(diversifiable). However, a large portion of the unsystematic risk can be diversified away

by holding a portfolio which contains only a few properties.

The findings also illustrate that real estate is a useful addition in mixed-asset portfolios. Real estate contributes to the effectiveness of both the inflation-hedged portfolio and the mean-variance efficient portfolio. In the inflation-hedged portfolio, real estate does not contribute as strongly as expected, but the results still demonstrate that real estate should be included in portfolios that are designed to hedge inflation. In the mean-variance efficient portfolio, real estate is found to have a low or negative correlation with other assets, making the potential to diversify very high.

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INTRODUCTION

1.0

The discussion of portfolio selection has occupied the pages of financial journals for over thirty years. The breadth of the discusssion has extended from the efficiency principles of Markowitz[40] and the simplifying model of Sharpe[55] to issues of portfolio size, strategy, and to the degree of diversification both in domestic and international markets. Nevertheless, research on portfolio selection has been limited to the investigation of only a few investment instruments, with the major emphasis on securities. Real estate as an investment has been ignored. Why? Researchers have been reluctant to assess real estate because information on returns is not readily available.

This paper extends the research of portfolio selection by considering real estate in investment portfolios. The paper examines real estate as an investment through a sample of apartment properties in Vancouver, British Columbia. With these properties, quarterly realized returns are generated over a 10-year period ending in 1979 for the purpose of conducting an empirical analysis. The analysis concentrates on two questions of relevance to investors: (1) Can investors diversify their portfolios solely within a real estate market? (2) Can the inclusion of real estate result in more efficient mixed-asset portfolios?

To answer the first question, the paper investigates the rate at which variations of returns, for randomly selected portfolios, are reduced as a function of the number of properties in a portfolio. We will test the hypothesis that investors can diversify their portfolios within a real estate market--i. e. that the risk of real estate for the most part is diversifiable risk and that investors can benefit from diversification. Previous research has shown that investors can diversify within investment markets. Using the stock market to test diversification, Evans and Archer[17], Latane and Young[36], Elton and Gruber[16], and Brealy[7] have found that the relationship between the number of securities included in a portfolio and the level of variation takes the form of a decreasing asymtotic function. In the only study using the real estate market, Miles and McCue[44] have come to similar conclusions. They considered the relationship between portfolio size and the return variation to follow the 1/n rule of McEnally and Boardman [43]. [1]

An hypothesis directed to question 2 postulates that the inclusion of real estate can improve the efficiency of investors' portfolios. Efficiency in this context includes portfolios that hedge against inflation as well as mean-variance efficient portfolios --i. e. those portfolios which offers the highest expected return for a given nominal variance, or which minimizes nominal variance for a given expected return. Support for this hypothesis stems from prior academic works. Results from Friedman[22] and Hoag[28] have illustrated that because a low or negative correlation exists between real estate and other investment assets, the inclusion of real estate improves the performance of mean-variance efficient portfolios. Fama and Schwert[19] and Hallegren[27] have concluded that real estate is a good hedge against inflation.

In approaching the investigation of the paper's two questions, we first review the literature associated with portfolio selection. In Chapter 2, works which reinforce the hypotheses or are relevant to the issues raised in this paper are discussed. Next, in Chapter 3 the data used in the study is described. The process of selecting the final property sample and the assumptions necessary to complete the information for the sample are dealt with here in some detail. After the description of the data, the methodology used to answer the two questions is presented in Chapter 4. Included in this section are the procedures used to measure the diversification capabilities within real estate and the techniques used to compute efficient portfolios. Chapter 5 introduces the valuation function needed to determine quarterly market values for the apartment properties. Since real estate does not have the continuous market transactions of most equities, a valuation model must be developed to estimate quarterly values for the properties. Empirical testing and analysis is discussed in Chapter 6; here also the validity of the hypotheses is assessed. Lastly, in Chapter 7 the paper reviews the implications of the findings with respect to real estate investors.

1.1 CONSTRAINTS OF THE STUDY

This paper like most studies examining real estate suffers from less than adequate information. Ideally, the data base should consist of a time-series of returns for the national real estate market; a market that includes properties of all types from across Canada. With such a data base, the potential for diversification within real estate could be fully tested, and an appropriate real estate return index constructed to compute efficient mixed-asset portfolios. However, since real estate lacks observable market transactions and related investment return information, i. e. cash flows from properties, reseachers investigating real estate have often either to narrow the scope of their analysis, or to place less weight on their findings.

This paper chooses to narrow the scope of the analysis. Although the sample used is as complete as possible, certain aspects of the data base impede a fully adequate analysis of the two questions. First, the sample is confined to one local real estate market. Obviously, having data for only one local market inhibits the investigation of geographical diversification, thus reducing the possiblity of creating an efficient portfolio of real estate properties. If, however, we find that diversification is obtainable even within a local market, we would have strong evidence in support of our first hypothesis.

Secondly, the sample was intended to contain commercial as well as apartment properties, thereby increasing the possibility for diversification. However, sufficient information to provide reliable rates of return for the commercial properties was not available, and so these properties were dropped from the study.

Thirdly, the data base is also constrained by the number of assumptions and estimating procedures needed to complete it. Because real estate properties are traded infrequently, quarterly prices must be estimated by means of a fundamental valuation function. This function is critical to the results of the paper since the capital gain(loss) on the properties is the major factor determining the rate of return. In addition, estimations are necessary for cash flows and debt. Thus all factors contributing to the return of the properties are in some way estimated.

As a result of these constraints, the paper will test a limited version of its hypothesis that investors can diversify solely within a real estate portfolio. The problems stated above have forestalled an investigation of geographic and property-type diversification, two of the ways in which investors spread their risk within real estate. As a result, the hypothesis should be restated that investors can diversify their portfolios within a local real estate market. If there is either geographic diversification within the city or the existence of high property specific risk, then this hypothesis will be accepted.

The problems mentioned above do not affect to any serious degree the analysis of question two. The issue as to whether real estate can improve the efficiency of investors' portfolios deals with the covariance of real estate returns to the returns of other investment assets. The returns generated from the study of apartment blocks in Vancouver should reflect the movement of the national real estate market, if we agree with Sharpe's argument that stocks, or in this case properties, move together because of macroeconomic events. [2] The variance of these apartment returns may be greater than they would be elsewhere since the Vancouver real estate market is considered quite volatile, but the pattern still reflects the action of the national real estate market. As a result, the measure of covariance between real estate and the the other investment assets should be reasonable.

1.2 IMPORTANCE OF STUDY

Even though data problems affect the analysis, the paper provides valuable information to researchers and to investors. First, in view of the dearth of empirical studies involving real estate returns, this paper provides much-needed evidence on the performance of real estate. Second, the study can be of value to individual or small corporate investors on the subject of how to structure their portfolios more effectively. In real estate, it is not uncommon to find limited capital investors restricting their portfolios to one local market or even to one property type. These investors confine their portfolios to a limited number of holdings due to high transaction costs, and because real estate is a lumpy and indivisible asset, making it difficult for them to own just a small percentage of the asset. The results of the study will indicate to these small capital investors whether they can diversify while holding a narrow portfolio based on a local market, or whether they should consider the cost/benefits of further diversifying their portfolios into other real estate markets or into a mixed asset portfolio. Third, the study gives all investors, large or small, information on how real estate covaries with other investment assets.

Because the study is intended for use by members of the lay public, we will frequently explain some terms at length and reiterat aspects of investment procedures for the purposes of additional clarity and understanding.

FOOTNOTES

1. The 1/n rule of McEnally and Boardman is expressed in equation form as:

$$V_p = V_s + 1/n(V_u)$$

where Vp is the expected average variance of a portfolio, Vs is systematic risk and Vu is unsystematic risk.

2. Sharpe, William F., "A Simplified Model for Portfolio Analysis", Management Science, Vol.9, January 1963, pp. 277-293

2.0 LITERATURE REVIEW

This chapter reviews a selection of academic studies concerning portfolio theory and diversification, beginning with a discussion of the efficiency principles of Markowitz and the basic models of portfolio theory as developed by Markowitz and Sharpe. The chapter then presents a number of empirical studies which use securities to examine the question of diversification. Although the articles that are examined consider the question of diversification in the context of the stock market, they have been included because of their relevance to the analysis of the paper. The final section deals with work that has been done on portfolio theory and diversification within the context of real estate. In addition, the theory underlying the valuation models used in the paper is reviewed.

2.1 THE EFFICIENT PRINCIPLES AND THE BASIC MODELS OF PORTFOLIO THEORY

Harry Markowitz proposed the efficiency principles of portfolio theory over thirty years ago.[1] In 1952, he introduced the efficiency principles as part of a new hypothesis on investment behavior. The new hypothesis stated that "the investor does(or should) consider expected return a desirable thing and variance of return an undesirable thing."[2] Before Markowitz proposed this hypothesis, theories and models interpreted investment behavior as that behavior of an investor to maximize the discounted value of future returns.

In his initial article on portfolio selection Markowitz considered the hypothesis of maximizing the discounted value of future returns, but rejected it:

> If we ignore market imperfections the foregoing rule never implies that there is a diversified portfolio which is preferrable to all non-diversified portfolios. Diversification is both observed and sensible; a rule of behavior which does not imply the superiority of diversification must be rejected as both a hypothesis and as a maxim.[3]

In place of the maximum return hypothesis, Markowitz presented what he termed as his mean-variance rule. The hypothesis stated that an investor does(or should) select portfolios that have a maximum expected return for a given variance of return or that an investor does(or should) select portfolios that have a minimum variance for a given expected return.[4] Portfolios that fit the description elaborated by his hypothesis, Markowitz called efficient; such portfolios make up the efficient frontier. Investors would choose from among this set of efficient portfolios according to their utility preference.

In his article, Markowitz did not illustrate the techniques necessary to calculate the set of efficient portfolios, but he described the components which made up the model: the measurements of expected return and variance(risk) of a portfolio. The measurement of the expected return of a portfolio is fairly straightforward and is calculated as follows:

$$E = \sum_{i=1}^{N} X_i \mu_i$$

where X_i is the percentage of the investor's assets allocated to the ith security, and μ_i is the expected value of the ith security. The measurement of the variance of a portfolio is more complex as it includes the variance of the individual assets as well as the covariance between the assets. The calculation of the variance of a portfolio is as follows:

$$V = \sum_{i=1}^{N} \sum_{j=1}^{N} X_i X_j \sigma_{ij}$$

where X_i, X_j are the percentage of the investor's assets allocated to the ith and jth security and σ_{ij} is the covariance between asset i and j. It is the covariance between the assets which enables investors to diversify their portfolios. If investors select assets in their portfolio which have a low or negative covariance, then the overall variance of the portfolio is reduced. Markowitz's mean-variance rule differed from previous hypotheses in that it considered the interrelationship of returns.

Markowitz's findings and investment model alter the concept of portfolio theory. However investors and researchers soon realized that the model was not practical; it needed too much information to be useful. The next step in portfolio analysis had to be the development of a more simplified model.

William Sharpe provided this simplified model in 1963.[5] In considering his model, referred to as the Diagonal Model, Sharpe had two objectives: to make it practical so that investors could perform portfolio analysis at a very small cost, and to construct a model that would not assume away the existence of the interrelationship among securities.

Sharpe achieved his objectives by proposing a model that allowed for two important assumptions. The first of these considered the returns of various securities to be related only through a common relationship with some basic underlying factor. Sharpe incorporated this assumption directly in his model:

$$R_i = A_i + \beta_i I + C_i$$

where:

R_i is the return on the ith security;

A_i and β_i are parameters;

C_i is a random variable with an expected value of zero; and

I is the level of some index for the underlying factor.

The second assumption that Sharpe made, which must hold true for the first assumption to be true, is that the covariance between the random variables of any two securities is zero. With these two assumptions, the return for any security is determined by the relationship of the security to the underlying factor and by random factors.

Through his model, Sharpe decomposed the risk of a portfolio into systematic(non-diversifiable) and unsystematic(diversifiable) risk. Systematic risk is associated with the underlying factor and affects all securities; unsystematic risk relates to the individual securities, and is represented by the random factors in the model. The unsystematic risk can and should be diversified away.

2.2 EMPIRICAL RESEARCH IN THE STOCK MARKET

The initial question of this paper asks whether investors can diversify solely within a real estate market. To answer this question, we examine the relationship between the risk of a portfolio and the number of properties it contains. Most of the literature investigating the effect of portfolio size and the reduction of return variation has focused on securities. Empirical studies by Evans and Archer[17], Latane and Young[36], Elton and Gruber[16], and Brealy [7] have examined exhaustively the effect of portfolio size on the reduction of return variation with respect to securities. Since all of these studies have reached similar conclusions, we will only discuss one of the articles here: the article examined is the Evans and Archer paper.

Evans and Archer argue that if portfolio size has an effect on the reduction of return variation, the result must be a function of the reduction of the unsystematic portion of the total variance. They also argue that as the number of securities in a portfolio approaches the number of securities in the market, the variation of the portfolio return will approach the level of systematic variation, suggesting a relationship that behaves as a decreasing asymptotic function.[6]

To prove their point, they constructed randomly selected portfolios of sizes 2 to 40. The portfolios were then regressed by the equation: $Y = A + B(1/X)$
where Y is the computed mean portfolio standard deviation(the measure of risk), and X is the portfolio size. The results of the regression analysis were quite positive: the coefficient of determination(another term for R^2) for the equation was .9863. When the average standard deviation of return was plotted against the number of securities in the portfolio, the plotted graph formed a decreasing asymptotic function.

Evans and Archer then conducted one more experiment. This one involved t-tests on successive mean portfolio standard deviations to determine at what point significant reduction of variation(at the .05 level) took place. The results of the test indicated that the addition of one security to a portfolio of size 2 caused significant reduction in the mean portfolio standard deviation. For portfolio of size 8, the necessary increase was 5 securities; for a portfolio of size 16, the necessary increase was 19 securities. Evans and Archer concluded that there was probably little economic justification for increasing portfolio size beyond 10 or so securities, and suggested that investors include some form of marginal analysis in their portfolio selection models.

Moving from the investigation of diversification, we now review studies that examine efficient portfolios. The paper uses two definitions for efficiency: Markowitz's mean-variance definition and inflation-hedged portfolios.

To illustrate the potential advantages of diversification under the definition of mean-variance efficiency, Robichek, Cohn and Pringler[50] presented a study on returns of alternative investment instruments. The paper computed _ex post_ rates of return and correlation coefficients for twelve alternative investment media for the period 1949-1969. The authors' aim was to identify the degree to which investment alternatives, other than common stock and riskless one-period bonds, influenced the construction of efficient portfolios.

The investment media included common stocks from the United States, Canada and Japan; U.S. government and corporate bonds; real estate; and commodity futures. The data used to compute returns on real estate was the U.S. Department of Agriculture index of value per acre of farm real estate. Though farm land returns are a dubious indicator of the returns on real estate, the authors were not able to discover a better one.

The paper found that the correlation coefficients among the various assets were generally low, and that the signs of the coefficients were almost equally divided between positive and negative. Of the 66 correlation coefficients between all pairs of assets, only 4 indicated positive correlation significant at the .05 level. For real estate, all the correlations with the other assets were negative except for the positive correlation with U.S. Treasury Bills and with Japanese stocks, which was significant. The implication of the findings is that diversification among the twelve investment media leads to improved portfolio efficiency in the mean-variance context.

To demonstrate which assets are effective hedges against inflation and therefore useful in a inflation-hedged portfolio, we review a paper written by Fama and Schwert[19], "Asset Returns and Inflation". Fama and Schwert developed a model to test the effectiveness of such assets based on the work of Irving Fisher, [7] who had hypothesized that the nominal interest rate can be expressed as the sum of an expected real return and an expected inflation rate. From Fisher's proposition, Fama and Schwert designed their model so that the expected nominal return on an asset from t-1 to t is the sum of the expected real return and the best possible assessment of the expected and unexpected inflation rate from t-1 to t. Fama and Schwert's model, which they tested by regression analysis, appeared as:

$$R_{jt} = a + \beta_j E(\tilde{\Delta}_t/\Phi_{t-1}) + \delta_j[\Delta_t - E(\tilde{\Delta}_t/\Phi_{t-1})] + N_{jt}$$

where:

R_{jt} is the nominal return on asset j from t-1 to t;

$E(\tilde{\Delta}_t/\Phi_{t-1})$ is the best possible assessment of the expected value of the inflation rate Δ_t, that can be made on the basis of the set of information Φ_{t-1} available at t-1;

$[\Delta_t - E(\tilde{\Delta}_t/\Phi_{t-1})]$ is unanticipated inflation(inflation at time t minus expected inflation made on the base of Φ_{t-1};

N_{jt} is the random term for asset j at time t;

β_j and δ_j are the linear coefficients to be estimated; and the tildes denote random variables.

If β_j=1.0, in the model, the asset is a complete hedge against expected inflation, and the expected real return on the asset is uncorrelated with expected inflation. If δ_j=1.0, the asset is a complete hedge against unexpected inflation and when $\beta_j=\delta_j=1.0$ then the asset is a complete hedge against both aspects of inflation.

The regression model was tested using a number of assets:

(1) T-Bills with one-to six-month maturity

(2) common stocks from the New York Stock Exchange

(3) U.S. government bonds

(4) human capital (the rate of change of labor income per capita)

(5) privately held residential real estate(the rate of inflation of the Home Purchase Price component of the CPI).

Fama and Schwert first analyzed how well the selection of assets hedged against expected inflation during three time horizons: monthly, quarterly, and semi-annually. The estimates of Bj(the coefficient for the expected inflation), were close to one for treasury bills, government bonds and real estate for all three periods. Human capital was positively related to the monthly and quarterly expected inflation rate but was negatively related to the semiannual expected inflation rate. Common stock returns showed a negative relationship for all time horizons, with the coefficient increasing in magnitude with time.

The results from the test of unexpected inflation showed only real estate to be a complete hedge against unexpected inflation for all time horizons. The coefficient for human capital was moderately positive with monthly unexpected inflation, but turned negative for quarterly and semiannual unexpected inflation. Government bonds and common stock had increasingly negative coefficients as the time horizon increased.

The study of Fama and Schwert implies that real estate is the only asset which acts as a complete hedge against both expected and unexpected inflation. Real estate returns move in high correspondence with both components of the inflation rate. If their findings hold up, then real estate should prove a hedge against inflation and contribute to the inflation-hedged portfolio developed in this study.

In Fama and Schwert's study, the regression equation that included real estate had an R^2 of roughly 60 percent, implying that the inflation adjusted return of real estate is not certain and that real estate has a considerable amount of real return variation.[8]

2.3 PORTFOLIO ANALYSIS WITH REAL ESTATE

The examination of portfolio selection did not extend to real estate until 1970, when Harris Friedman applied portfolio theory to equity investment in real estate.[9] Friedman's initial work investigated the concept of selecting real estate portfolios, through the application of mathematical models used to select and evaluate common stock portfolios. In addition, he evaluated the relationship of real estate to common stock by comparing real estate portfolios to common stock portfolios and by constructing a portfolio containing both real estate and common stock. To build the individual real estate and common stock portfolios in the study, Friedman employed Sharpe's diagonal model;[10] when he combined the two investment assets into one portfolio, he used the Cohen-Pogue multi-index model.[11]

In writing this first paper, Friedman initiated the procedures to resolve data problems associated with real estate returns. To construct his real estate portfolios, he needed the holding period returns for each property in the portfolio. Using five one-year holding periods for the study, he had information on the yearly cash flow from the properties, but knew the market values for only the beginning and ending years of the study. Friedman estimated the intermediate values by assuming that the properties appreciated at the compound growth rate. Thus, Friedman understated the riskiness of real estate, and provided real estate with an added advantage in its comparison to common stock.

Friedman encountered another difficulty when he tried to select an appropriate index to use in Sharpe's diagonal model for his real estate portfolios. He employed an average of the Boeckh construction cost indexes for hotels, residences, apartments, commercial properties, and factories with the American Appraisal Index.[12] This "hodgepodge" of an index would be expected to have a low association with the returns of the properties in the sample; hence most real estate risk would appear to be diversifiable.[13] Again the risk associated with real estate was understated, making real estate appear undeservedly attractive.

The last major difficulty Friedman faced was the choice of a super-index to use in the Cohen-Pogue model when combining real estate and common stock into one portfolio. Friedman used the GNP index - an index really not adequate to explain the variation of returns for real estate and common stock.[14]

Despite its problems, Friedman's paper presented some notable findings. First, both on a before-and after-tax basis, efficient real estate portfolios dominated common stock portfolios except in the range of unusually 4 high returns. Friedman qualified this finding by pointing out that the sample used in the study was not representative of the universe of real estate assets. Second, taxes had more impact on common stock returns than they did on real estate. The reason for this was that tax shelter benefits of real estate help lessen the effect of taxes on the returns of real estate as compared to common stock. Third, real estate appeared as the dominant asset in the mixed asset portfolio, especially on an after-tax basis. Lastly, the covariance between real estate and common stock was negative, which greatly reduced the total mixed asset portfolio risk.

In conclusion, Friedman stated that models developed to select common stock portfolios can be adapted to the selection of real estate portfolios, and that real estate dominates common stock as an investment asset.

A more recent paper by Hoag[28] attempted to correct some of the problems that Friedman encountered. Hoag's objective was not to improve on Friedman's work, but to provide information on risk and return of real estate investments in order that current investment management technology could be applied to real estate. Hoag tried to accomplish this objective by constructing an index of real estate value and return for non owner- occupied industrial property.

The importance of the Hoag paper to this study is in the method he uses to determine property value. Because capital gain(loss) is the major factor for the return on real estate, the valuation model plays a critical role on the estimate of the return on real estate. Hoag employed a property valuation function based on fundamental characteristics of the properties: property type, size, age, economic and demographic factors, cash flows and transaction prices. Hoag argued that this valuation model was equivalent to income capitalization appraisal, except that as appraisal is subjective the valuation model makes an objective judgement. Hoag further argued that this type of fundamental analysis is accomplished by security analysts in the stock market where macroeconomic variables and firm-specific data are used to assess a firm's value.[15]

Hoag estimated his valuation function by using actual transaction prices from the sample of industrial properties. In his model, a value for each nontransacting property, at any given time, is estimated from the valuation function applied to the fundamental characteristics at that time. The macroeconomic characteristics of the model try to capture the supply and demand functions of the industrial property market through time, while the microeconomic and physical characteristics of the properties describe the building, surroundings and location. Hoag considered the results of the model to be quite reasonable, with an adjusted R^2=.89. However, the standard error was unacceptably high, being $352, 000 or 30 percent of the mean sales price.

From the valuation function, Hoag calculated the individual properties rate of returns and the overall market rate of return.This overall market rate of return represented his return index for real estate. The return on the index was high(.0338/quarter) as was the the risk(a standard deviation of .0861/quarter). Hoag concluded that the two measures were comparable to those obtainable on stocks and bonds. When Hoag calculated the cross correlation of real estate to other assets and inflation, the results illustrated that real estate could help investors diversify their portfolios and in addition allow them to use real estate as a hedge against inflation. These results support the hypothesis of question two in this paper that real estate can improve the efficiency of investors' portfolios.

In his implementation of a fundamental valuation function Hoag did not fully detail the theory underlying his model. Hoag argued that since stock analysts use fundamental techniques to value stocks, it would be reasonable to develop a fundamental valuation function for real estate. Since a valuation function plays a major role in this paper in determining the rate of return on the sample of properties, reference to two papers which discuss the theory behind fundamental valuation functions is in order. Both papers consider the valuation of properties from the point of view an appraiser.

"The Valuation of Multiple Family Dwellings by Statistical Inference, " by William Shenkel[59] is the foundation for the valuation model developed for this paper. Shenkel initiated his paper with the proposition that income properties are bought and sold on the basis of anticpated net income.

However, he argued that, in practice, appraisers deviate from the proposition that value is determined by net income since it is difficult to estimate net income. Instead they often use gross income as a proxy for net income, and thus assume a relationship between gross income and value. This relationship is illustrated by the gross income multiplier: V = f(GIM).

To find the gross income for a property, appraisers often calculate the average or median GIM from a sample of recently sold properties. Shenkel contended that the statistical technique of simple regression can serve as a substitute for the standard GIM and that regression can be a more precise tool in estimating value: " The regression derived multiplier is produced with statistical measures of reliability and an estimate of the expected error."[16] Shenkel admitted that the error from simple regression is often too great to determine value; he argued rather that to value property accurately, reliance must be placed on multiple regression.

In advocating multiple regression, he presented a second proposition which stated that if it could be shown that net income and, therefore, value were related to a set of common property characteristics, then property characteristics could predict value. Shenkel wanted to demonstrate that market value could be estimated directly from value-significant property characteristics, and that appraisers could dispense with the capitalization process.[17]

Shenkel, to confirm his proposition, ran a stepwise multiple regression analysis on a sample of 47 apartment houses over a five-year period. The sample of apartment houses were located in a single metropolitan area. He selected 69 property characteristics through which to explain value. These characteristics could be associated with three groups: those associated with area or size; those associated with locational attributes; and those covering amenities and services of a given apartment house. In Shenkel's initial run, the coefficient of determination was .9719 with 20 significant variables. The average predictive error was 6.85 percent. Shenkel reran the regression analysis eliminating gross income as a variable. The results from this run were very similar (a coefficient of determination of .9776 and a predictive error of 7.20 percent). Shenkel suggested from this second model, that reasonable accuracy might be obtained without reference to gross income, net income, capitalization rates or the usual capitalization procedures. He further pointed out that the model could have been even more accurate if the time period had been shorter: "Ideally, sales should be confined to the shortest possible time period...the shorter the time interval the less the influence of time on the sales price." He suggested a one year time frame.

From the results of the test, Shenkel confirmed that market value could be determined by a set of property characteristics. He also declared that multiple regression analysis is more objective than conventional capitalization, that multiple regession deals directly with those factors important to net income and to value.

A second article that provides a theoretical argument for using statistical regression models is Albert Church's, " An Econometric Model for Appraisers".[18] Church opened the discussion of his model by deriving the structural supply and demand function for individual properties. The quantity demanded is a function of price, P, and a set of characteristics, X, that possess value to the buyer:

$Qd_i = f\ (P_i,\ X_i)$ i=1...n the number of properties

The quantity supplied is a function of price, P, and a set of characteristics, Y, that are valued by the seller:

$$Qs_i = g\ (P_i,\ Y_i)$$

After having derived the supply and demand function, Church presented the methodology for determining market value. He considered the supply and demand function to be discontinuous, since a property is either sold or not sold and since the price may not be uniquely determined by the supply and demand function. He says there is a range of coincidence between the supply and demand functions where the buyer and seller bargain on price. Because of the coincidence of the supply and demand functions when a property is sold, the model can only determine the expected value of the selling price $[E(P_i,X_i,Y_i)]$,given a set of characteristics for the buyer and seller. The actual price for the property is a function of the expected selling price and a random variable, N_i. The random variable denotes the bargaining range of the buyer and seller. The "most probable selling price" for a property not sold can be inferred from a property which is sold during the time interval and which possesses identical characteristics and identical supply and demand functions. Therefore Church assumed that sales data could be used to determine the expected or probable sales price for all properties classified by type of characteristic.

From this assumption that the supply and demand function holds for all properties, Church simplified the model. The new equation reduced to its simplest form is:

$$P_i = e(X_i, Y_i, N_i)$$

where price equals the function, e ,which contains the characteristics important to the buyer and seller and the random variable. It is this function, e ,which should be employed in regression analysis. In the regression analysis the value of Ni is assumed to be equal to zero.

Church concluded his article by pointing out a number of problems that arise when applying the model in regression analysis. The first problem is that linear least-squares regression requires the specified equation to be linear in coefficient. To accomplish this the function, e ,is linearized for m observable characteristics:

$$P_i = a_o + A_1 Z_{i1} + A_j Z_{ij} + \ldots + A_m Z_{im} + A_{m+1} + N_i$$

i=1,...n for properties
j=1,...m for the characteristics
a_o = is a constant

where:

A_j is the linear coefficient to be estimated from data on property sales;

Z_{ij} is the specific characteristics or combination of characteristics for properties(derived from the X_i, Y_i); and

N_i is the random term.

The second problem is the selection of characteristics derived from X_i, Y_i to be included in the equation. Church reasoned that attributes which varied from property to property and which explained sales price differences should be included. Characteristics which were similar between properties need not be included. He categorized the variables that should be in the equation: physical, locational, market, and prior knowledge. The last problem Church mentioned is the interaction effect of the characteristics. Interaction occurs when a joint occurrence of two or more variables(characteristics) produces an effect which is different from the individual occurrences of two separate events. For example a den adds X dollars to a house and a fireplace adds Y dollars; together their worth is greater than or less than X and Y.

A final article, which has been of great benefit to this work, is an empirical study of question one: Can an investor diversify within a real estate market? Only one study has examined diversification with regard to real estate portfolios; it was performed in 1980 by Miles and McCue[44].

Miles and McCue conducted their study on a large commingled real estate fund with over 300 properties, dispersed across the United States and containing five different property types. The majority of properties were office buildings, and industrial properties. The objective of the study was to test real estate portfolios against the 1/n rule of McEnally and Boardman, where the expected average variance of the portfolio equals the systematic risk plus 1/n unsystematic risk:

$$V_p = V_s + 1/n(V_u)$$

Miles and McCue began their study by calculating quarterly returns on the sample of properties over a five-year period. Just as we have done in the present study, the authors had to estimate value. To do this, Miles and McCue accepted the annual appraised value of the properties as market value.[19] To determine the quarterly value of the properties, they selected two methods: the first geometrically smoothed the changes in value over the intermediate quarters; the second assumed that price did not change from quarter to quarter, but only on an annual basis. Since the authors utilized two methods to estimate value, they needed two return measures(both were on a before tax basis). Summaries of the returns and variances for the sample are shown in Tables 2.1 and 2.2.[20]

The results from Table 2.2 show that portfolio size does have an effect on the reduction of return variation. These results are consistent for each property type. When Miles and McCue divided the sample into four geographic regions, the results were still the same. Return variation decreased substantially with portfolio size.

Miles and McCue conducted one more experiment. They compared the average total variance to the market related variance. Table 2.3 presents the results. Except in one case(unsmoothed returns in the West),the ratio of market related variance to average total variance is below 15 percent. Thus the non-market risk of real estate is quite high, demonstrating that potential gains from diversification in real estate are quite large. It is of particular interest to this study that Miles and McCue repeated this experiment for one property type, over each of the regions. The highest ratio of market variance to average total variance in any region was 16 percent. This result suggests that the present study,though restricted in its final analysis to one property type in one local market, can still show the possibility of diversification.

TABLE 2.1

SUMMARY STATISTICS FOR PROPERTIES WITH 20 QUARTERS OF DATA

- BREAKDOWN BY TYPE -

	Total Sample	Industrial	Office	Other
N	166	118	29	19
Unsmoothed Returns	.0386	.0393	.0402	.0319
Smoothed Returns	.0364	.0370	.0382	.0303
Variance Unsmoothed Returns	.0048	.0048	.0067	.0021
Varaince Smoothed Returns	.0013	.0012	.0023	.0011
Mean Beta	1.0	.973	1.138	.938

- BREAKDOWN BY Region -

	Total Sample	East	Midwest	South	West
	166	13	78	42	33
Unsmoothed Returns	.0386	.0449	.0340	.0335	.0535
Smoothed Returns	.0364	.0422	.0326	.0321	.0488
Variance Unsmoother Returns	.0048	.0063	.0034	.0034	.0092
Variance Smoothed Returns	.0013	.0032	.0010	.0013	.0016
Mean Beta	1.0	1.713	.9183	.6176	1.399

Source: Miles and McCue[44]

TABLE 2.2

DESCRIPTION OF PORTFOLIO SIZE AND REDUCTION IN RETURN VARIANCE BY PROPERTY TYPE

(MEAN OF VARIANCE x 10)

	- Smoothed Returns -	- Unsmoothed Returns -
	Total Sample	Total Sample
All Properties Individually	12.739	48.670
Random Portfolios of Properties:		
2 Properties	8.647	23.359
4 Properties	3.942	15.433
6 Properties	2.713	12.084
8 Properties	1.900	10.529
10 Properties	1.999	7.985
12 Properties	1.659	7.690
14 Properties	1.432	7.051
16 Properties	1.332	6.400
18 Properties	1.297	6.398
20 Properties	1.182	6.815
30 Properties	1.042	5.771
All Properties	.627	4.177

Source: Miles and McCue[44]

TABLE 2.3

NON-DIVERSIFIABLE RETURN AS A PROPORTION OF TOTAL RISK

By Type

Smoothed Returns

	Total	Industrial	Office	Other
Vp1	12.739	11.098	21.596	10.953
Vpall	.627	.674	2.571	1.194
Ratio	.049	.061	.119	.109

Unsmoothed Returns

	Total	Industrial	Office	Other
Vp1	48.760	49.211	63.594	22.532
Vpall	4.166	5.945	6.708	2.171
Ratio	.086	.121	.105	.096

By Region

Smoothed Returns

	Total Sample	East	Midwest	South	West
Vp1	12.739	31.849	9.096	12.193	14.516
Vpall	.627	3.494	.764	.677	1.815
Ratio	.049	.110	.084	.056	.125

Unsmoothed Returns

	Total Sample	East	Midwest	South	West
Vp1	48.670	64.209	35.015	33.921	93.593
Vpall	4.177	9.223	8.057	2.312	25.419
Ratio	.086	.144	.230	.068	.271

Source: Miles and McCue[44]

ENDNOTES

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20. The unsmooth returns and variations assume no price change during a year. The smooth returns are geometrically compounded on a quarterly basis.The total sample is 166 properties,since the authors only had complete data on these properties for the five year study.

3.0 DATA BASE

The previous chapter explained, in some detail, the literature which has provided a platform for this work. This chapter explains the data base utilized in the paper. The data consist of a set of apartment properties located in Vancouver, British Columbia, and a set of returns from a number of other investment instruments which are required to answer question two of the paper. In order to discuss the data base, the chapter divides into three sections. The first presents an overview of the apartment market in Vancouver, so as to familiarize the reader with this market and to help him better understand the results of the paper. Section 3.2 describes the sample of apartment properties and their characteristics along with the assumptions and estimating procedures necessary to complete the information on the properties. The chapter concludes with a presentation of the other investment instruments, and explains the methods used for calculating the rates of returns for this group of assets.

3.1 THE APARTMENT MARKET IN VANCOUVER

The apartment market in Vancouver primarily developed over a ten-year span from 1961-1971. During this period, the total number of apartment units in Vancouver almost tripled, the major concentration of growth occurring in the high density zoned area of the West End.[1] The increase was stimulated by a strong demand for rental units, the result of the coming of age of the post-war baby boom generation. The members of this generation were young, and with a good economic climate were able to form new households. The types of housing they sought were rental apartments.

After this ten-year period of expansion, construction of new apartment units slowed considerably. The supply of rental units even slipped slightly over the next nine years, 1971-1979(see Table 3.1). The factors for this turn-around can be associated with the considerable change in conditions on the supply side of the market. The supply side had started to encounter constraints unfamilar to the industry, constraints that began to appear in 1970 when mortgage rates reached double digits. Developers, believing that the high cost of capital was short term, decided to wait on the sidelines until rates decreased. However, when mortgage rates did not recede, these developers looked for other investment opportunities in real estate. They switched to the condominium market, an attractive investment since the pay-back period for condominiums was short(until the condominuium units were sold off), while the pay-back period for rental apartments extended over a much longer period of time. In Vancouver, condominiums starts represented 90 percent of all multi-unit starts in the seventies.[2]

Another constraint that affected supply was the change in

TABLE 3.1

VANCOUVER APARTMENT DATA

CITY OF VANCOUVER

YEAR	BUILDINGS	SUITES	VACANCY RATES
1971	2,135	51,128	2.1
1972	-	-	-
1973	1,983	49,930	0.2
1974	-	-	-
1975	1,969	48,899	0.1
1976	-	-	-
1977	1,973	49,077	1.0
1978	-	-	-
1979	1,955	50,982	0.2

Note: Data limited to privately-owned rental units in apartment buildings containing six or more units

Source: Canada Mortgage and Housing Corporation the federal tax laws. Effective January 1, 1972 a loss created by capital cost allowance on the rental of real property could no longer be applied to non-rental income. In addition, the revised law discontinued the pooling of real estate assets, so that a different pool had to be created for each building over $50,000. The effect of these tax law changes to investors who were looking for tax shelter benefits was to discourage them from investing in the apartment market.

The final constraint impeding new construction was the combined effect of high inflation and rent controls imposed by the provincial government. High inflation was a new phenomenon in the seventies, and forced the cost of construction to soar as land, labor and material costs all rose. To recover the higher costs, developers began to charge higher rents. But as the rents began to rise, renters cried out to the government to stop the higher cost of living. So, in 1974, the Province of British Columbia established controls over rent increases for existing apartment buildings. The following limits were in effect during the time period of the study:

January 1, 1974 - December 31, 1974	8.0 percent/year
January 1, 1975 - April 30, 1977	10.6 percent/year
May 1, 1977 - June 30, 1980	7.0 percent/year

The rent controls imposed on existing buildings kept prevailing market rents low, making it difficult for new apartment buildings to compete. The rents that developers could receive on new apartment buildings were too low for them to recover their costs, with the result that developers refrained from participating in the market.

The Canadian Government tried to step in to stimulate construction activity in the multi-family housing market. The same supply constraints that were affecting the construction activity in Vancouver were affecting cities throughout Canada. The Federal Government decided to initiate two supply-side programs: one was started in 1974 and the other in 1976. In 1974, the government developed the MURB Program, a program that tried to return private capital to the apartment market by once again permitting capital cost allowance to be applied to non-rental income for all new construction after January 1, 1974. The program the government initiated in 1976 was the ARP(Assisted Rental Program). This program encouraged developers to construct moderately priced rental housing by giving them interest-free loans for 10-15 years with a maximum limit on the loans. Unfortunately, as seen in Table 3.1, Vancouver did not have an increase in rental units, suggesting that neither of the two programs fully achieved the expectations of the government.

3.2 APARTMENT BLOCK SAMPLE

In statistical terms, the universe which this sample is drawn from is all the apartment blocks located in the city of Vancouver and built before 1970(the starting time of the study). From this universe, those apartment blocks sold during 1979 and

1980 were selected as the sampling base. The decision to sample apartment blocks that were sold during 1979 and 1980 was due to the availability of information(provided by the British Columbia Assessment Authority). Also, the two years of sales, 1979 and 1980, coincided with the time period which the data were collected. The number of apartment blocks sold during the two year period totaled 347.

The sample base of 347 properties was reduced in size by eliminating apartment blocks which lacked sufficient information for the study. The study required sales transactions and income, debt and physical characteristcs of the properties. In the elimination process 87 properties were dropped from the sample base, to produce a final sample consisting of 260 apartment blocks. Of the 87 properties eliminated, 58 were thrown out for lack of income information,17 were dropped due to the unavailability of either debt or transaction information,and 12 were discarded because of missing physical characteristics. General statistics for the final sample appear in Table 3.2.

Even though the final sample contained apartment blocks with all the required information, certain assumptions and estimating procedures still had to be carried out to calculate quarterly returns. Assumptions and estimates were required on the income, operating expenses, debt,and quarterly market values for the properties.

All of the 260 apartment blocks in the final sample had some income information, but very few had income figures for all

TABLE 3.2

SUMMARY STATISTICSS FOR THE APARTMENT BLOCK SAMPLE

CHARACTERISTICS	MEAN	STANDARD DEVIATION
Number of Suites	19.71	15.08
Gross Floor Area(square feet)	13,542.78	9978.77
Average Suite Size(square feet)	715.72	219.58
Age(as of 1983)	37.19	21.02
Number of Stories	3.10	1.89
Lot Size(square feet)	8,547.08	4061.50
Number of Properties/Area		
West End	73	
Kitsilano	29	
Kerrisdale	4	
Marpole	23	
South Granville	43	
East Hastings	75	
Rest of the City	13	

ten years of the study.[3] Estimating procedures were therefore necessary to fill in the years when information on income was missing on the properties. The primary method for estimation was interpolation. If a property had no more than three consecutive years of missing income, then the compound growth rate was applied over the intermediate period. For almost all the properties, this procedure was employed over some portion of the ten-year period. In cases where the spread between income years was greater than three years, extrapolation was utilized. Two methods were used in extrapolating income, depending on the time period. The first method, applied to the time period 1970-1973, extrapolated by means of a yearly growth rate model, based on the average rent for a given area of the city. The city was divided into seven areas; from each area the average rents for studio, one bedroom and two bedrooms suites was found.[4][5] The average rent for the three different types of suites was then weighted by the proportion of that suite type to the total number of suites in the area to derive an overall average rent for each area. Table 3.3 presents the growth rates for the various areas.

The second method of extrapolation, applied during the time period 1974-1979, used the maximum allowable rent increases permitted under the rent controls of British Columbia(see Section 3.1). Since the rental market was extremely tight at the time, we assume that landlords would have increased rents by the maximum amount granted by law. Our assumption seemed

TABLE 3.3

AN AVERAGE RENT INDEX FOR VANCOUVER BY AREA

YEAR	WEST END	KITSILANO	KERRISDALE
1970	100.00	100.00	100.00
1971	109.74	100.00	103.89
1972	112.16	101.50	111.12
1973	119.35	113.04	120.65
1974	125.65	122.56	127.99

YEAR	SOUTH GRANVILLE	EAST HASTINGS	MARPOLE	REST OF THE CITY
1970	100.00	100.00	100.00	100.00
1971	105.09	106.59	110.39	106.96
1972	110.77	110.17	116.51	109.91
1973	117.93	117.07	123.75	118.68
1974	126.21	129.05	135.91	130.59

justified by the results of the interpolation computations made for this same time period, which showed that the compound growth rates in rents were very similar to the maximum allowed rent increases.

To determine the operating expenses for the properties, the statistical technique of multiple regression was used. Since the properties themselves did not have sufficient operating expense information to run the regression analysis, the paper made use of the analysis performed by Gau.[6] Table 3.4 provides a complete description of the results. The reader should note that the estimation is an expense ratio (operating expenses to gross income) and not an actual estimate of operating expenses. By looking at the table, the reader can see that the only physical characteristic that has a positive sign is age. This implies that older buildings result in higher operating expenses. The other two physical characteristics, number of stories and gross floor area, have negative signs indicating economies of scale.

The complete debt background on the properties was gathered from the British Columbia Land Title Office. Assumptions were required to determine what debt on the properties was property specific. Since real estate is an asset which is often used as collateral, the properties contained many debt obligations which were not property specific. The additional debt on the properties could have been for the purpose of financing other investments or for personal needs, and as such the leverage on

TABLE 3.4

APARTMENT OER EQUATION

AOER =	47.992 (16.058)*	+ .297 AGE (6.768)*	- .194 STOR (1.894)*	- .008 GFA (2.616)*
	+ .511 LOC1 (.295)	- 2.282 LOC2 (1.299)	- 1.666 LOC3 (.988)	- 4.605 LOC4 (2.018)*
	- .582 D68 (.226)	+ .857 D69 (.414)	- 1.740 D70 (.869)	- .291 D71 (2.018)
	-2.317 D72 (.949)	- 3.500 D73 (1.689)	- 2.768 D74 (1.296)	- 1.759 D75 (.771)
	-1.883 D76 (.832)	+ .086 D77 (.029)	- 3.884 D78 (1.599)	-1.177 D79 (.500)

$R^2 = .302$ SE = 6.694 n = 263

t-statistic in parentheses
* = coefficient significant at .05 level
AOER = operating expense ratio of apartment properties (x100)
AGE = age in years of apartment building
STOR = number of stories of building
GFA = average gross floor area per suite in square feet
LOC1...LOC4 = dummy, 0-1 variable for specific geographical locations
D68...D78 = dummy, 0-1 variable for year of ratio from 1968 to 1979.

Source: Gau[23]

the properties was often overstated. Two assumptions were employed to limit the debt solely to property specific debt:

(1) Debt could not be greater than the value of the property at the time of purchase.

(2) Debt obligations released and not refinanced were not considered property specific unless the released obligation occurred at the time of a sales transaction.

Under the first assumption, we believe that lenders would have been unwilling to lend funds greater than the worth of the property; therefore the loan-to-value ratio had to be less than one at time of purchase. Under the second assumption, we reason that funds from other investments must have retired the debt obligation, suggesting that the financing must have initially been used for these other investments too.

The estimating procedure to determine the quarterly market values of the properties is discussed in Chapter 5.

3.3 OTHER INVESTMENT ASSETS AND THEIR RATE OF RETURNS

The selection of investment instruments chosen for the study includes assets of the kind most likely to be incorporated into an investor's portfolio. Each of these assets, which are listed below, can be considered to have a different investment objective for the investor, i.e. fixed income, growth potential, hedge against inflation:

(1) COMMON STOCK - The total return index of the Toronto Stock Exchange 300 represents this asset.

(2) GOVERNMENT OF CANADA TREASURY BILLS - The 91-day treasury bills sold by the government represent this asset. The yield on the T-Bill was used as the rate of return.

(3) LONG-TERM GOVERNMENT BONDS - The total rate of return on long-term government bonds was calculated for the paper.[7]

(4) Gold - The return on gold is measured by the quarterly price change. The source of information was the International Monetary Fund.

The consumer price index for Canada,as supplied by the Bank of Canada Review, is the measure used for inflation.

ENDNOTES

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2. Mitchell,E.C.,"Multiple Housing Activity in Metropoltan Vancouver:Quo Vadis?", Real Estate Trends in Metropolitan Vancouver,1977,pp.B-1
3. There were two sources from which income was collected:The B.C. Assessment Authority, and The Greater Vancouver Real Estate Board Multiple Listing Service.
4. The seven areas are: 1.West End 2.Kitsilano 3.Kerrisdale 4.Marpole 5.South Granville 6.East Hastings 7.Remaining areas of city
5. The source for the average rent was Real Estate Trends in Metropolitan Vancouver,1970-1979
6. Gau,George W.,"Determinants of Return in Real Estate Investment and the Role of Real Estate Management", Institute of Real Estate Management Foundation,July 1981,pp.1-46
7. The total rate of return was calculated as follows:

$$\frac{P_{t+1} + I_b + I_t - P_t}{P_t}$$

where:

P&t+1 is the bond price at the end of the quarter;

I_b is the interest paid on the bond for the period;

I_t is the interest collected from reinvesting the bond coupons at the T-Bill rate; and

P_t is the bond price at the beginning of the quarter.

4.0 PROCEDURES

Chapter 3 discussed the data chosen to test diversification; this chapter presents the methodology required to answer the two questions posed at the outset of this paper. It begins by delineating return and risk: the two parameters used to measure the performance of the apartment properties as well as of the randomly selected portfolios. Next, the chapter describes the procedures used to examine diversification within real estate. Lastly, the chapter presents the methods used to calculate efficient portfolios, mean-variance and inflation hedged portfolios.

4.1 RETURN AND RISK

Investors in selecting or ranking alternative investment choices evaluate these investment choices by their expected return and variance of return(risk).[1] The most appropriate way to characterize this expected return is in terms of a probability distribution. Tests have shown that the probability distributions of returns on investments(common stock) are normally or lognormally distributed.[2] Since they are distributed in this manner, investors can distinguish them from one another by two parameters: mean or expected return, and the standard deviation(the squared deviation is the variance). The standard deviation or variance measures the dispersion of the probability distribution around the mean(expected return). These measures of dispersion disclose the riskiness of an investment.

For the purpose of the study, returns on the apartment properties are not expected returns but realized (ex post) returns. The study looks historically at these properties to examine the diversification potential of real estate. Two measures of return are calculated. The first, often referred to as return on capital, is calculated as follows:

Equation 1. $$R_{it} = \frac{[(MV_{it+1} + C_{it}) - MV_{it}]}{MV_{it}}$$

where:

R_{it} is the quarterly holding period return of the i property in period t;

MV_{it+1} is the ending market value estimate;

C_{it} is the net cash flow during the period t; and

MV_{it} is the beginning market value estimate.

This return measure is calculated for each of the 260 apartment properties in the study.

The other return measure computed for each property is the return on equity, which takes into consideration any financing applied to the property. The return on equity is determined as follows:

Equation 2. $$R_{it} = \frac{[(MV_{it+1} - D_{it+1}) + C_{it}) - (MV_{it} - D_{it})]}{(MV_{it} - D_{it})}$$

where R_{it}, MV_{it+1}, C_{it}, MV_{it} are the same as in Equation 1, D_{it+1} is the debt outstanding at the end of the period and D_{it} is the debt outstanding at the beginning of the period. Equation 2. can be further simplified:

Equation 3. $$R_{it} = \frac{[(BTER_{it} + C_{it}) - Eo]}{Eo}$$

where $BTER_{it}$ and Eo are the before-tax equity reversion of property i at the end of period t and the initial equity respectively.

In both cases, the return measures are before tax. Using a before-tax rate of return raises the question of whether these return measures have any relevance for investors, who are usually more concerned with an after-tax rate of return. A before-tax return facilitates the comparison of the real estate returns with the returns of the other investment instruments(which are calculated on a before-tax basis). However, the reader can argue that the relationship between real estate returns and those of other assets might be one thing on a before-tax basis and quite another on an after-tax basis, because of the tax shelter benefits associated with real estate, i.e. the benefits from capital cost allowances. Gau[23] using almost the same data base as this paper found that the tax shelter benefits were not a major determinant of the return.[3] He noted that the lack of relative importance of the tax shelter was due to the high land-to-total-value ratio of the properties. Therefore using before-tax rate of return measures should not prejudice the results of the analysis.

Another issue should be clarified. Often two return measures exist for real estate, return on capital and return on equity, while only one is used for the other assets, return on capital. The return on equity measure is included for real estate, because of the importance of leverage to a real estate investor. Since real estate is a lumpy and an indivisible asset, small capital investors often must obtain financing in order to purchase real estate. The real estate investor is concerned not only with the return on the property, but also with how his equity return is affected by leverage. With other investments, financing is not as critical; investors can usually acquire equities without the need of leverage. In this study, the return on equity will not be compared to the return on capital of the other investments, but is included in order to provide real estate investors and researchers with information on how financing affects the return on capital.

Given these conditions, the before-tax return on the market and on randomly selected portfolios can be calculated.The return on the market includes all properties in the sample, and is calculated as follows:

Equation 4. $$R_m = \sum_{i=1}^{K} R_{it}/K$$

where:

R_m is the return on the market at time t;

R_{it} is the return of the ith property at time t; and

K is the number of properties in the market.

For the return on the market, each property is equally weighted. The return on a randomly selected portfolio is:

Equation 5. $$R_{pt} = \sum_{i=1}^{M} R_{it}/M$$

where R_{pt} is the return on the portfolio at time t, and M is the number of properties in the portfolio.

After calculating the different return measures, the average quarterly variance(risk) for each property is determined. The variance for each property can be computed as follows:

Equation 6. $$V_i = \frac{(R_{it} - \overline{R_i})^2}{n-1}$$

where:

V_i is the variance for property i;

$\overline{R_i}$ is the mean quarterly return for the property; and n is the number of quarters in the study.

With the variance for each property known, the average total variance for the real estate market can be calculated.[4] The average total variance represents the upper boundary for risk, systematic risk as well as the unsystematic risk of real estate. The average total variance is computed as:

Equation 7. $$V_t = \sum_{i=1}^{K} V_i / K$$

where V_t is the average total variance and K is the number of properties in the market.

Next the market variance is calculated for the total sample:

Equation 8. $$V_m = \frac{(R_{mt} - \overline{R}_m)^2}{n-1}$$

where:

V_m is the variance of the market;

R_{mt} is the return on the market in period t; and

$\overline{R}_m$ is the mean return of all properties in the market over the period of the study, n.

V_m represents a completely diversified portfolio and serves as a proxy for systematic risk. The difference between V_t and V_m

reflects the unsystematic or diversifiable risk within the market.

The measure of variance is also required for the randomly selected portfolios. The average quarterly variance for these portfolios is computed as follows:

Equation 9. $$V_p = \frac{(R_{pt} - \bar{R}_p)^2}{n-1}$$

where V_p is the average quarterly variance, R_{pt} and $\bar{R}_p$ are the return of the portfolio in period t and the mean return of the portfolio respectively. The variance for a portfolio, V_p, like the average total variance of the market, can be decomposed into systematic(non-diversifiable) and unsystematic (diversifiable) risk:

Equation 10. $$V_p = V_s + V_{us}$$

where V_s is the systematic and V_{us} is the unsystematic risk.

4.2 PROCEDURES TO TEST DIVERSIFICATION WITHIN REAL ESTATE

Is there sufficient unsystematic risk within real estate to allow investors to reduce risk by purchasing a cross-section of properties? We have approached this question by measuring the effect of portfolio size on return variation. If return variation is reduced as additional properties are added, then the potential to diversify within real estate exists.

The exact method used to answer this question follows a number of steps. First the return and variances for all the properties will be calculated. From this set of properties(which will be termed the market), the return of the market and the risk of the market(total(V_t) and market(V_m)) will be computed. Next, on a preliminary basis, a comparison of market risk to total risk is made,(V_m/V_t). This comparison will indicate the extent to which risk can be diversified away. The lower the ratio of (V_m/V_t), the greater the possibility of diversification within real estate. We repeat the comparison by dividing the sample into two sub-samples by location: one for properties located in the West End, the urban section of the city, and the other covering the outlying parts of the city. This test will check for geographic diversification within the city.

The next step in measuring diversification within real estate is to generate random samples of portfolios from size 2 to 30 properties. For each property size,30 random portfolios are created, so that a total of 870 portfolios are formed. By having 30 random portfolios for each portfolio size, the distribution of returns and variance of returns for each portfolio size should be normal. Therefore the mean return and variance for the different portfolio sizes can be used in the analysis without great concern for outliers or abnormal results. The set of mean return variances for the different portfolio sizes will first be perused to see if the variances are reduced as portfolio size increases. If return variance is reduced, then t-tests will be employed to find out at what portfolio size significant reduction in variation take place.

Finally, a simple regression analysis is run to determine how much reduction in variation can be explained by portfolio size. The regression equation is:

$$Y = a + b(1/\sqrt{X})$$

where Y equals the return variance of the portfolio and X is the portfolio size.[5] The R^2 will provide the answer for how much reduction in variation is explained by portfolio size.

4.3 PROCEDURES TO CALCULATE EFFICIENT PORTFOLIOS

To find the efficient portfolios under conditions of mean-variance, recall that under Markowitz's definition of mean-variance, efficient portfolios are the set of portfolios which offers the highest expected return for a given variance. Mathematically this objective function is written as:

Equation 11. maximize $$\sum_{i=1}^{N} X_i R_i - \lambda \sum_{\substack{i=1 \\ i \neq j}}^{N} \sum_{j=1}^{N} X_i X_j \sigma_{ij}$$

where:

X_i, X_j are the proportional weights of the assets in the portfolio;

R_i is the return on asset i;

σ_{ij} is the covariance between asset i and j;and

λ is a Lagrangian multiplier.

The first section($\sum_{i=1}^{N} X_i R_i$) of the equation calculates the highest possible return;the second section($\lambda \sum_{i=1}^{N} \sum_{j=1}^{N} X_i X_j$)constrains the highest return by minimizing the variance of the portfolio.

Added to this objective function is the constraint that the sum of the weights of the assets in the portfolio equals one:

Equation 12.

$$\text{maximize} \quad \sum_{i=1}^{N} X_i R_i - \lambda \sum_{i=1}^{N} \sum_{j=1}^{N} X_i X_j \sigma_{ij} - \mu(\sum_{i=1}^{N} X_i - 1) \qquad i \neq j$$

where μ is another Lagragian multiplier and ($\sum_{i=1}^{N} X_i - 1$) constrains the portfolio weights to one.To derive this objective function, a computer program has been written(see Appendix A). The design of the computer program permits the weights of the assets to be negative, implying that the assets can be sold short. If real estate is found to have a negative weight in the portfolios, a conclusion can be drawn that real estate does not contribute to the efficiency of the portfolio, since real estate cannot be sold short.

The procedure used to compute an inflation-hedged portfolio is ordinary least squares regression analysis. By regressing inflation (the dependent variable) against the various investment returns(independent variables), a linear equation is derived which replicates inflation. To constrain the portfolio so that the sum of the weights of the assets equals one, the regression coefficients are added and each coefficient is then divided by the sum of those coefficients. Like the mean-variance portfolios, the inflation-hedged portfolio can have assets with negative weights. All assets that have a positive weight contribute as a hedge against inflation. Those assets that have a negative weight should be sold short since they are not effective hedges against inflation.[6]

ENDNOTES

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2. Fama, Eugene F., Foundations Of Finance, Basic Books Inc., 1976
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4. Miles, Mike and McCue, Tom, "Considerations in Real Estate Portfolio Diversification" ,Working Paper, University of North Carolina, 1980
5. Latane, H. and Young, W., "Test of Portfolio Building Rules", Journal of Finance, Vol.24, September 1969, pp.595-612
6. A correlation matrix of the assets and inflation can also confirm which assets are hedges against inflation.

5.0 Valuation Model

In this chapter a valuation model is developed to estimate quarterly market values for the apartment properties. The first section of the chapter describes the theoretical specifications of the model. Then Section 5.2 presents the estimated regression equation for the apartment properties and considers the effectiveness of the model.

5.1 THEORETICAL SPECIFICATION

In the marketplace, the value of apartment blocks in Vancouver is determined by the interaction of the supply and demand schedules. Since we need to estimate the value for these properties, we must derive their supply and demand schedules. To do this, two assumptions are made: that all apartment blocks have the same supply and demand curves, [1] and that the market is in equilibrium so that price is determined where the quantity demanded equals the quantity supplied.

To examine the supply and demand curves, we first consider the apartment block market in the long run. The supply and demand curves are neither perfectly elastic nor inelastic(see Figure 5.1). The supply, the stock of apartment blocks, can adjust in response to the demand.

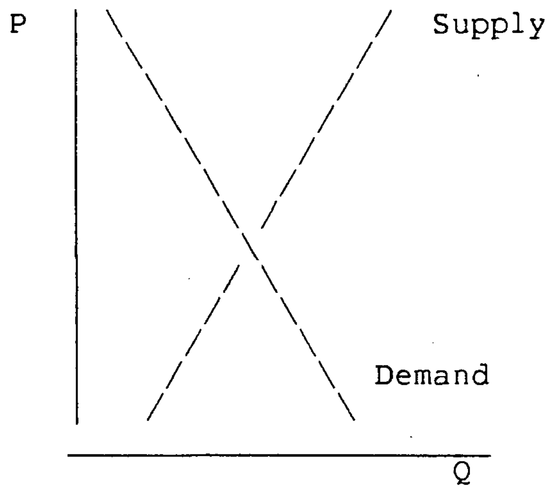

Figure 5.1

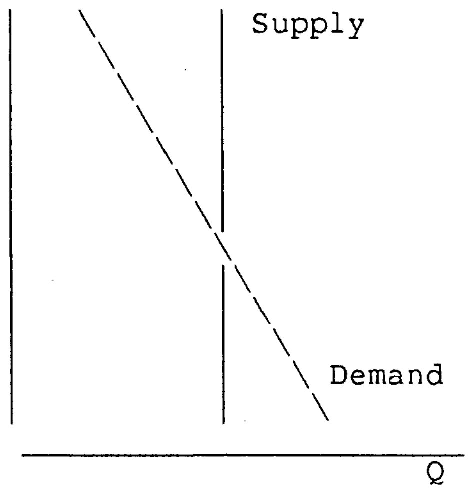

Figure 5.2

The variables that are important to the developers who provide the supply and to the investors who are the demand are characterized as follows:

Supply = f(price of apartment blocks, construction costs, interest rates, rental income, land prices, inflation, taxes, availablity of zoned sites, increase in non-family households, vacancy rate)

Demand = f(price of apartment blocks, future rents, risk premium of apartment investments, inflation, interest rates, potential of new supply, taxes, expected return on alternative investment opportunities)

If we reduce the time span to examine the apartment block market in the short run, the supply curve becomes inelastic(see Figure

5.2). The time period is too short for any new stock to be added to the market; hence, market value is primarily determined by the demand variables.[2]

Investors incorporate the information from the supply and demand schedules into mathematical models which analyze the investment. The models which investors often use for analysis are discounted cash flow models. The most popular of these is the net present value model, NPV, a model which evaluates an investment through a comparison of the equity invested in a property at the time of purchase(Eo) and the present value of the after-tax equity cash flows(C_t) accruing to the real estate investors during the holding period(t=1, ...n) discounted at the required rate of return(r).[3]

Equation 1.
$$NPV = \sum_{i=1}^{N} \frac{C_t}{(1+r)^t} - Eo$$

The decision criterion is to accept the real estate investment if NPV ≥ 0 and reject it if NPV<0.

From this equation, we find the value of a property by setting the equation equal to its present value, PV, by adding Eo to each side of the equation. In this new equation, the discounted future benefits equal the present value of the property.

Equation 2.
$$PV = \sum_{i=1}^{N} \frac{C_t}{(1+r)^t}$$

Shenkel has shown by use of multiple regression analysis that the future benefits of a property are related to a set of common property characteristics, and that these property characteristics can be used to predict market value.[4] The set of property characteristics that Shenkel used are grouped into three categories: area(or size), location, and services and amenities.

Church, in his use of multiple regression analysis, argued that property characteristics are related to the supply and demand schedules. He considered as important those property characteristics that "explained" sales price differences from property to property, and categorized these characteristics under physical, locational, market(economic and financial) and prior knowledge classifications.

This paper follows the work of Shenkel and Church by using least-squares regression analysis to explain the value for the apartment properties. The variables we judged to be pertinent for this study are listed below, together with reasons for selection and some descriptive detail:

Market Value

The market value(sales price) of the apartment blocks is the dependent variable for the initial runs in the regression model. The market value is taken as the actual sales price of the property as filed with the British Columbia Land Title Office.

Gross Income Multiplier

The gross income multiplier(GIM) is the dependent variable for the final regression model. It represents the relationship between the purchase price of the property and its gross income. The GIM was used as a proxy for sales price because the GIM model increases the significance of many of the independent variables.

Gross Income

The gross income for each property is the first independent variable, and is estimated from the procedure described in Chapter 3, Section 2. The gross income reflects the present benefits of the property and indicates the potential for future benefits. The expected sign of the variable is negative, because of the inverse relationship between income and the GIM; as income increases, the GIM decreases.

Age

The age of the building is taken as the number of years from the year of construction to the year of valuation. The age variable relates to the net operating income as well as to the reversion value. The expected sign is negative.

Gross Floor Area

The gross floor area(measured in square feet)is a size factor, and relates to the present(future) gross income and the operating expenses of a property. The expected sign is positive.

Floor Area Per Suite

The floor area per suite (also measured in square feet) reflects on average the type of suites in the buildings. The floor area per suite relates to income and operating expenses. The expected sign for the floor area per suite is positive.

Number of Stories

The number of stories of the apartment block is assumed to have an effect on gross income and operating expenses. The expected sign is positive.

Lot Size

The size of the lot is calculated in square feet and is assumed to have an effect on the reversion value. The expected sign is positive.

Location

The locational variables are dummy variables and four are included in the model. The areas for the dummy variables are: (1)West End, (2)Kitsilano, (3)South Granville, (4)East Side.[5] Dummy variables were used for location, to attempt to pick up the different factors relating to location, i.e. proximity to downtown, vacancy rates, desirability of area, etc. The expected signs for the West End, Kitslano, and South Granville are positive. The expected sign for the East Side is either positive or negative.

Quarterly Dummy Variables

The quarterly dummy variables are used to capture the change in economic conditions as well as shifts in the supply and demand curves. The quarterly dummy variables are also included in the regression equation to determine the quarterly price changes of the properties. The expected sign will vary over the time period.

There are no financial variables included in the regression model. Church suggested that a variable that reflects the duration of the debt on the property or the interest rate weighted by the size of the remaining principal of each mortgage should be included.[6] These variables were excluded because of data which was unable to be processed.

5.2 DEVELOPMENT AND ANALYSIS OF THE REGRESSION MODEL

The first step in the development of the regression model was to see if the model could be separated into annual equations. Table 5.1 presents the total number of sales transactions by year. The rule of thumb for estimating our model on an annual basis is that the number of observations/equation be greater than the degrees of freedom. The table shows that there were enough observations(sales transactions)for each year to permit annual estimated regression equations. These annual equations were useful, because, as Shenkel pointed out by limiting the estimated equation to a short period of time, the influence of time on the equation is reduced and the accuracy of the model is increased.

As a next step, a summary of statistics was generated on the variables. The statistics were useful in analyzing the model, and in insuring that the model conformed to the assumptions of regression analysis. One assumption the model needed to conform to was that there be linearity in the coefficients of the independent variables.[78] To increase the likelihood that the model satisfied this assumption, the distributions of the variables were examined for normality, by assessing the skewness of the distributions on an annual basis. The distributions for the price, GIM, number of stories, floor area per suite and lot size were all positively skewed. To normalize these distributions, lograrithmic transformations were applied. The log transformations constricted the intervals of the data as the values increased in size. The consequences to the distributions were that the right tail was drawn in while the values of the left tail of the distribution were moved away from the mean, thus tending to normalize the distributions.[9]

After transforming the variables, a series of regression equations were run to identify the best possible model: we

TABLE 5.1

NUMBER OF SALES TRANSACTIONS PER YEAR

YEAR	NUMBER OF TRANSACTIONS
1970	28
1971	35
1972	39
1973	56
1974	31
1975	34
1976	37
1977	44
1978	102
1979	132

needed a model that minimized predictive error and a model that included enough variables so as to distinguish price differences from property to property.

The first run of the model had the log of the price as the dependent variable, with the variables decribed in Section 5.1 as the independent variables. The first run produced quite surprisingly good results with the coeffcent of determination for each of the ten annual regression equations above .90. The standard error of the estimate ranged from .10 to .28. These results were superior to those obtained by Hoag[28] but not as strong as Shenkel's results.

The problem with this inital regression model was that only one explanatory variable, the log of income, was significant for all ten equations. Even though the estimated equations achieved the objective of a strong predictive model with minimal error, the model did not contain enough significant variables to explain price differences between the properties. By having only income as a significant variable, price would be essentially estimated by simple regression, a method rightfully critized for its lack of accuracy.[10] Moreover, by only having a single variable to predict price, the correlations of the properties would be so strongly positive that there would be little possiblity of finding potential diversification within real estate. So since this model failed to achieve the objective of including property characteristics that vary from property to property and that explain sales price differences, the model was discarded.

The model was then altered by dropping income as an explanatory variable. This procedure had been tried by Shenkel with great success.[11] In the current study, the results from the regression run were also quite reasonable. The coefficient of determination for the ten estimated equations ranged from .70 to .96. The standard errors of the estimate were higher than in the first run, ranging from .11 to .34. this second run also brought out the significance of many of the independent variables. As a result, this model was adequate for use in the study; it had predictive power and could explain sales price differences of the study.

Even though this model was satisfactory, another approach was taken to assure that it was the appropriate model. The new approach substituted GIM for market value as the dependent variable. With GIM as the dependent variable, a regression was run leaving the log of income out as an explanatory variable. The results from this run were poor, with the coefficient of determination for the ten equations ranging from .17 to .68. Most of the independent variables were not significant. The only good statistic was that the standard error of the estimate was low, from .11 to .22.

Another run was attempted, keeping the GIM as the dependent variable, but in this equation the log of income was included as an independent variable. By including income, the significance of the other independent variables increased. The t-values for these variables were larger in this equation than in the three previous equations. The coefficents of determination were mixed, varying from .404 to .761, but the standard errors of the estimates were quite good, ranging from .10 to .21.

To compare the predictive accuracy of this model to the model with market value as the dependent variable, the average residual error, in absolute terms, was calculated. Table 5.2 reveals that the average predictive error was lower for nine of the ten annual equations with the GIM model. The average residual error was 11.3 percent in the GIM model as compared to 15.8 percent in the market value model. As a result, since the GIM model appeared the strongest predictive model with minimal error and it had more significant property characteristics to explain sales price differences, this model was used to predict market value.

The ten annual equations of the model appear in Table 5.3. An attempt was made to keep only those variables which had a t-value greater than 1.0, so as to minimize the standard error. The quarterly dummy variables were an exception; these variables were always kept in the equation even if the t-values were below 1.0. Since all the other independent variables were constant throughout the year, the quarterly dummy variables were needed to calculate the change in value on a quarterly basis. The t-values of many of these variables(DM2, DM3, DM4) were low, implying that for many periods of time the change in value was not significant. As a result of keeping in all the dummy

TABLE 5.2

THE AVERAGE PREDICTIVE ERROR FOR THE GIM AND THE MARKET VALUE MODEL (BY PERCENTAGE)

YEAR	GIM MODEL	MARKET VALUE MODEL
1970	11.25	17.10
1971	7.54	9.67
1972	11.41	17.72
1973	12.16	19.68
1974	23.73	10.93
1975	7.34	12.10
1976	13.58	13.94
1977	8.87	13.92
1978	7.44	23.76
1979	10.04	19.39
AVERAGE	11.33	15.79

TABLE 5.3

THE ANNUAL VALUATION EQUATIONS

1970

GIM=-.644+.037LINC-.005AGE+.154LOC1 +.184LOC5+.120LOC6 +.345LFAST -.141DM2-.157DM3-.048DM4
(-.591) (.493) (-2.3) (1.6) (1.6) (1.2) (3.0) (-1.1) (-1.2) (-.351)

R2=.603 S.E.=.18404 F=3.042 OBS=28

1971

GIM=5.645-.476LINC-.007AGE+.633LOC1+.617LOC2+.585LOC5+.580LOC6+.405E-04FLAR +.078DM2+.155DM3+.062DM4
(6.0) (-4.2) (-4.4) (3.1) (3.3) (3.0) (3.2) (3.6) (1.1) (2.0) (.725)

R2=.634 S.E.=.12099 F=4.159 OBS=35

1972

GIM=1.415+.007LINC-.004AGE+.136LOC1+.192LOC2 +.204LOC6 +.294LFAST -.165LLOT-.061DM2-.022DM3-.111DM4
(1.3) (.071) (-2.3) (1.0) (1.3) (1.9) (1.9) (-1.2) (-.594) (-.270) (-1.3)

R2=.382 S.E.=.18168 F=1.520 OBS=39

1973

GIM=4.185-.252LINC-.007AGE+.097LOC1+.223LOC2+.119LOC5 +.114E-04FLAR +.030LLOT-.002DM2-.097DM3+.062DM4
(4.6) (-2.7) (-4.4) (1.1) (2.2) (1.0) (2.3) (1.1) (-.021) (-1.2) (.726)

R2=.444 S.E.=.20867 F=3.589 OBS=56

1974

GIM=2.439-.137LINC-.006AGE -.105LOC5-.150LOC6 +.196LFAST -.042DM2-.085DM3-.180DM4
(2.5) (-2.3) (-4.0) (-1.1) (-1.8) (2.3) (-.674) (-.834) (-2.2)

R2=.710 S.E.=.14058 F=5.706 OBS=31

1975

GIM=4.194-.371LINC-.004AGE+.130LOC1+.258LOC2+.067LOC5 +.886E-05FLAR- +.185LLOT-.020DM2+.007DM3+.056DM4
(6.6) (-5.7) (-3.8) (2.4) (3.2) (1.1) (2.4) (2.7) (-.295) (.112) (.842)

R2=.761 S.E.=.10302 F=7.326 OBS=34

1976

```
GIM=4.477-.228LINC-.004AGE                  -.159LOC6+.813E-05FLAR          -.026DM2+.003DM3-.132DM4
    (6.3) (-3.1)   (-3.1)                     (-2.8)   (1.7)                 (-.400) (.040)  (-.1.9)
```

R2=.565 S.E.=.14574 F=5.388 OBS=37

1977

```
GIM=5.066-.281LINC-.005AGE+.059LOC1+.081LOC2+.084LOC5-.112LOC6+.118E-04FLAR  -.129DM2-.085DM3-.211DM4
   (6.4)  (-3.5)   (-4.0)   (1.0)    (1.1)    (1.4)   (-1.9)    (2.0)        (-1.96)  (-1.3)  (-3.2)
```

R2=.592 S.E.=.12720 F=4.784 OBS=44

1978

```
GIM=3.318-.146LINC-.004AGE+.031LOC1+.129LOC2+.096LOC5   +.031LFAST+.098LNOST  -.061DM2-.015DM3+.049DM4
  (13.2)  (-6.0)   (-7.2)   (1.0)    (3.7)    (3.3)       (2.1)     (3.0)     (-2.0)  (-.480    (1.8)
```

R2=.543 S.E.=.10056 F=10.840 OBS=102

1979

```
GIM=2.848-.197LINC-.002AGE+.107LOC1+.074LOC2+.083LOC5-.044LOC6   +.130LNOST+.134LLOT-.003DM2+.007DM3+.053DM4
  (10.0)  (-4.6)   (-3.0)   (2.6)    (1.6)    (2.0)   (-1.3)       (3.0)     (2.4)   (-.077)  (.202)  (1.4)
```

R2=.304 S.E.=.12837 F=4.783 OBS=132

Definitions of Variables

T-Statistic in Parentheses
GIM - Gross Income Multiplier
LINC - Log of gross income
AGE - Age of Apartment Block
LOC1 - West End
LOC2 - Kitsilano
LOC5 -South Granville
LOC6 - East Side of Vancouver
Flar - Gross Floor Area
LFAST - Log of Floor Area/Suite
LNOST - Log of the Number of Stories
LLOT - Log of the Lot Size
DM2 - Economic Variable for 2nd Quarter
DM3 - Economic Variable for 3rd Quarter
DM4 - Economic Variable for 4th Quarter

variables, the variablity of value may be overstated, making the variance of return of the properties overstated.

Looking again at Table 5.3, we see that most of the signs for the variables were consistent with the expected signs. Income and age had negative signs and gross floor area, floor area per suite, number of stories, lot size and the locational variables were positive. There were two equations, 1970 and 1972, where the signs for income, lot size, and the dummy variable for the East Side were the reverse of their signs in other equations. These reverse signs along with the high standard errors of the estimate in the equations suggest that these equations maybe the weakest of the ten.

In terms of problems that are associated with regression analysis: multicolinearity, heteroscedasticity, and outliers, the equations showed little evidence of their effects. With respect to multicolinearity the correlation matrices(see Appendix B) illustrate that the variables associated with size (log of lot size, gross floor area, and log of the number of stories) had a high correlation with income. The high correlations, though, did not alter any of the expected signs. Also, the standard errors of the coefficients for these variables were not significantly greater than the standard errors of the other variables. A possible reason that multicolinearity did not have an impact is that often only one of the variables reflecting size appeared in an equation with income at a time.

In checking for heteroscedascticity, the residual errors were plotted versus the predicted values for GIM(see Appendix B). The results show there to be some heteroscedasticity. However, the standard errors for the equations are low enough that the equations can tolerate some overstatement of the reliability because of heteroscedasticity.

The last problem to check for is outliers. Outliers exist when a residual is extremely large(positive or negative) compared with other residuals. There were some outliers in the equations. Trial runs were made throwing out these observations, but there were no differences in the results. Hence all observations were kept in the study.

In conclusion the weakness of using this model is that it employs quarterly dummy variables to determine the quarterly price changes. As a result, all properties increase in value by the same percentage, making the correlations between the properties 100 percent, from quarter to quarter and hindering the test to find diversification. On the whole, the model to predict market value is reasonable. On average, the predictive error is 11 percent. Also, the model also contains enough variables to explain sales price differences.

ENDNOTES

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2. Grether, D. and Mieskowski, P., "Determinants of Real Estate Values", Journal of Urban Economics, April 1974, pp.47-52
3. Gau, George W., "Risk Analysis and Real Estate Investment: Theoretical and Methodological Issues", Working Paper, University of British Columbia, 1982
4. Shenkel, William M., "The Valuation of Multiple Family Dwellings by Statistical Inference", The Real Estate Appraiser, January-Febuary 1975, pp.25-36
5. For an area to be included as a dummy variable, at least 10 percent of the sample to be located in that area.
6. Church, Albert M., "An Econometric Model for Appraising", American Real Estate and Urban Economics Association Journal, Vol.3, No.1, Spring 1975, pp.25-36
7. In least-squares regression, the most efficient estimator of a coefficient is a linear least squares estimator.
8. Rummel, R.J., <u>Applied Factor Analysis</u> , Evanston: Northwestern Press, 1970
9. ibid
10. Shenkel, William M., "The Valuation of Multiple Family Dwellings by Statistical Inference", The Real Estate Appraiser, January-Febuary 1975, pp.25-36
11. ibid

6.0 RESULTS

This chapter presents the empirical results of the study and analyzes the two questions proposed in the introduction of the paper. The chapter begins with a description of the rates of returns, the standard deviations, and the variances for the set of apartment properties. In Section 6.2, we present the analysis of the answer to question one: can investors diversify their portfolios solely within real estate market? Lastly in Section 6.3, we frame our response to question two: can real estate improve the efficiency of investor's portfolios?

6.1 RETURN AND RISK MEASURES OF APARTMENT BLOCKS

In the last chapter, a valuation model was developed to estimate market value. Using the predicted sales prices from the model and the cash flow information described in Chapter 3, rates of returns were calculated on the apartment properties. These rates of returns are set out in Appendix C. Most of the properties exhibit a mean return on capital of between 4 and 6 percent/quarter. The returns on equity are more dispersed, with a number of properties having a negative mean return. Generally, though, most properties have a positive return on equity which is greater than the return on capital. These higher returns on equity illustrate the benefits of leverage to an investor.

The standard deviations and variances(the measures of risk), are much more dispersed for the returns on equity, as compared to the returns on capital. The majority of properties have a standard deviation for the return on capital that fall within a range of 11.00 percent to 15.00 percent/quarter, and variance of 1.50 percent to 3.25 percent/quarter. In respect to the standard deviation and variance for the return on equity, no such defined range exists. The vast dispersion of the standard deviation and variance for the returns on equity demonstrates the high risk factor of leverage.

Table 6.1 displays the mean return of the market(R_m), the average total risk(V_t), and the market risk(V_m). The mean return on capital is 5.00 percent/quarter and the return on equity is 15.81 percent/quarter. In terms of risk, the market risk(V_m) and the average total risk(V_t) associated with the return on capital is 1.50 percent/quarter and 2.10 percent/quarter repectively. The market and average total risks associated with the return on equity are far greater at 28.21 percent and 169.27 percent/quarter respectively.[1] The additional risk caused by leverage seems to outweigh the benefit of a higher return.

6.2 ANSWER AND ANALYSIS OF QUESTION ONE

In the introductory chapter of the paper, the following question was proposed: can investors diversify their portfolios solely within real estate? The only other study to investigate

TABLE 6.1

THE RETURN AND RISK MEASURES FOR THE SET OF APARTMENT BLOCKS(PERCENTAGE/QUARTER)

	Return on Capital	Return on Equity
Mean Return on Market(Rm)	5.01	15.81
Variance of Market(Vm)	1.50	28.21
Average Total Variance(Vt)	2.10	169.28
Ratio(Vt/Vm)	.71	

this question so far was conducted by Miles and McCue[44]; they found that diversification was possible within real estate.[2] Given the results of Miles and McCue, this paper has tested the hypothesis that real estate investors can diversify their portfolios within a local real estate market.

Beginning the analysis of question one, we calculated the ratio of (V_m/V_t) for the return on capital.[3] This ratio indicates the proportion of total risk accounted for by the market , i.e. non-diversifiable risk. The more important systematic or market influences are, the closer this particular ratio will be to 1.0.[4] The ratio appearing in Table 6.1 illustrates that market risk is 71.43 percent of average total risk. In comparison to other equities, market risk was 54.40 percent of average total risk for bonds and 37.80 percent for stocks.[5] Thus it appears that the potential to diversify within real estate is quite small; only 28.57 percent of the total risk is diversifiable.

To determine whether geographical diversification within the city is possible, the sample was divided into two subsamples by location(see Chapter 4). The results of this test appears in Table 6.2. The ratio of (V_m/V_t) for the West End was 79.80 percent, and for the outlying areas the ratio was 71.59 percent. These ratios show little potential to diversify within the city, not a surprising finding given the results above. When comparing the two ratios, the outlying areas contribute more to

TABLE 6.2

THE RETURN AND RISK MEASURES FOR THE SUB-SAMPLE OF APARTMENT BLOCKS(PERCENTAGE/QUARTER)

	WEST END	REST OF THE CITY
Mean Return on Market(Rm)	4.48	5.09
Variance of Market(Vm)	1.71	1.49
Average Total Variance(Vt)	2.15	2.08
Ratio(Vt/Vm)	79.80	71.59

diversification than does the West End. The latter, an area with more varied types of apartment blocks, from garden apartments to high-rise apartments, does not contribute strongly to portfolio diversification.

The next step of the analysis was to examine the rate at which variation of return for randomly selected portfolios was reduced as a function of the number of properties included in the portfolio. This examination looked at portfolios from size 2 to 30 properties. The results of the test appear in Table 6.3. The variations of return show a downward but inconsistent trend. From portfolios of size 2 to 13, all but four portfolios had a variance of return greater than 1.60 percent, but from portfolio size 14 to 30 all variances of return were below 1.60 percent, indicating that some reduction in variation of return was occurring with diversification. The table also illustrates that most of the unsystematic risk was diversified away through the holding of only a few properties: at two properties, approximately 50 percent of the total unsystematic risk had been diversified away, while at 29 properties(the lowest variance of return) only 75 percent of the unsystematic risk was diversified away, an improvement of a mere 25 percent for a portfolio of fourteen times the size.

To analyze the results in more detail, we ran t-tests on successive portfolios to indicate which portfolio sizes cause significant reduction in return variation. The results of these tests showed that the addition of one property to a portfolio of

TABLE 6.3

DESCRIPTION OF PORTFOLIO SIZE AND REDUCTION IN RETURN VARIATION

PORTFOLIO SIZE	VARIANCE OF RETURN (percentage/quarter)
2 Properties	1.79
3 Properties	1.73
4 Properties	1.61
5 Properties	1.56
6 Properties	1.78
7 Properties	1.56
8 Properties	1.66
9 Properties	1.70
10 Properties	1.56
11 Properties	1.65
12 Properties	1.59
13 Properties	1.62
14 Properties	1.58
15 Properties	1.53
16 Properties	1.56
17 Properties	1.57
18 Properties	1.56
19 Properties	1.57
20 Properties	1.57
21 Properties	1.54
22 Properties	1.53
23 Properties	1.58
24 Properties	1.57

25 Properties	1.57
26 Properties	1.57
27 Properties	1.54
28 Properties	1.52
29 Properties	1.51
30 Properties	1.55

sizes 3, 6, and 9 cause significant reduction at the .05 level. However the results should be qualified. Since the variations of return show an inconsistent downward trend, it seems unreasonable to conclude that certain portfolio sizes do significantly reduce variance of return. With regard to portfolio sizes 6 and 9, the variance of return increased, thus raising the possibility that a significant reduction in variance would occur with the addition of another property to the portfolio.

As a final test on the set of random portfolios, a simple regression analysis was run on the variations of return to analyze the relationship of decreasing portfolio variation as diversification increases. Regression analysis was performed fitting by least squares the regression function:

$$Y = a + b(1/\sqrt{x})$$

where Y equals the return variance of the portfolios and x is the portfolio size. The function did not produce an extremely good fit, as indicated by the low coefficient of determination, .36310. Only 36 percent of the variance of return can be explained by diversification. This result differs from the conclusions reached by Evans and Archer[17] whose regression equation had a fit of .9863. Our study's comparatively poor result is due to the inconsistent trend seen in the variations of return, and the fact that much of the reduction of variance occurred within a very few properties. Therefore, the results from the tests on the random portfolios are similar to the results comparing market risk to average total risk; the potential to diversify is marginal.

With the analysis concluded, we can now answer the first question proposed in the paper: can investors diversify their portfolios solely within a real estate market? The answer to the question is no, investors cannot diversify solely within a real estate market if that market is confined to one locale and one property type. The results demonstrate that less than 30 percent of the risk is diversifiable. Since the answer to the question is no, the hypothesis that investors can diversify their portfolios within a local real estate market must also be rejected. The rejection of the hypothesis might be reversed if different property types were included in the portfolio. A discussion on the effects these conclusions have on real estate investors is presented in the next chapter.

6.3 ANSWER AND ANALYSIS OF QUESTION TWO

The second question of the study asks if real estate can improve the efficiency of investors' portfolios. To deal with this question, two different types of efficient portfolios are considered. The first type of efficient portfolio refers to an inflation-hedged portfolio: a portfolio that has a return which keeps pace with inflation and has a high correlation with the rate of inflation. The second type of efficient portfolio follows Markowitz's description of efficient portfolios, that set of portfolios which offer the highest expected return for a given variance of return.

Past research has shown that real estate does improve the efficiency of investors' portfolios in respect to both definitions. Since past literature demonstrated the usefulness of real estate in mixed asset portfolios, the paper proposed the hypothesis that real estate will improve the efficiency of investors' portfolios under both definitions of efficient.

Given this hypothesis, we start the analysis by examining the effects of real estate on an inflation-hedged portfolio. Table 6.4 presents the mean rate of returns and standard deviations for the various investment assets to be included in the portfolio, and the inflation rate.[6] All the assets except treasury bills, as the table indicates, have a rate of return that surpasses inflation. Treasury bills have a slightly lower rate of return but also a lower standard deviation. In the case of real estate, the return is high, 5.00 percent/quarter, with a quarterly standard deviation of 8.61 percent. The return and risk are comparable to those obtainable on the other investment assets.

Turning to Table 6.5, we can view the cross correlations of the assets to inflation. The cross correlations indicate which assets might be useful in an inflation-hedged portfolio. The table shows that treasury bills have the strongest correlation with inflation, .50, and that real estate and gold are slightly positively correlated, .24 and .10 respectively. Bonds and stocks have a negative correlation of -.28 and -.13 respectively. So treasury bills, real estate and gold, being positively correlated, appear useful in an inflation-hedged

TABLE 6.4

THE INFLATION RATE, THE MEAN RETURNS AND STANDARD DEVIATIONS FOR THE INVESTMENT ASSETS(PERCENTAGE/QUARTER)

	MEAN RETURN	STANDARD DEVIATION
INFLATION	1.85	0.86
TREASURY BILLS	1.76	0.66
BONDS	2.22	4.53
GOLD	7.77	15.40
COMMON STOCK	2.93	8.28
REAL ESTATE	5.00	12.25

TABLE 6.5

CORRELATION MATRIX OF INFLATION
AND THE INVESTMENT ASSETS

	CPI	TBILLS	BONDS	GOLD	TSE	RE
CPI	1.000	0.500	-0.283	0.100	-0.129	0.241
TBILLS	0.500	1.000	-0.116	-0.006	0.001	0.049
BONDS	-0.283	-0.116	1.000	-0.121	0.332	-0.343
GOLD	0.100	-0.006	-0.121	1.000	0.078	0.223
TSE	-0.129	0.001	0.332	0.078	1.000	-0.243
RE	0.241	0.049	-0.343	0.223	-0.243	1.000

portfolio.

To determine the mixture of the assets in an inflation-hedged portfolio, the returns of the assets were regressed against inflation. From the equation, we determined which assets would be included and which assets would be sold short. Also from the equation, we calculated the weights of the asset in the portfolio. Table 6.6 presents the weights of the assets in the inflation-hedged portfolio. As seen from the table, treasury bills dominate the portfolio and appear to be the only valuable asset in it. Real estate and gold are included in the portfolio, but only a small percentage is allocated to these assets. Bonds and stocks would be sold short.

At the bottom of the table is the rate of return and standard deviation that could have been obtained from this portfolio over the period of the study. The rate of return is slightly less than the rate of inflation, 1.82 percent/quarter compared to 1.85 percent/quarter for inflation. However, the variability of the portfolio is also lower than that of inflation. The low return and variability is a reflection of the dominance of treasury bills in the portfolio. When the correlation between inflation and the portfolio was calculated, the correlation was .55, not much larger than the correlation of inflation to treasury bills. Therefore this inflation-hedged portfolio is not a perfect hedge.

The results illustrated that real estate does contribute to an inflation-hedged portfolio. However, treasury bills are the

TABLE 6.6

THE WEIGHTED PROPORTIONS FOR EACH ASSET IN AN INFLATION-HEDGED PORTFOLIO

Treasury Bills	1.0368
Bonds	- .0503
Gold	.0053
Common Stock	- .0083
Real Estate	.0165

dominant asset in the portfolio, and even by including real estate and gold, the hedge against inflation does not improve greatly over a portfolio consisting solely of treasury bills.

Turning to the second definition of efficient, we begin by recalling that Markowitz demonstrated that through diversification the overall variablity of the portfolio can be reduced, thereby making it more efficient. The reduction of risk occurs when assets are combined that have a negative(or low positive) correlation with other assets in the portfolio. The result of combining such assets is that the individual risk of the assets is diversified away, while only the interrelationship of the assets contributes to the portfolio risk. To see if real estate improves the efficiency of an investor's portfolio, we should then inspect the correlations of real estate to the other investment assets. The correlation matrix in Table 6.5 reveals that the correlation of real estate to the other assets is low positive for gold and treasury bills and slightly negative with common stock and bonds. It appears that real estate can improve the efficiency of investors' portfolios. The low correlation with the other assets should help diversify away individual risk of the assets.

To actually ascertain if real estate improves the efficiency of an investors' portfolio, we employed the objective function described in Chapter 4:

$$\text{maximize} \quad \sum_{i=1}^{N} X_i R_i - \lambda \sum_{i=1}^{N} \sum_{\substack{j=1 \\ i \neq j}}^{N} X_i X_j \sigma_{ij} - \mu\left(\sum_{i=1}^{N} X_i - 1 \right)$$

To derive this objective function a computer program was written which computes the efficient frontier(see Appendix A).

Figure 6.1 presents a graph of the efficient frontier. The scattered line represents the efficient frontier with real estate included in the portfolios, while the solid line denotes portfolios that contains all investment assets except real estate. The graph illustrates that the portfolios which include real estate strongly dominate the portfolios without real estate. The dominant position of the real estate-augmented portfolios decrease as the returns of the portfolio decrease. This is because at the lower rates of returns real estate becomes a decreasing percentage of the portfolios. Table 6.7 shows the asset mixture for portfolios (that include real estate) along the efficient frontier. If we divide the table in two, we see that the portfolios with high returns (a return above 3.94 percent/quarter) sell treasury bills short. This reflects the need of leverage to obtain these high rates of returns. Of the other assets, bonds are dominant; real estate and gold approximately have the same weight in the portfolios; and common stock contributes slightly less than that of real estate and gold. Bonds are a major factor because of their low risk relative to the other positive weighted assets. Looking

Figure 6.1

THE EFFICIENT FRONTIER

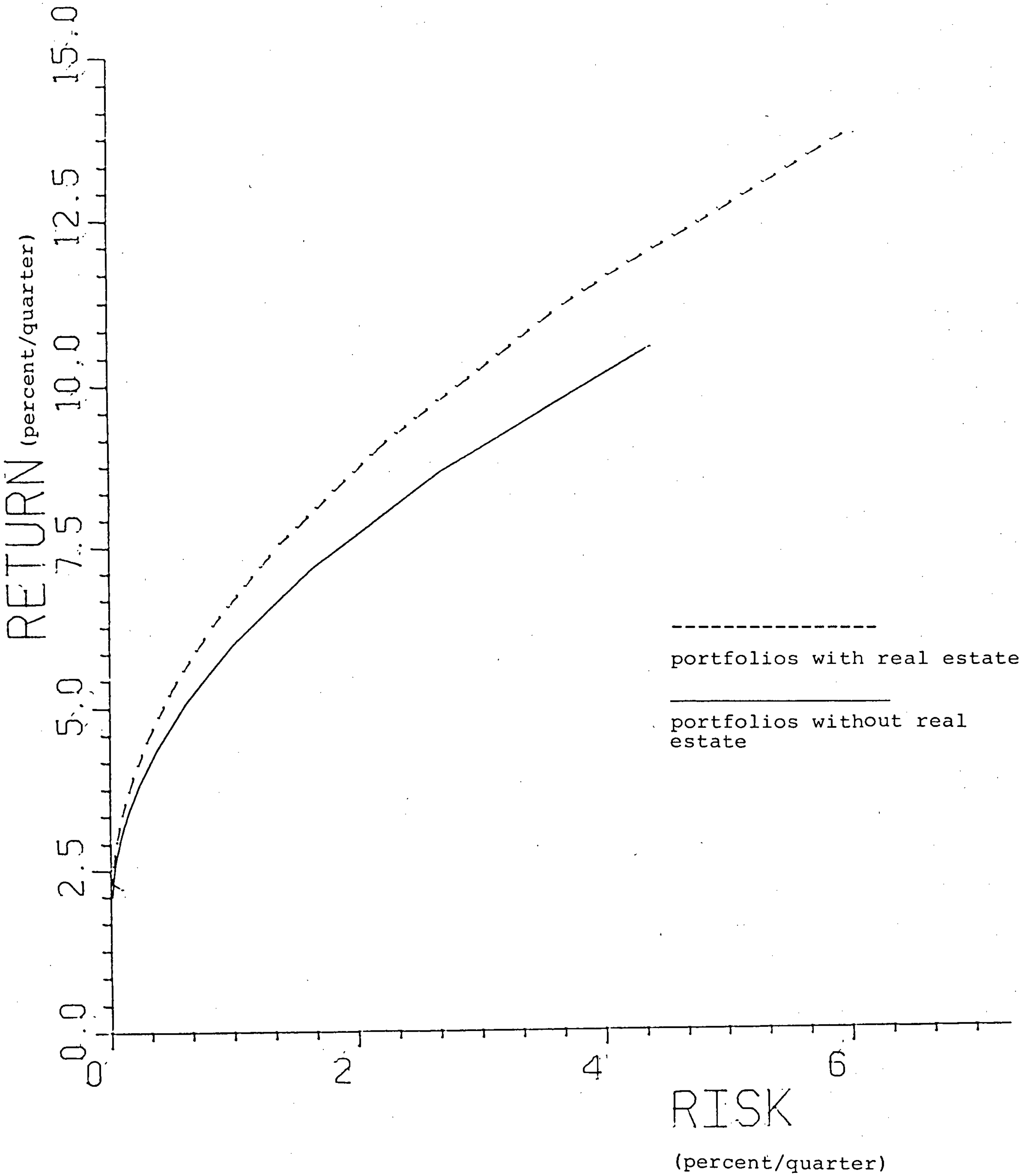

TABLE 6.7

A SET OF PORTFOLIOS ALONG THE EFFICIENT FRONTIER
(BY DECREASING RATE OF RETURN)

RETURN percent/ quarter	VARIANCE percent/ quarter	OPTIMAL PROPORTIONS FOR EACH ASSET ARE:				
		T-BILLS	BONDS	GOLD	TSE	R.E.
13.73	5.99	- 3.97	2.03	1.10	0.70	1.14
11.16	3.66	- 2.90	1.60	0.86	0.55	0.89
9.12	2.23	- 2.05	1.26	0.67	0.43	0.70
7.52	1.37	- 1.40	0.99	0.52	0.33	0.55
6.27	0.84	- 0.88	0.78	0.41	0.26	0.43
5.30	0.51	- 0.48	0.62	0.32	0.20	0.34
4.53	0.31	- 0.17	0.49	0.25	0.16	0.26
3.94	0.19	- 0.08	0.40	0.20	0.12	0.21
3.47	0.12	0.27	0.32	0.15	0.10	0.16
3.11	0.07	0.42	0.26	0.12	0.08	0.13
2.83	0.05	0.53	0.21	0.10	0.06	0.10
2.61	0.03	0.63	0.17	0.07	0.03	0.08
2.43	0.02	0.70	0.14	0.06	0.04	0.06
2.30	0.01	0.75	0.12	0.05	0.03	0.05
2.19	0.01	0.80	0.10	0.04	0.02	0.04

TABLE 6.8

COMPARISONS OF THE RISK (VARIANCE) OF THE INDIVIDUAL ASSETS TO EFFICIENT PORTFOLIOS WITH THE SAME MEAN RETURN

ASSET	VARIANCE (percent/quarter)		
	ASSET	EFFICIENT PORTFOLIO	PERCENTAGE DIFFERENCE
REAL ESTATE	1.50	0.43	- 71.33
BONDS	0.20	0.01	- 95.00
GOLD	2.37	1.49	- 37.13
COMMON STOCK	0.69	0.06	- 91.30

Note: Treasury Bills are not included in the comparisons, since they have the lowest possible risk obtainable.

at the low return portfolios, the table illustrates that treasury bills are the most significant asset; bonds are a minor portion of the portfolios; while real estate, gold and common stock contribute only marginally to the portfolios.

To further examine the benefits of diversifying in mixed-asset portfolios, Table 6.8 compares the risk of the individual assets to the risk of efficient portfolios with the same mean return. The comparisons clearly indicate the benefits of diversifying in mixed-asset portfolios. The risk of the mixed-asset portfolios is significantly less than the risk of the individual assets. For example, an efficient portfolio with the same mean return as real estate has approximately 70 percent less variability than real estate (.43 percent/quarter versus 1.50 percent/quarter).

In conclusion, real estate does improve the efficiency of investors' portfolios. Our second hypothesis can be accepted under both definitions of efficiency. Real estate does help an investor hedge against inflation; real estate has a negative(or low positive) correlation with other investment assets, which enables investors to further reduce their diversifiable risk.

ENDNOTES

1. The distributions for the market and average total variance are strongly skewed positive. A few properties that have very large variances greatly influence the market and average total risk.
2. Miles, Mike and McCue, Tom, "Considerations in Real Estate Portfolio Diversification", Working Paper, University of North Carolina, 1980
3. Since the return on equity is influenced by investor's leverage, it can not indicate the risk that is strictly associated to real estate. Therefore it is unnecessary to calculate (Vm/Vt) for the return on equity.
4. Evans, John L. and Archer, Stephen N., "Diversification and the Reduction of Dispersion: An Empirical Analysis", Journal of Finance, December 1968, pp.761-767
5. Miles, Mike and McCue, Tom, "Considerations in Real Estate Portfolio Diversification", Working Paper, University of North Carolina, 1980
6. Only the return on capital for real estate is included in the efficient portfolios. It is only reasonable to use similar rates of return measures for both real estate and the other investment assets. Also the correlations for both measures for real estate, the return on capital and the return on equity, to the other investment assets are so similar that their effect on a mixed-asset portfolio is about the same.

7.0 DISCUSSION

Chapter 6 presented the empirical results and answered the two questions proposed in this paper. This chapter briefly reviews the results, in the context of explaining their implications to investors.

7.1 Implications of Findings to Investors

The popularity of real estate, as an investment, increased substantially through the seventies. The demand for real estate soared, as investors perceived real estate to be the investment to combat inflation.[1] But what was the return on real estate during this decade? No one really knows. Since real estate lacks a "centralized" exchange, [2] it is difficult to compile information on returns. As a result, little research has been conducted on the behavior of real estate returns, although studies investigating the behavior of other assets are quite extensive.

This study calculated a set of real estate returns for apartment blocks located in Vancouver, British Columbia, from 1970-1979. The paper used these returns to focus on the potential benefits of diversification in real estate. Two issues of diversification were dealt with: the potential of diversifying within real estate, and the benefits of including real estate in mixed-asset portfolios.

The mean return calculated on the apartment blocks was 5.00 percent/quarter and the standard deviation was 12.25 percent/quarter. The return and risk of real estate were second highest to gold, with real estate returns outpacing those of treasury bills, bonds, and common stock. Investors received a return from real estate that not only matched inflation, but also provided a real return of approximately 3.20 percent/quarter. Investors who applied leverage on their properties, on average, tripled their return; however the risk contributed by leverage might outweigh the benefits of the higher return. In comparing the average total variance(Vt) for the return on capital to the return on equity, the average total variance for the return on equity was overwhemingly greater. This information illustrates to investors the importance of conducting some form of analysis;such an analysis will make them aware of cash flow difficulties that might result from the added fixed costs of leverage.

After calculating the returns on the properties, the paper examined the potential of diversification within real estate. The first part of the examination looked at the relative proportions of systematic and unsystematic risk. The investigation found that only 29 percent of total risk is unsystematic(diversifiable). In contrast, Miles and McCue[44] found that between 87 and 95 percent of total risk is unsystematic(they used a sample containing different property types throughout the United States). Miles and McCue considered the important factors for the high unsystematic risk to be the result of a property's unique character, i.e. location, cash flow, and lease on property. There were four reasons why our study had such different results from that of Miles and McCue: (1) the data were confined to a single property type, (2) the property type was limited to one locale, (3) the valuation model was not able to incorporate enough of the characteristics Miles and McCue considered to be important, (4) the method to estimate value overstated the correlation of the properties(see Chapter 5).

In evaluating the results of this paper, real estate investors should discount the problems of the valuation model, and recognize the fact that portfolios confined to one property type in one local market are not well diversified. If investors want a diversified portfolio holding only real estate, then they need to include a range of property types throughout various markets. A factor that investors should consider if they try to fully diversify within real estate, is the cost of diversification. By having to diversify across property types and geographical regions, they may find the costs of obtaining information too high and the quality of that information of uncertain value.

For the next part of the examination, the paper investigated the effect of portfolio size on the reduction of return variation. The results of this investigation were weak with only 36 percent of the variation of return being explained by diversification. The return variation of portfolios of increasing size showed a downward but inconsistent pattern. When t-tests were run to see if any of the portfolios caused significant reduction in variation, three portfolios were found to have caused significant reduction, portfolio sizes 4, 7, and 10. But, because of the inconsistent pattern in return variation, these results should not be considered fully reliable. However, investors should note that it is possible to diversify away a large portion of the total unsystematic risk by holding portfolios which contain only a few properties. Investors do not have to incur large transaction costs to eliminate diversifiable risk in a local market; through two or three properties, investors can take advantage of most of the diversification potential.

Even though the paper did not find the potential to diversify efficiently within a portfolio consisting solely of real estate, it did discover that investors can benefit by including real estate in mixed-asset portfolios. The study found that the inclusion of real estate in an inflation-hedged portfolio was beneficial. In this portfolio, real estate, treasury bills, and gold all contributed to its efficiency. The most valuable asset in the portfolio was treasury bills. Treasury bills had a correlation of .50 with inflation, while the inflation-hedged portfolio only had a correlation of .55. In other studies, Fama and Schwert[19] and Hallengren[27] observed that real estate was the most effective hedge against inflation. Even though real estate did not contribute as strongly in this study's inflation-hedged portfolio, the results still demonstrate to investors that they should include real estate in portfolios that are designed to hedge inflation.

The study also found real estate to have a low or negative correlation with other assets, making the potential to diversify very high in a mean-variance efficient portfolio. For example, an efficient mixed-asset portfolio with the same return as one consisting solely of real estate(5.00 percent/quarter) had over 70 percent less risk. So investors can enjoy the high return associated with real estate without taking on a great deal of risk. Also, they can diversify in a mixed-asset portfolio without incurring great costs. If investors select mutual funds which reflect the return behavior of other equity markets, then transaction costs(including information costs) should be low, and the investor's portfolio will be well diversified. In addition, the study found that the efficient portfolios which had high rates of return sold treasury bills short, illustrating the need of leverage in obtaining high rates of return.

The implication of these findings are that:

(1) small individual investors who own their home should concentrate their remaining funds in other investment assets, in order to take advantage of diversification;

(2) investors who invest strictly in real estate should consider the benefits of including other assets in their portfolio. The cost to diversify in a mixed-asset

portfolio may be less than the costs of diversifying within real estate.

(3) investors concerned with the illiquidity of real estate can enjoy the benefits of diversification without having to feel that a large portion of their portfolio is tied up(illiquid);

In conclusion, the paper discovered that real estate was beneficial in mixed-asset portfolios. Real estate is a useful addition to almost any portfolio no matter what the investment objectives are. The amount of real estate to be included in a portfolio depends on the investor, his investment objectives, and his beliefs on the return of real estate and how it covaries with other assets.

THAT'S ALL FOLKS

ENDNOTES

1. Investors believed that the after-tax rate of return on real estate would be greater than other investments in an inflationary environment, because of leverage and the tax advantages of real estate.
2. Miles, Mike and McCue, Tom, "Considerations in Real Estate Portfolio Diversification", Working Paper, University of North Carolina, 1980

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APPENDIX A

```
      REAL SIGNVR,SIGNVJ,JSGNVJ,JSGNVR
      REAL ER,VLAM,VAR,SUM
C     PROG TO FORM PORTS CROM COUNTRY DATA
      DIMENSION VMN(5),VARC(5,5),
     1CORR(20,20),SIG(20),RP(20)
      DIMENSION B(5,5),SIGNVR(5),SIGNVJ(5),IPERM(15),X(100)
C     READ VMEAN
      DO 10 I=1,5
      READ(1,7)(VMN(I))
    7 FORMAT(5X,F7.3)
   10 CONTINUE
C     READ VARC
      DO  9 KK=1,5
      READ(2,12)(VARC(KK,J),J=1,5)
   12 FORMAT(5X,5F9.3)
    9 CONTINUE
      CALL FINV(5,5,VARC,IPERM,5,B,DET,JEXP,COND)
      DO 14 K=1,5
      SIGNVR(K)=0.0
      SIGNVJ(K)=0.0
      DO 15 J=1,5
      SIGNVR(K)=SIGNVR(K)+B(K,J)*VMN(J)
      SIGNVJ(K)=SIGNVJ(K)+B(K,J)*1
   15 CONTINUE
   14 CONTINUE
      JSGNVR=0
      JSGNVJ=0
      DO 16 K=1,5
      JSGNVR=JSGNVR+SIGNVR(K)
      JSGNVJ=JSGNVJ+SIGNVJ(K)
   16 CONTINUE
      VLAM=0.010
      DO 18 KL=1,15
      VMV=(JSGNVR-2*VLAM)/JSGNVJ
      W1=1.0/(2.0*VLAM)
      W2=VMV/(2.0*VLAM)
      DO 19 K=1,5
      X(K)=W1*SIGNVR(K)-W2*SIGNVJ(K)
   19 CONTINUE
      SUM=0
      DO 731 I=1,5
      SUM=SUM+X(I)
  731 CONTINUE
      ER=0.0
      VAR=0.0
      DO 20 K=1,5
      ER=ER+X(K)*VMN(K)
      DO 21 J=1,5
      VAR=VAR+X(K)*X(J)*VARC(K,J)
```

```
 21    CONTINUE
 20    CONTINUE
       WRITE(6,282)
282    FORMAT(///,5X,17X,'EXPECTED RETURN',13X,'VARIANCE'///)
       WRITE(6,283)ER,VAR
       WRITE(6,997)
997    FORMAT(/'THE OPTIMAL PROPORTIONS FOR EACH ASSET ARE:'//)
       WRITE(6,998)
998    FORMAT(3X,'T-BILLS',3X,'BONDS',5X,'GOLD',5X,'TSE',7X,'R.E.'
       WRITE(6,284)(X(I),I=1,5)
284    FORMAT(//,10F9.2,/10F9.2)
283    FORMAT(5X,16X,F13.9,15X,F13.9)
       VLAM=VLAM*1.28
 18    CONTINUE
       STOP
       END
```

1970

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.666	0.186	0.044	-0.100	-0.37
AGE	-0.666	1.000	-0.264	-0.118	0.039	0.39
LOC1	0.186	-0.264	1.000	-0.269	-0.236	-0.33
LOC2	0.044	-0.118	-0.269	1.000	-0.190	-0.26
LOC5	-0.100	0.039	-0.236	-0.190	1.000	-0.23
LOC6	-0.379	0.390	-0.333	-0.269	-0.236	1.00
FLAR	0.884	-0.467	0.140	0.024	-0.176	-0.18
LFAST	0.042	-0.015	-0.119	-0.013	0.050	-0.14
LNOST	0.581	-0.422	-0.105	0.051	-0.155	0.12
LLOT	0.868	-0.612	-0.095	0.169	-0.223	-0.21
DM2	-0.134	0.190	0.132	-0.321	0.156	0.13
DM3	0.328	-0.184	0.048	0.162	-0.000	-0.14
DM4	-0.330	0.088	-0.221	0.278	-0.062	0.13
LGIM	0.377	-0.563	0.211	-0.129	0.111	-0.24

	LGIM
LINC9	0.377
AGE	-0.563
LOC1	0.211
LOC2	-0.129
LOC5	0.111
LOC6	-0.249
FLAR	0.290
LFAST	0.436
LNOST	0.297
LLOT	0.428
DM2	-0.224
DM3	0.046
DM4	0.086
LGIM	1.000

MULTIPLE R	0.77675
R SQUARE	0.60333
ADJUSTED R SQUARE	0.40500
STANDARD ERROR	0.18404

ANALYSIS OF VARIANCE

	DF
REGRESSION	9
RESIDUAL	18

F = 3.04202

VARIABLES IN THE EQUATION

VARIABLE	B	SE B	BETA	T	SIG
LINC9	0.03702	0.07504	0.11183	0.493	0.62
LFAST	0.34540	0.11518	0.47333	2.999	0.00
LOC5	0.18411	0.11725	0.27498	1.570	0.13
DM2	-0.14072	0.13406	-0.28051	-1.050	0.30
LOC1	0.15377	0.09778	0.28420	1.573	0.13
DM3	-0.15679	0.13126	-0.28978	-1.194	0.24
LOC6	0.12010	0.10438	0.22196	1.151	0.26
AGE	-0.00514	0.00220	-0.49508	-2.338	0.03
DM4	-0.04751	0.13518	-0.09471	-0.351	0.72
(CONSTANT)	-0.64434	1.08959		-0.591	0.56

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
         -3.0           0.0            3.0
SEQNUM    O:.............:.............:O          LGIM
     1    .              .      *       .        2.0953
     2    .  *           .              .        1.2790
     3    .              .        *     .        1.9354
     4    .              *              .        1.8076
     5    .           *  .              .        1.7489
     6    .            * .              .        1.7817
     7    .              *              .        1.9439
     8    .         *    .              .        1.8050
     9    .           *  .              .        1.6726
    10    .              .*             .        2.0093
    11    .           *  .              .        1.8399
    12    .            * .              .        1.9917
    13    .             *.              .        1.8659
    14    .            * .              .        2.0527
    15    .             *.              .        1.7577
    16    .              .  *           .        1.9124
    17    .              .*             .        1.8759
    18    .              .  *           .        1.9872
    19    .              . *            .        2.0130
    20    .     *        .              .        0.9282
    21    .              *              .        1.6156
    22    .              .    *         .        1.7546
    23    .              .        *     .        1.9703
    24    .              . *            .        1.9833
    25    .          *   .              .        1.7951
    26    .              .    *         .        1.8999
    27    .              .  *           .        1.9261
    28    .             *.              .        1.8291
SEQNUM    O:.............:.............:O          LGIM
         -3.0           0.0            3.0
```

FILE NONAME (CREATION DATE = 02/06/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.2686	2.1225	1.8242	0.1686	28
*ZPRED	-3.2959	1.7699	-0.0000	1.0000	28
*SEPRED	0.0367	0.1379	0.0543	0.0190	28
*ADJPRED	1.5601	2.1357	1.8434	0.1365	28
*MAHAL	0.2182	15.7172	1.9286	2.8479	28
*COOK D	0.0000	5.3060	0.2247	0.9992	28

TOTAL CASES = 28

DURBIN-WATSON TEST = 2.38276

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

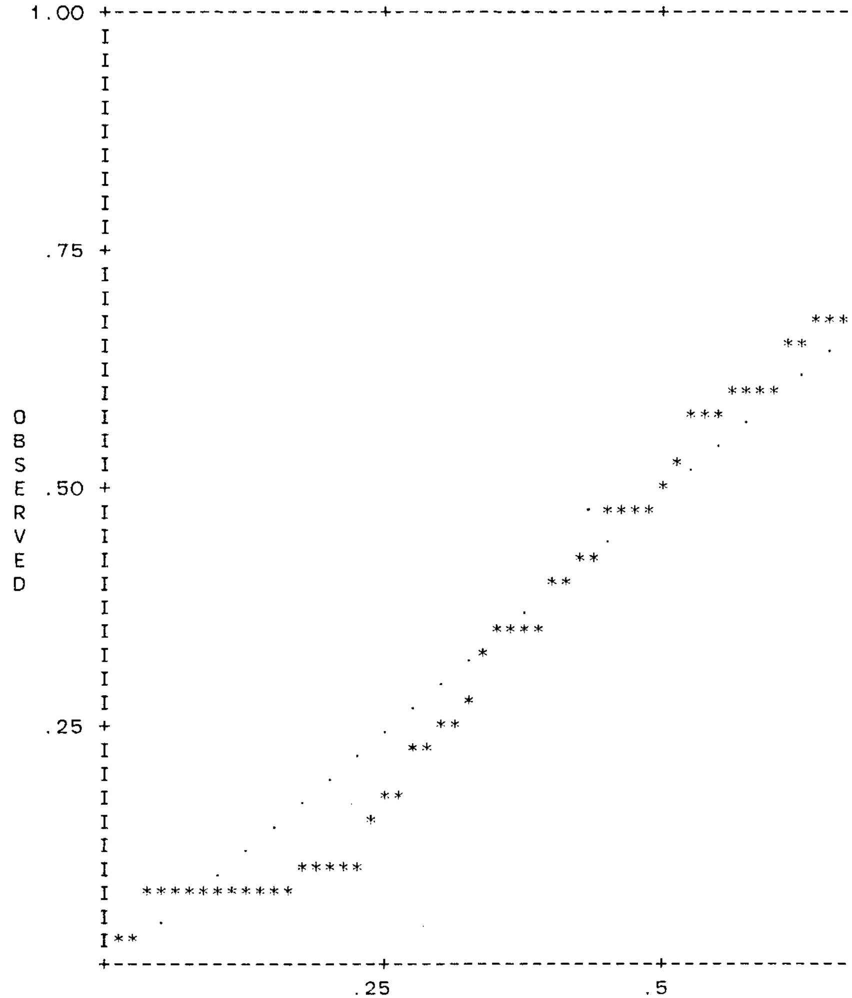
SEQNUM	SUBFILE	*ZRESID
2	NONAME	-2.57561
20	NONAME	-1.93982
3	NONAME	1.75529
23	NONAME	1.71903
1	NONAME	1.33676
22	NONAME	0.97819
8	NONAME	-0.96630
26	NONAME	0.94388
25	NONAME	-0.71622
11	NONAME	-0.69269

```
FILE    NONAME    (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N       ( * = 1 CASES,      . : = NORMAL CURVE)
 0  0.03   OUT
 0  0.02  3.00
 0  0.02  2.87
 0  0.03  2.75
 0  0.04  2.62
 0  0.06  2.50
 0  0.08  2.37
 0  0.11  2.25
 0  0.15  2.12
 0  0.19  2.00
 0  0.24  1.87
 2  0.30  1.75 **
 0  0.37  1.62
 0  0.45  1.50
 1  0.54  1.37 :
 0  0.64  1.25 .
 0  0.74  1.12 .
 2  0.85  1.00 :*
 0  0.95  0.87 .
 0  1.05  0.75 .
 3  1.15  0.62 :**
 0  1.23  0.50 .
 2  1.30  0.37 :*
 1  1.35  0.25 :
 1  1.38  0.12 :
 3  1.40  0.00 :**
 1  1.38 -0.12 :
 2  1.35 -0.25 :*
 2  1.30 -0.37 :*
 2  1.23 -0.50 :*
 1  1.15 -0.62 :
 2  1.05 -0.75 :*
 0  0.95 -0.87 .
 1  0.85 -1.00 :
 0  0.74 -1.12 .
 0  0.64 -1.25 .
 0  0.54 -1.37 .
 0  0.45 -1.50
 0  0.37 -1.62
 0  0.30 -1.75
 0  0.24 -1.87
 1  0.19 -2.00 *
 0  0.15 -2.12
 0  0.11 -2.25
 0  0.08 -2.37
 0  0.06 -2.50
 1  0.04 -2.62 *
 0  0.03 -2.75
 0  0.02 -2.87
 0  0.02 -3.00
 0  0.03   OUT
```

FILE NONAME (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



FILE   NONAME   (CREATION DATE = 02/06/84)

STANDARDIZED SCATTERPLOT

```
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                                     I
    I                                     I     MAX N
  2 +                                     +
    I           ..                        I   .    1.
    I                   .                 I   :    2.
  1 +         .     .                     +
    I                 .. .                I
    I                      :.             I
  0 +          .      . :  .              +
    I                 . . .     . .       I
    I                .  . . .             I
 -1 +                       .             +
    I                                     I
                                          I
 -2 .                                     +
                                          I
    I               .                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

1971

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.693	0.385	0.117	-0.074	-0.33
AGE	-0.693	1.000	-0.134	0.164	-0.199	0.12
LOC1	0.385	-0.134	1.000	-0.207	-0.139	-0.49
LOC2	0.117	0.164	-0.207	1.000	-0.139	-0.49
LOC5	-0.074	-0.199	-0.139	-0.139	1.000	-0.33
LOC6	-0.331	0.125	-0.496	-0.496	-0.334	1.00
FLAR	0.862	-0.613	0.219	0.089	-0.113	-0.27
LFAST	-0.090	0.012	-0.175	0.104	0.186	-0.27
LNOST	0.464	-0.339	0.395	0.007	0.136	-0.41
LLOT	0.854	-0.666	0.027	0.172	-0.110	-0.07
DM2	0.040	0.100	0.093	-0.062	-0.042	0.04
DM3	0.045	-0.072	-0.120	0.216	0.032	-0.18
DM4	0.174	-0.287	0.152	-0.227	0.102	0.02
LGIM	0.173	-0.526	-0.107	-0.087	0.192	0.03

LGIM

LINC9	0.173
AGE	-0.526
LOC1	-0.107
LOC2	-0.087
LOC5	0.192
LOC6	0.035
FLAR	0.302
LFAST	0.057
LNOST	0.079
LLOT	0.312
DM2	0.009
DM3	0.178
DM4	0.007
LGIM	1.000

MULTIPLE R	0.79628
R SQUARE	0.63406
ADJUSTED R SQUARE	0.48159
STANDARD ERROR	0.12099

ANALYSIS OF VARIANCE

	DF
REGRESSION	10
RESIDUAL	24

F = 4.15850

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.47565	0.11412	-1.71090	-4.168	0.00
DM2	0.07802	0.07367	0.23077	1.059	0.30
LOC5	0.58540	0.19305	0.98946	3.032	0.00
LOC2	0.61735	0.18945	1.40481	3.259	0.00
LOC1	0.63322	0.20339	1.44092	3.113	0.00
DM4	0.06187	0.08531	0.14943	0.725	0.47
AGE	-0.00705	0.00161	-0.91751	-4.376	0.00
DM3	0.15525	0.07762	0.42347	2.000	0.05
FLAR	0.40504E-04	0.1110E-04	1.30687	3.649	0.00
LOC6	0.57993	0.17971	1.74431	3.227	0.00
(CONSTANT)	5.64515	0.94772		5.957	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
              -3.0          0.0          3.0
    SEQNUM    O:.............:..............:O        LGIM
         1     . *           .              .       1.4834
         2     .             . *            .       1.9543
         3     .            *.              .       1.8951
         4     .             .     *        .       1.9643
         5     .             . *            .       1.9113
         6     .             . *            .       1.8254
         7     .             .   *          .       2.0133
         8     .       *     .              .       1.6154
```

```
     9     .                *                .        1.7537
    10     .                *                .        1.8656
    11     .              * .                .        1.9490
    12     .                .     *          .        2.2322
    13     .           *    .                .        1.9048
    14     .                .      *         .        1.9720
    15     .               *.                .        1.9636
    16     .                *                .        1.9717
    17     .              * .                .        1.9244
    18     .                .  *             .        1.8274
    19     .                *                .        1.9720
    20     .          *     .                .        1.7206
    21     .                .  *             .        1.9438
    22     .                . *              .        1.8224
    23     .                . *              .        1.6513
    24     .                .      *         .        1.7217
    25     .               *.                .        1.8866
    26     .                .     *          .        1.9602
    27     .                *                .        1.9113
    28     .       *        .                .        1.3571
    29     .             *  .                .        1.5726
    30     .               *.                .        1.7837
    31     .                .   *            .        1.8828
    32     .                *                .        1.9210
    33     .             *  .                .        1.7726
    34     .                *                .        2.0330
    35     .             *  .                .        1.9643
SEQNUM     0:...............:...............:0          LGIM
          -3.0            0.0             3.0
```

FILE NONAME (CREATION DATE = 02/06/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

* * * * * * * * * * * * *

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.5401	2.0959	1.8544	0.1320	35
*ZPRED	-2.3817	1.8300	-0.0000	1.0000	35
*SEPRED	0.0371	0.1189	0.0585	0.0149	35
*ADJPRED	1.5122	2.0623	1.8556	0.1361	35
*MAHAL	2.3449	33.0286	7.7714	5.2737	35
*COOK D	0.0	0.6118	0.0408	0.1046	35

TOTAL CASES = 35

DURBIN-WATSON TEST = 2.02195

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

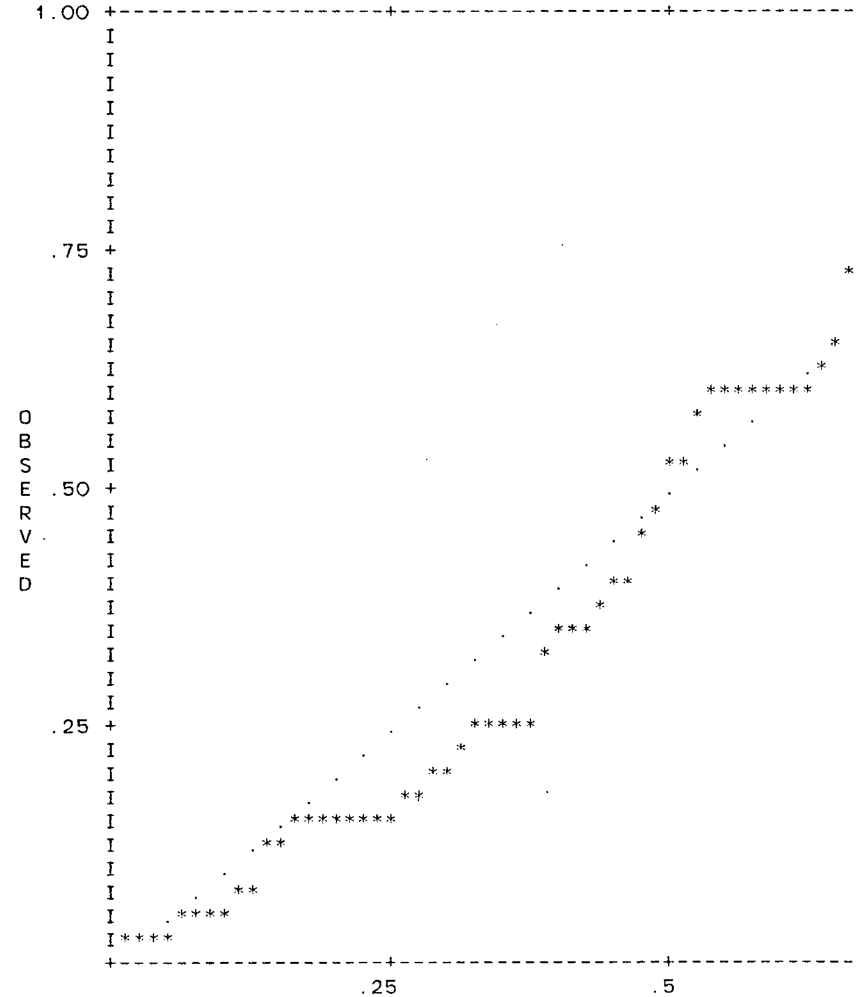
SEQNUM	SUBFILE	*ZRESID
1	NONAME	-2.72133
28	NONAME	-1.53805
4	NONAME	1.34821
24	NONAME	1.34102
14	NONAME	1.32322
20	NONAME	-1.25785
26	NONAME	1.21091
12	NONAME	1.14536
8	NONAME	-1.12219
13	NONAME	-0.98796

```
FILE    NONAME    (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N      ( * = 1 CASES,     . : = NORMAL CURVE)
 0  0.04   OUT
 0  0.02  3.00
 0  0.03  2.87
 0  0.04  2.75
 0  0.06  2.62
 0  0.08  2.50
 0  0.10  2.37
 0  0.14  2.25
 0  0.18  2.12
 0  0.24  2.00
 0  0.30  1.87
 0  0.38  1.75
 0  0.47  1.62
 0  0.57  1.50 .
 3  0.68  1.37 :**
 1  0.80  1.25 :
 1  0.93  1.12 :
 0  1.06  1.00 .
 0  1.19  0.87 .
 2  1.32  0.75 :*
 2  1.44  0.62 :*
 0  1.54  0.50  .
 5  1.63  0.37 *:***
 0  1.69  0.25  .
 1  1.73  0.12 *.
 4  1.74  0.00 *:**
 3  1.73 -0.12 *:*
 4  1.69 -0.25 *:**
 0  1.63 -0.37  .
 2  1.54 -0.50 *:
 2  1.44 -0.62 :*
 0  1.32 -0.75 .
 0  1.19 -0.87 .
 1  1.06 -1.00 :
 1  0.93 -1.12 :
 1  0.80 -1.25 :
 0  0.68 -1.37 .
 1  0.57 -1.50 :
 0  0.47 -1.62
 0  0.38 -1.75
 0  0.30 -1.87
 0  0.24 -2.00
 0  0.18 -2.12
 0  0.14 -2.25
 0  0.10 -2.37
 0  0.08 -2.50
 0  0.06 -2.62
 1  0.04 -2.75 *
 0  0.03 -2.87
 0  0.02 -3.00
 0  0.04   OUT
```

FILE NONAME (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



FILE   NONAME   (CREATION DATE = 02/06/84)

STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED   DOWN - *ZRESID

```
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                                     I
    I                                     I     MAX N
  2 +                                     +
    I                                     I   .    1.
    I     .          *                    I   :    2.
  1 +                         .   .       +   *    3.
    I              ..   . .               I
    I       .      :   .  .               I
  0 +             .     ..: .. .          +
    I                .    .  *            I
    I         .       .        .          I
 -1 +             .            .          +
    I                   .                 I
    I    .                                I
 -2 +                                     +
    I                                     I
    I                .                    I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

1972

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.417	0.554	-0.202	-0.042	-0.24
AGE	-0.417	1.000	-0.032	0.160	0.198	-0.20
LOC1	0.554	-0.032	1.000	-0.225	-0.298	-0.43
LOC2	-0.202	0.160	-0.225	1.000	-0.195	-0.28
LOC5	-0.042	0.198	-0.298	-0.195	1.000	-0.24
LOC6	-0.240	-0.200	-0.439	-0.287	-0.248	1.00
FLAR	0.885	-0.247	0.552	-0.210	-0.099	-0.20
LFAST	0.033	0.163	0.080	0.201	0.061	-0.24
LNOST	0.664	-0.392	0.454	-0.159	-0.239	-0.06
LLOT	0.808	-0.340	0.356	-0.142	-0.116	-0.02
DM2	0.175	-0.009	-0.088	0.262	0.135	-0.02
DM3	-0.200	0.009	-0.107	0.101	-0.036	0.00
DM4	-0.123	-0.003	-0.107	-0.240	-0.036	0.12
LGIM	-0.076	-0.294	-0.067	0.161	-0.152	0.21

LGIM

LINC9	-0.076
AGE	-0.294
LOC1	-0.067
LOC2	0.161
LOC5	-0.152
LOC6	0.211
FLAR	-0.043
LFAST	0.182
LNOST	0.159
LLOT	-0.065
DM2	0.025
DM3	0.192
DM4	-0.251
LGIM	1.000

MULTIPLE R	0.61843
R SQUARE	0.38245
ADJUSTED R SQUARE	0.13086
STANDARD ERROR	0.18168

ANALYSIS OF VARIANCE

	DF
REGRESSION	11
RESIDUAL	27

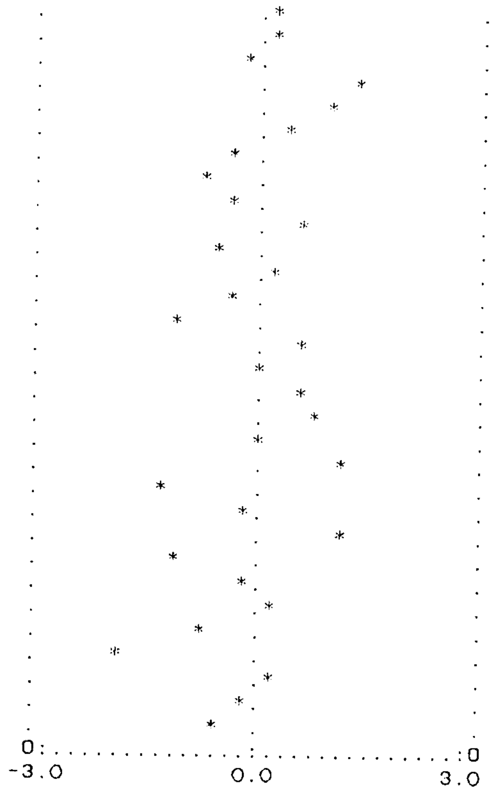
F = 1.52013

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	0.00715	0.10120	0.02585	0.071	0.94
LFAST	0.29350	0.15226	0.34930	1.928	0.06
DM4	-0.11140	0.08468	-0.26061	-1.316	0.19
DM2	-0.06060	0.10198	-0.11366	-0.594	0.55
LOC6	0.20394	0.10744	0.50859	1.898	0.06
AGE	-0.00355	0.00154	-0.43807	-2.303	0.02
DM3	-0.02286	0.08468	-0.05348	-0.270	0.78
LOC2	0.19164	0.14265	0.33306	1.343	0.19
LOC1	0.13574	0.13332	0.30813	1.018	0.31
LLOT	-0.16461	0.13864	-0.36300	-1.187	0.24
(CONSTANT)	1.41488	1.05392		1.342	0.19

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
           -3.0             0.0            3.0
  SEQNUM    O:...............:..............:O          LGIM
       1     .               .               *        2.5268
       2     .               *               .        1.9476
       3     .              *.               .        1.8058
       4     .           *   .               .        1.9210
       5     .               .*              .        2.0055
       6     .             * .               .        1.9055
       7     .         *     .               .        1.5619
```



SEQNUM	LGIM
8	2.0381
9	1.9000
10	1.8943
11	2.0730
12	2.2933
13	2.0104
14	1.9119
15	1.8271
16	1.9803
17	1.9699
18	1.9238
19	1.9866
20	1.7921
21	1.7722
22	2.1669
23	1.7615
24	1.9622
25	1.8933
26	2.0254
27	2.0456
28	1.6797
29	1.9048
30	2.0090
31	1.5968
32	1.9633
33	1.9622
34	1.8874
35	1.3156
36	1.9360
37	2.0480
38	1.9199

```
FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL


          -3.0            0.0            3.0
  SEQNUM   O:..............:..............:O          LGIM
      39   .               .   *          .        2.0259
  SEQNUM   O:..............:..............:O          LGIM
          -3.0            0.0            3.0
```

* * * * * * * * * * * * *

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.6704	2.1117	1.9269	0.1019	39
*ZPRED	-2.5185	1.8145	-0.0000	1.0000	39
*SEPRED	0.0351	0.1040	0.0610	0.0156	39
*ADJPRED	1.7205	2.0867	1.9277	0.1017	39
*MAHAL	0.5406	12.3611	3.8974	2.5565	39
*COOK D	0.0001	0.6800	0.0499	0.1332	39

TOTAL CASES =   39

DURBIN-WATSON TEST =   1.73371

FILE NONAME (CREATION DATE = 02/06/84)

OUTLIERS - STANDARDIZED RESIDUAL

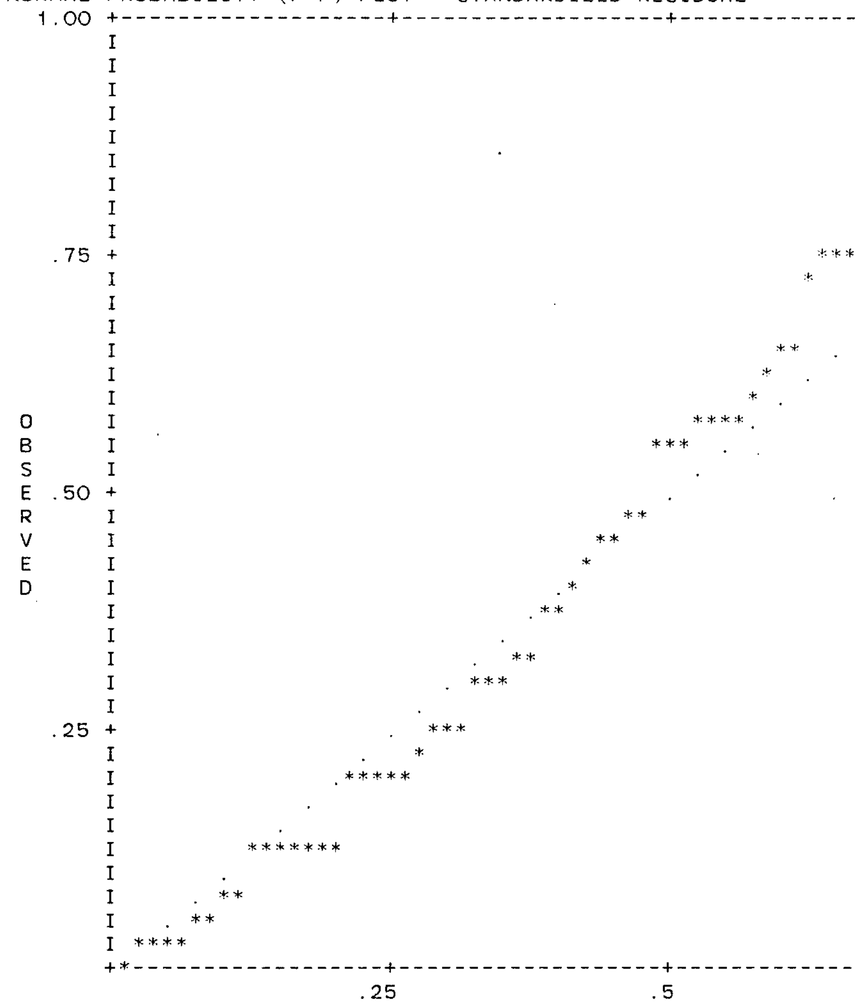
SEQNUM	SUBFILE	*ZRESID
1	NONAME	3.26051
35	NONAME	-2.02022
28	NONAME	-1.44804
11	NONAME	1.40058
31	NONAME	-1.29031
30	NONAME	1.27666
21	NONAME	-1.20674
7	NONAME	-1.20032
27	NONAME	1.17467
12	NONAME	1.03389

```
FILE   NONAME   (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N      ( * = 1 CASES,     . : = NORMAL CURVE)
 1  0.04   OUT *
 0  0.02  3.00
 0  0.03  2.87
 0  0.04  2.75
 0  0.06  2.62
 0  0.09  2.50
 0  0.12  2.37
 0  0.16  2.25
 0  0.20  2.12
 0  0.26  2.00
 0  0.34  1.87
 0  0.42  1.75
 0  0.52  1.62 .
 0  0.63  1.50 .
 1  0.76  1.37 :
 1  0.89  1.25 :
 1  1.03  1.12 :
 1  1.18  1.00 :
 2  1.33  0.87 :*
 0  1.47  0.75 .
 3  1.60  0.62 *:*
 0  1.72  0.50  .
 1  1.81  0.37 *.
 5  1.88  0.25 *:***
 1  1.93  0.12 *.
 3  1.94  0.00 *:*
 2  1.93 -0.12 *:
 4  1.88 -0.25 *:**
 1  1.81 -0.37 *.
 2  1.72 -0.50 *:
 2  1.60 -0.62 *:
 1  1.47 -0.75 :
 2  1.33 -0.87 :*
 0  1.18 -1.00 .
 0  1.03 -1.12 .
 3  0.89 -1.25 :**
 0  0.76 -1.37 .
 1  0.63 -1.50 :
 0  0.52 -1.62 .
 0  0.42 -1.75
 0  0.34 -1.87
 1  0.26 -2.00 *
 0  0.20 -2.12
 0  0.16 -2.25
 0  0.12 -2.37
 0  0.09 -2.50
 0  0.06 -2.62
 0  0.04 -2.75
 0  0.03 -2.87
 0  0.02 -3.00
 0  0.04   OUT
```

FILE NONAME (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



FILE NONAME (CREATION DATE = 02/06/84)

```
STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                  .                  I
    I                                     I      MAX N
  2 +                                     +
    I                                     I   .     1.
    I           .  ..               .     I   :     2.
  1 +                .            .       +   *     3.
    I         .     ..         .          I
    I                 ..  .: .            I
  0 +         .      .  . .   .           +
    I               ..  .  : ..  .        I
    I                     .   * .         I
 -1 +                                     +
    I          .  .     .  .              I
    I                                     I
 -2 +    .                                +
    I                                     I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
     -3    -2    -1     0     1     2     3 OUT
```

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CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.488	0.668	-0.153	-0.060	-0.36
AGE	-0.488	1.000	-0.411	0.185	0.185	0.27
LOC1	0.668	-0.411	1.000	-0.189	-0.189	-0.58
LOC2	-0.153	0.185	-0.189	1.000	-0.098	-0.30
LOC5	-0.060	0.185	-0.189	-0.098	1.000	0.07
LOC6	-0.369	0.271	-0.584	-0.302	0.074	1.00
FLAR	0.757	-0.418	0.422	-0.120	-0.072	-0.34
LFAST	0.131	0.000	-0.039	0.087	0.100	0.07
LNOST	0.610	-0.387	0.253	0.001	-0.070	-0.17
LLOT	0.213	-0.245	0.229	0.064	-0.444	-0.29
DM2	0.078	-0.005	0.077	0.142	-0.011	-0.06
DM3	0.062	-0.101	-0.070	-0.036	-0.181	-0.06
DM4	0.099	-0.007	0.049	0.124	-0.024	-0.02
LGIM	0.073	-0.475	0.144	0.180	-0.063	-0.28

	LGIM
LINC9	0.073

AGE	-0.475
LOC1	0.144
LOC2	0.180
LOC5	-0.063
LOC6	-0.289
FLAR	0.201
LFAST	-0.062
LNOST	0.225
LLOT	0.222
DM2	0.003
DM3	-0.093
DM4	0.103
LGIM	1.000

MULTIPLE R	0.66608	ANALYSIS OF VARIANCE	
R SQUARE	0.44367		DF
ADJUSTED R SQUARE	0.32004	REGRESSION	10
STANDARD ERROR	0.20867	RESIDUAL	45
		F = 3.58866	

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.25185	0.09094	-0.64432	-2.769	0.00
LOC5	0.11855	0.11420	0.13480	1.038	0.30
DM2	-0.00179	0.08536	-0.00293	-0.021	0.98
LOC2	0.22997	0.10554	0.26149	2.179	0.03
DM3	-0.09714	0.08158	-0.16773	-1.191	0.24
LLOT	0.02975	0.02600	0.14790	1.144	0.25
AGE	-0.00652	0.00147	-0.58927	-4.440	0.00
DM4	0.06197	0.08534	0.10434	0.726	0.47
LOC1	0.09702	0.09129	0.17133	1.063	0.29
FLAR	0.11436E-04	0.4987E-05	0.43875	2.293	0.02
(CONSTANT)	4.18512	0.88906		4.707	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
           -3.0           0.0            3.0
 SEQNUM    0:.............:..............:0          LGIM
      1    .           *  .              .          2.1801
      2    .              .   *          .          2.1014
      3    .              .     *        .          2.2015
      4    .              .*             .          1.8881
      5    .              .   *          .          1.7896
      6    .       *      .              .          1.6916
```

```
     7   .             * .               .          1.9663
     8   .               *               .          1.9285
     9   .               *               .          1.8540
    10   .               .*              .          2.0608
    11   .           *   .               .          1.8279
    12   .               . *             .          2.1469
    13   .           *   .               .          1.9671
    14   .        *      .               .          1.7979
    15   .              *.               .          1.9386
    16   .               .*              .          1.7792
    17   .           *   .               .          1.8743
    18   .               .*              .          2.0609
    19   .               . *             .          2.1826
    20   .               .    *          .          2.0777
    21   .               *               .          1.8669
    22   .             * .               .          1.9327
    23   .               .   *           .          1.8934
    24   .               .  *            .          1.8658
    25   .      *        .               .          1.3016
    26   .               .             * .          2.1292
    27   .          *    .               .          1.5306
    28   .               .    *          .          2.0501
    29   .              *.               .          1.7042
    30   .               .  *            .          2.0577
    31   .               .   *           .          2.0023
    32   .               *               .          1.8690
    33   .               . *             .          2.0193
    34   .           *   .               .          1.4022
    35   .    *          .               .          1.1128
    36   .               *               .          1.7336
    37   .              *.               .          1.6941
    38   .               .*              .          1.9798
SEQNUM   0:..............:..............:0            LGIM
        -3.0            0.0            3.0
```

FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
           -3.0          0.0          3.0
  SEQNUM   O:...............:..............:O          LGIM
      39    .               .  *           .         1.7544
      40    .               .      *       .         2.0085
      41    .               . *            .         1.7482
      42    .               *              .         2.0534
      43    .               . *            .         2.0870
      44.   .               *              .         2.0990
      45    *               .              .         0.9239
      46    .        *      .              .         1.4628
      47    .            *  .              .         1.7532
      48    .               .    *         .         2.0623
      49    .               .  *           .         1.8856
      50    .               .*             .         1.9851
      51    .               . *            .         1.9481
      52    .              *.              .         1.8732
      53    .               . *            .         2.0619
      54    .               *              .         1.9301
      55    .          *    .              .         1.9285
      56    .               .   *          .         2.0680
  SEQNUM   O:...............:..............:O          LGIM
           -3.0          0.0          3.0
```

FILE NONAME (CREATION DATE = 02/06/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.5744	2.2872	1.8767	0.1603	56
*ZPRED	-1.8849	2.5604	-0.0000	1.0000	56
*SEPRED	0.0370	0.1268	0.0633	0.0229	56
*ADJPRED	1.4902	2.3288	1.8770	0.1643	56
*MAHAL	0.8011	20.0048	4.9107	4.6780	56
*COOK D	0.0000	0.3179	0.0244	0.0575	56

TOTAL CASES = 56

DURBIN-WATSON TEST = 2.01126

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

SEQNUM	SUBFILE	*ZRESID
45	NONAME	-3.32209
26	NONAME	2.70164
35	NONAME	-2.29126
25	NONAME	-1.84541
14	NONAME	-1.43436
40	NONAME	1.35646
6	NONAME	-1.34934
46	NONAME	-1.28536
3	NONAME	1.24258
28	NONAME	1.07308

```
FILE   NONAME   (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N      ( * = 1 CASES,     . : = NORMAL CURVE)
 0  0.06   OUT
 0  0.03  3.00
 0  0.04  2.87
 1  0.06  2.75 *
 0  0.09  2.62
 0  0.12  2.50
 0  0.17  2.37
 0  0.22  2.25
 0  0.29  2.12
 0  0.38  2.00
 0  0.48  1.87
 0  0.60  1.75 .
 0  0.75  1.62 .
 0  0.91  1.50 .
 1  1.09  1.37 :
 1  1.28  1.25 :
 1  1.48  1.12 :
 2  1.69  1.00 *:
 1  1.90  0.87 *.
 4  2.11  0.75 *:**
 4  2.30  0.62 *:**
 1  2.46  0.50 *.
 6  2.60  0.37 **:***
 5  2.71  0.25 **:**
 4  2.77  0.12 **:*
 4  2.79  0.00 **:*
 2  2.77 -0.12 **.
 3  2.71 -0.25 **:
 1  2.60 -0.37 *  .
 4  2.46 -0.50 *:**
 0  2.30 -0.62   .
 3  2.11 -0.75 *:*
 1  1.90 -0.87 *.
 0  1.69 -1.00   .
 1  1.48 -1.12 :
 1  1.28 -1.25 :
 2  1.09 -1.37 :*
 0  0.91 -1.50 .
 0  0.75 -1.62 .
 0  0.60 -1.75 .
 1  0.48 -1.87 *
 0  0.38 -2.00
 0  0.29 -2.12
 1  0.22 -2.25 *
 0  0.17 -2.37
 0  0.12 -2.50
 0  0.09 -2.62
 0  0.06 -2.75
 0  0.04 -2.87
 0  0.03 -3.00
 1  0.06   OUT *
```

```
FILE    NONAME    (CREATION DATE = 02/06/84)



NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL
  1.00 +-------------------+-------------------+-------------
       I
       I
       I
       I
       I
       I
       I
       I
       I
   .75 +
       I                                                    *
       I
       I
       I                                                  **
       I                                                 .
       I                                               .**
 O     I                                             .
 B     I                                           .   *
 S     I                                         . ****
 E .50 +                                       .
 R     I                                     .    *
 V     I                                   .     *
 E     I                                 .      *
 D     I                               .       *
       I                             .       **
       I                           .      ***
       I                         .      **
       I                       .       *
       I                     .   ******
   .25 +                   .    *
       I                 .     *
       I               .  *****
       I             .
       I           .   ***
       I         . ****
       I       ****
       I     .*
       I  ****
       I**
       +-------------------+-------------------+-------------
                          .25                 .5
```

FILE   NONAME   (CREATION DATE = 02/06/84)

```
STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED      DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I        .                            I
    I                                     I      MAX N
  2 +                                     +
    I                                     I   .     1.
    I              .       .              I   :     2.
  1 +                 ....                +   *     3.
    I         ..  .:   .  ..              I
    I           .     . . * .*  :         I
  0 +             ..  ... ..    ..        +
    I             ..   .  . . :           I
    I                        . :  .     . I
 -1 +        .     .                      +
    I             .        .    .         I
    I                                     I
 -2 +            .                        +
    I        .                            I
    I                                     I
 -3 +                                     +
OUT ++-----+ . --+-----+-----+-----+-----++
     -3    -2    -1     0     1     2     3 OUT
```

1974

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.435	0.028	-0.166	-0.234	0.27
AGE	-0.435	1.000	-0.034	-0.145	0.123	-0.02
LOC1	0.028	-0.034	1.000	-0.107	-0.160	-0.36
LOC2	-0.166	-0.145	-0.107	1.000	-0.160	-0.36
LOC5	-0.234	0.123	-0.160	-0.160	1.000	-0.54
LOC6	0.277	-0.029	-0.361	-0.361	-0.540	1.00
FLAR	0.906	-0.437	-0.034	-0.202	-0.219	0.34
LFAST	-0.275	-0.272	-0.018	0.013	0.262	-0.26
LNOST	0.461	-0.446	-0.082	-0.032	-0.438	0.35
LLOT	0.760	-0.713	-0.040	-0.116	-0.162	0.23
DM2	0.108	-0.107	0.008	-0.226	-0.338	0.34
DM3	-0.117	-0.015	-0.107	0.262	0.392	-0.36
DM4	-0.063	-0.008	0.153	0.153	0.007	-0.30
LGIM	-0.211	-0.541	0.204	0.231	0.063	-0.33

LGIM

LINC9	-0.211
AGE	-0.541
LOC1	0.204
LOC2	0.231
LOC5	0.063
LOC6	-0.336
FLAR	-0.076
LFAST	0.552
LNOST	-0.038
LLOT	0.200
DM2	-0.016
DM3	0.100
DM4	-0.040
LGIM	1.000

MULTIPLE R	0.84246
R SQUARE	0.70975
ADJUSTED R SQUARE	0.58535
STANDARD ERROR	0.14058

ANALYSIS OF VARIANCE

	DF
REGRESSION	9
RESIDUAL	21

F = 5.70563

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.13743	0.05920	-0.35143	-2.321	0.03
DM2	-0.04216	0.06254	-0.09177	-0.674	0.50
DM3	-0.08483	0.10169	-0.11678	-0.834	0.41
LFAST	0.19599	0.08475	0.34261	2.313	0.03
DM4	-0.18039	0.08326	-0.30894	-2.167	0.04
LOC5	-0.10506	0.09146	-0.19328	-1.149	0.26
AGE	-0.00569	0.00143	-0.59829	-3.989	0.00
LOC6	-0.14989	0.08311	-0.34733	-1.803	0.08
(CONSTANT)	2.43881	0.97716		2.496	0.02

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
          -3.0            0.0            3.0
 SEQNUM    O:..............:..............:O          LGIM
      1     .              .   *           .         2.2154
      2     .             *.               .         2.0522
      3     .              .   *           .         2.1143
      4     .              . *             .         1.9816
      5     .              *               .         2.1957
      6     .              .    *          .         2.0280
      7     .              . *             .         1.9432
      8     .            * .               .         1.8302
```

```
     9   .               .*              .       2.2405
    10   .             * .               .       1.9566
    11   .               . *             .       2.1337
    12   .        *      .               .       1.8681
    13   .           *   .               .       2.0610
    14   .      *        .               .       1.8704
    15   .       *       .               .       2.0129
    16   .          *    .               .       1.7265
    17   .               .        *      .       2.3657
    18   .               *               .       2.0611
    19   .      *        .               .       1.5293
    20   .               .*              .       2.1876
    21   .               . *             .       1.5911
    22   .               .     *         .       2.0693
    23   .               .        *      .       2.2247
    24   .               . *             .       1.9100
    25   .           *   .               .       1.7373
    26   .               .   *           .       2.1317
    27   .               *               .       2.0157
    28   .          *    .               .       1.4474
    29   .               .*              .       2.1273
    30   .              *.               .       2.1107
    31   .               .  *            .       2.2458
SEQNUM   0:..............:..............:0         LGIM
        -3.0            0.0            3.0
```

FILE NONAME (CREATION DATE = 02/06/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.5295	2.2355	1.9995	0.1672	31
*ZPRED	-2.8113	1.4116	-0.0000	1.0000	31
*SEPRED	0.0318	0.0926	0.0505	0.0170	31
*ADJPRED	1.4898	2.2778	2.0010	0.1672	31
*MAHAL	0.4198	10.7847	2.9032	2.8034	31
*COOK D	0.0000	0.2666	0.0370	0.0554	31

TOTAL CASES = 31

DURBIN-WATSON TEST = 1.51312

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

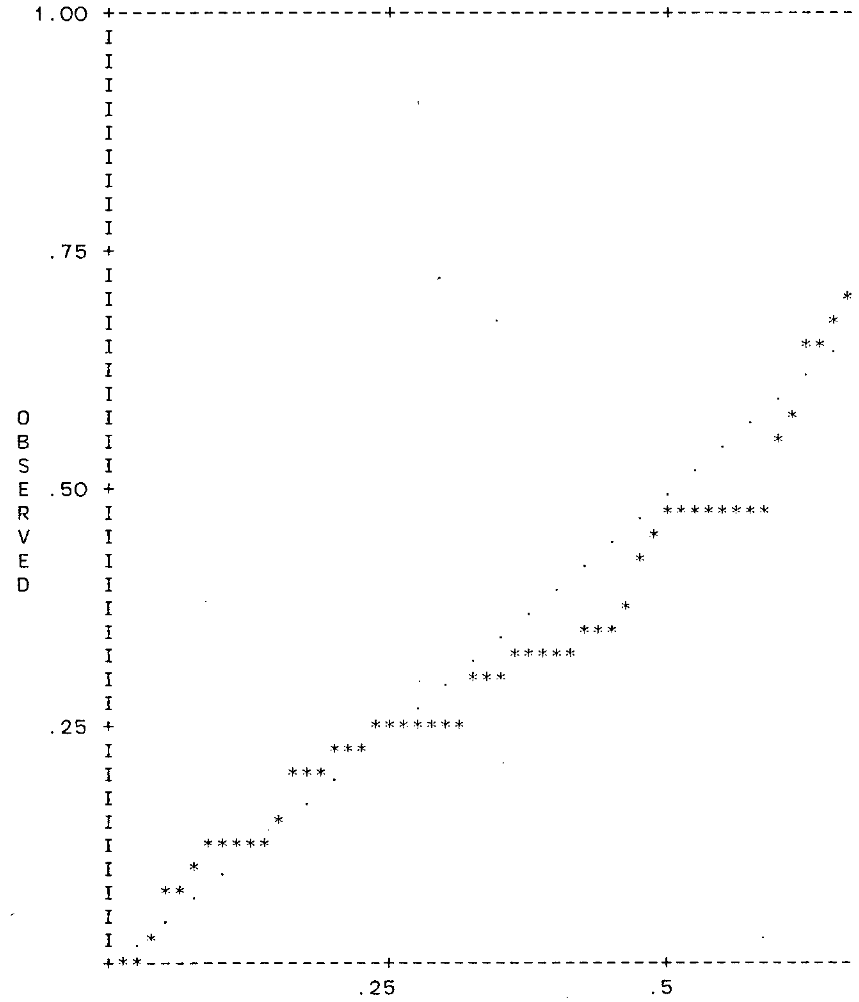
SEQNUM	SUBFILE	*ZRESID
23	NONAME	1.86060
17	NONAME	1.79273
19	NONAME	-1.78101
14	NONAME	-1.76555
15	NONAME	-1.50444
12	NONAME	-1.43084
22	NONAME	1.27155
28	NONAME	-1.07586
6	NONAME	1.03803
16	NONAME	-1.03069

```
FILE   NONAME   (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N      ( * = 1 CASES,     . : = NORMAL CURVE)
 0  0.03   OUT
 0  0.02  3.00
 0  0.02  2.87
 0  0.04  2.75
 0  0.05  2.62
 0  0.07  2.50
 0  0.09  2.37
 0  0.12  2.25
 0  0.16  2.12
 0  0.21  2.00
 1  0.27  1.87 *
 1  0.33  1.75 *
 0  0.41  1.62
 0  0.50  1.50 .
 0  0.60  1.37 .
 1  0.71  1.25 :
 0  0.82  1.12 .
 1  0.94  1.00 :
 0  1.05  0.87 .
 4  1.17  0.75 :***
 0  1.27  0.62 .
 1  1.36  0.50 :
 3  1.44  0.37 :**
 4  1.50  0.25 :***
 0  1.53  0.12  .
 2  1.54  0.00 *:
 2  1.53 -0.12 *:
 1  1.50 -0.25 :
 1  1.44 -0.37 :
 1  1.36 -0.50 :
 0  1.27 -0.62 .
 1  1.17 -0.75 :
 1  1.05 -0.87 :
 1  0.94 -1.00 :
 1  0.82 -1.12 :
 0  0.71 -1.25 .
 1  0.60 -1.37 :
 1  0.50 -1.50 :
 0  0.41 -1.62
 2  0.33 -1.75 **
 0  0.27 -1.87
 0  0.21 -2.00
 0  0.16 -2.12
 0  0.12 -2.25
 0  0.09 -2.37
 0  0.07 -2.50
 0  0.05 -2.62
 0  0.04 -2.75
 0  0.02 -2.87
 0  0.02 -3.00
 0  0.03   OUT
```

FILE NONAME (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



```
FILE   NONAME   (CREATION DATE = 02/06/84)

STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                                     I
    I                                     I      MAX N
  2 +                ..                   +
    I                      .              I   .     1.
    I              .                      I   :     2.
  1 +              .                      +
    I                  ..  ..             I
    I .            ...     :  ..          I
  0 +                   ..  . .           +
    I              .    . .               I
    I                       .             I
 -1 +    .        ..                      +
    I                     .               I
    I           .           .  .          I
 -2 +                                     +
    I                                     I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

1975

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.236	0.247	-0.204	-0.341	-0.00
AGE	-0.236	1.000	0.271	0.129	-0.009	-0.35
LOC1	0.247	0.271	1.000	-0.197	-0.327	-0.54
LOC2	-0.204	0.129	-0.197	1.000	-0.104	-0.17
LOC5	-0.341	-0.009	-0.327	-0.104	1.000	-0.11
LOC6	-0.003	-0.356	-0.544	-0.173	-0.110	1.00
FLAR	0.765	0.087	0.188	-0.162	-0.220	0.01
LFAST	-0.070	0.138	0.006	0.024	0.260	-0.20
LNOST	0.524	0.224	0.195	-0.111	-0.039	-0.14
LLOT	0.775	-0.417	-0.058	-0.130	-0.220	0.20
DM2	-0.208	0.481	-0.109	0.113	-0.086	-0.03
DM3	0.046	-0.360	-0.370	0.061	0.015	0.23
DM4	0.167	-0.102	0.430	-0.116	-0.192	-0.15
LGIM	-0.501	-0.330	-0.141	0.312	0.228	0.01

LGIM

LINC9	-0.501
AGE	-0.330
LOC1	-0.141
LOC2	0.312
LOC5	0.228
LOC6	0.018
FLAR	-0.366
LFAST	0.227
LNOST	-0.411
LLOT	-0.139
DM2	-0.266
DM3	0.222
DM4	0.045
LGIM	1.000

10.. FLAR

MULTIPLE R	0.87239	ANALYSIS OF VARIANCE	
R SQUARE	0.76106		DF
ADJUSTED R SQUARE	0.65717	REGRESSION	10
STANDARD ERROR	0.10302	RESIDUAL	23
		F =	7.32587

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.37152	0.06511	-1.38737	-5.706	0.00
DM3	0.00731	0.06512	0.02049	0.112	0.91
LOC2	0.25810	0.08147	0.35036	3.168	0.00
LOC5	0.06690	0.06308	0.13669	1.061	0.29
DM4	0.05590	0.06638	0.12293	0.842	0.40
AGE	-0.00446	0.00118	-0.58933	-3.762	0.00
LOC1	0.13007	0.05384	0.36467	2.416	0.02
DM2	-0.02016	0.06824	-0.05299	-0.295	0.77
LLOT	0.18458	0.06950	0.49403	2.656	0.01
FLAR	0.88627E-05	0.3688E-05	0.47139	2.403	0.02
(CONSTANT)	4.19436	0.63355		6.620	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
           -3.0           0.0           3.0
  SEQNUM    O:..............:..............:O          LGIM
       1    .               .    *         .         2.4785
       2    .               .   *          .         2.1502
       3    .               .   *          .         2.1263
       4    .          *    .              .         1.7989
```

```
     5   .               .   *           .      2.1738
     6   .               .      *        .      1.9842
     7   .       *       .               .      1.7558
     8   .               . *             .      1.9280
     9   .             * .               .      1.9925
    10   .               *               .      2.0101
    11   .               .      *        .      2.3183
    12   .               *               .      1.9821
    13   .              *.               .      1.9907
    14   .            *  .               .      1.9171
    15   .             * .               .      2.2085
    16   .               .*              .      2.2314
    17   .               .    *          .      2.0329
    18   .               .     *         .      2.1449
    19   .          *    .               .      1.8819
    20   .               .*              .      2.1331
    21   .            *  .               .      2.1320
    22   .       *       .               .      2.1594
    23   .               .   *           .      1.9308
    24   .          *    .               .      1.9880
    25   .               .*              .      2.0267
    26   .               .        *      .      2.4065
    27   .               *               .      2.1660
    28   .          *    .               .      2.0941
    29   .               *               .      2.1308
    30   .      *        .               .      1.9891
    31   .            *  .               .      1.6068
    32   .            *  .               .      2.0675
    33   .               .*              .      2.2595
    34   .               *               .      2.1742
SEQNUM   O:..............:..............:O        LGIM
        -3.0            0.0            3.0
```

FILE NONAME (CREATION DATE = 02/06/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.6656	2.3677	2.0697	0.1504	34
*ZPRED	-2.6871	1.9812	-0.0000	1.0000	34
*SEPRED	0.0268	0.0821	0.0434	0.0149	34
*ADJPRED	1.7337	2.4074	2.0691	0.1487	34
*MAHAL	1.3624	20.8647	5.8235	5.1259	34
*COOK D	0.0000	0.6438	0.0744	0.1474	34

TOTAL CASES = 34

DURBIN-WATSON TEST = 2.04040

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

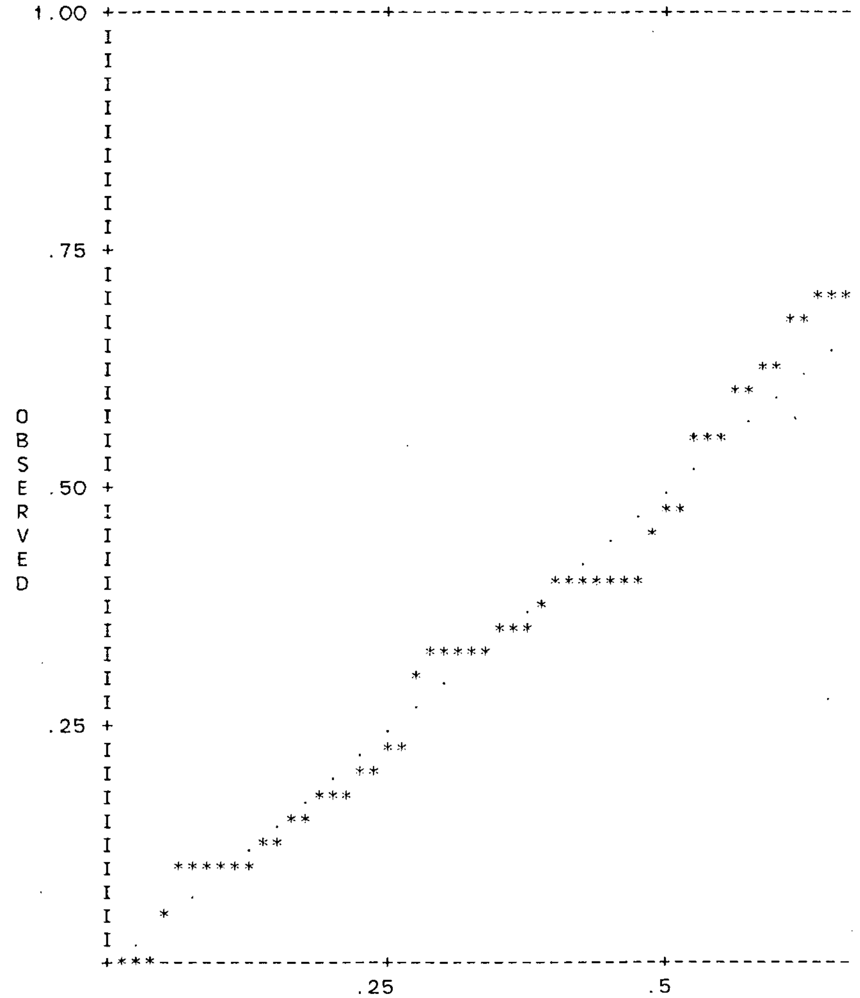
SEQNUM	SUBFILE	*ZRESID
30	NONAME	-1.75639
26	NONAME	1.70428
22	NONAME	-1.65217
7	NONAME	-1.56797
11	NONAME	1.37354
6	NONAME	1.30992
18	NONAME	1.21125
28	NONAME	-1.09741
1	NONAME	1.09741
19	NONAME	-1.02437

```
FILE    NONAME    (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N       ( * = 1 CASES,     . : = NORMAL CURVE)
 0  0.04    OUT
 0  0.02   3.00
 0  0.03   2.87
 0  0.04   2.75
 0  0.05   2.62
 0  0.07   2.50
 0  0.10   2.37
 0  0.14   2.25
 0  0.18   2.12
 0  0.23   2.00
 0  0.29   1.87
 1  0.37   1.75 *
 0  0.45   1.62
 0  0.55   1.50 .
 1  0.66   1.37 :
 2  0.78   1.25 :*
 1  0.90   1.12 :
 0  1.03   1.00 .
 5  1.16   0.87 :****
 0  1.28   0.75 .
 0  1.39   0.62 .
 0  1.50   0.50 .
 1  1.58   0.37 *.
 3  1.64   0.25 *:*
 1  1.68   0.12 *.
 5  1.69   0.00 *:***
 0  1.68  -0.12  .
 1  1.64  -0.25 *.
 2  1.58  -0.37 *:
 0  1.50  -0.50 .
 4  1.39  -0.62 :***
 1  1.28  -0.75 :
 1  1.16  -0.87 :
 1  1.03  -1.00 :
 1  0.90  -1.12 :
 0  0.78  -1.25 .
 0  0.66  -1.37 .
 0  0.55  -1.50 .
 2  0.45  -1.62 **
 1  0.37  -1.75 *
 0  0.29  -1.87
 0  0.23  -2.00
 0  0.18  -2.12
 0  0.14  -2.25
 0  0.10  -2.37
 0  0.07  -2.50
 0  0.05  -2.62
 0  0.04  -2.75
 0  0.03  -2.87
 0  0.02  -3.00
 0  0.04    OUT
```

FILE NONAME (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



FILE   NONAME   (CREATION DATE = 02/06/84)

```
STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                                     I
    I                                     I     MAX N
  2 +                                     +
    I                         .           I   .    1.
    I         .      .     .              I   :    2.
  1 +         .   .   ..           .      +
    I                   .                 I
    I           .        .  . .           I
  0 +              . :   . :              +
    I                ..       .           I
    I  .       .    .    .  .             I
 -1 +               .  .    .             +
    I                                     I
    I            .         .     .        I
 -2 +                                     +
    I                                     I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

1976

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.341	0.491	-0.148	0.038	-0.44
AGE	-0.341	1.000	-0.141	-0.246	0.204	0.30
LOC1	0.491	-0.141	1.000	-0.145	-0.241	-0.56
LOC2	-0.148	-0.246	-0.145	1.000	-0.094	-0.22
LOC5	0.038	0.204	-0.241	-0.094	1.000	-0.20
LOC6	-0.449	0.304	-0.561	-0.220	-0.206	1.00
FLAR	0.831	-0.258	0.408	-0.169	-0.118	-0.43
LFAST	0.173	-0.181	0.118	-0.121	0.084	-0.41
LNOST	0.548	-0.235	0.379	-0.044	-0.265	-0.06
LLOT	0.798	-0.625	0.282	-0.085	-0.091	-0.36
DM2	0.204	-0.226	0.228	0.090	0.064	-0.29
DM3	-0.221	0.331	0.062	-0.105	-0.174	0.18
DM4	0.044	0.187	-0.061	-0.136	0.144	-0.01
LGIM	-0.117	-0.458	0.139	0.260	-0.058	-0.35

LGIM

LINC9	-0.117
AGE	-0.458
LOC1	0.139
LOC2	0.260
LOC5	-0.058
LOC6	-0.350
FLAR	0.064
LFAST	0.342
LNOST	0.017
LLOT	0.196
DM2	0.197
DM3	0.021
DM4	-0.402
LGIM	1.000

MULTIPLE R	0.75187
R SQUARE	0.56530
ADJUSTED R SQUARE	0.46038
STANDARD ERROR	0.14574

ANALYSIS OF VARIANCE

	DF
REGRESSION	7
RESIDUAL	29

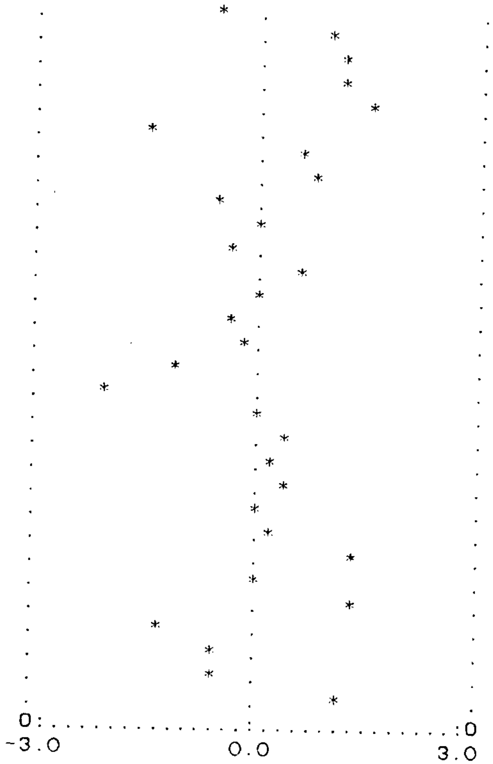
F = 5.38760

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.22773	0.07250	-0.75092	-3.141	0.00
DM4	-0.13210	0.07127	-0.28960	-1.853	0.07
DM3	0.00329	0.08298	0.00619	0.040	0.96
LOC6	-0.15920	0.05696	-0.40541	-2.795	0.00
AGE	-0.00370	0.00119	-0.45198	-3.113	0.00
DM2	-0.02619	0.06550	-0.06265	-0.400	0.69
FLAR	0.81283E-05	0.4828E-05	0.39095	1.684	0.10
(CONSTANT)	4.47714	0.71372		6.273	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
           -3.0            0.0            3.0
  SEQNUM   O:..............:..............:O        LGIM
      1    .               *.              .      2.1754
      2    .                .      *       .      2.1057
      3    .            *   .              .      1.9478
      4    .            *   .              .      1.9276
      5    .            *   .              .      1.9409
      6    .                *              .      2.0645
      7    .          *     .              .      2.0399
```



SEQNUM	LGIM
8	2.1381
9	1.9774
10	2.2389
11	2.1036
12	2.2439
13	1.6596
14	1.8933
15	2.0250
16	1.8644
17	2.1789
18	1.8650
19	1.9122
20	2.2182
21	1.7254
22	2.0571
23	1.7203
24	1.4325
25	1.7948
26	2.1211
27	1.9382
28	2.1029
29	1.9438
30	2.1124
31	2.1519
32	2.0660
33	2.0364
34	1.4161
35	2.0097
36	2.0885
37	2.1594

FILE NONAME (CREATION DATE = 02/08/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

* * * * * * * * * * * * *

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.6000	2.2284	1.9837	0.1487	37
*ZPRED	-2.5791	1.6454	-0.0000	1.0000	37
*SEPRED	0.0376	0.0939	0.0558	0.0118	37
*ADJPRED	1.6521	2.2529	1.9835	0.1530	37
*MAHAL	1.5724	14.8981	4.8649	2.6374	37
*COOK D	0.0000	0.1736	0.0408	0.0534	37

TOTAL CASES = 37

DURBIN-WATSON TEST = 1.80195

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

SEQNUM	SUBFILE	*ZRESID
24	NONAME	-2.19362
13	NONAME	-1.67919
12	NONAME	1.50417
31	NONAME	1.41750
2	NONAME	1.37331
33	NONAME	1.32154
34	NONAME	-1.30015
7	NONAME	-1.27995
11	NONAME	1.24864
23	NONAME	-1.17994

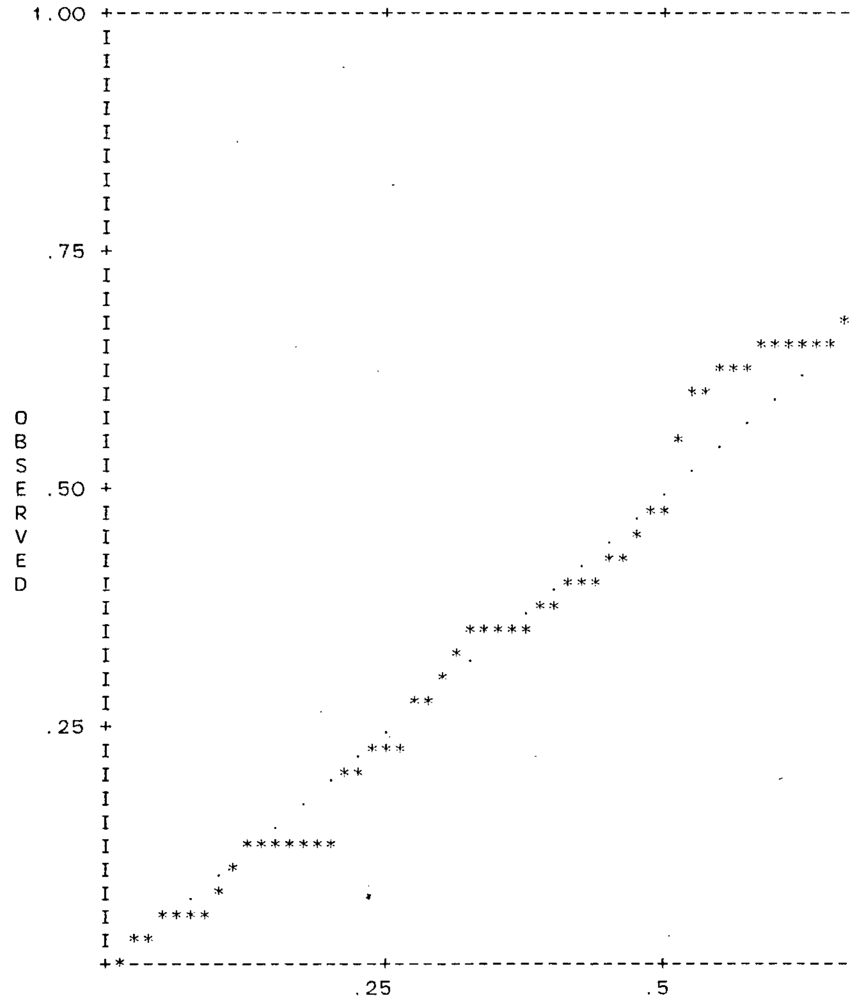
155

```
FILE    NONAME    (CREATION DATE = 02/08/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N       ( * = 1 CASES,      . : = NORMAL CURVE)
 0  0.04   OUT
 0  0.02  3.00
 0  0.03  2.87
 0  0.04  2.75
 0  0.06  2.62
 0  0.08  2.50
 0  0.11  2.37
 0  0.15  2.25
 0  0.19  2.12
 0  0.25  2.00
 0  0.32  1.87
 0  0.40  1.75
 0  0.49  1.62
 1  0.60  1.50 :
 3  0.72  1.37 :**
 1  0.85  1.25 :
 2  0.98  1.12 :*
 0  1.12  1.00 .
 2  1.26  0.87 :*
 0  1.39  0.75 .
 2  1.52  0.62 *:
 1  1.63  0.50 *.
 1  1.72  0.37 *.
 1  1.79  0.25 *.
 1  1.83  0.12 *.
 5  1.84  0.00 *:***
 2  1.83 -0.12 *:
 2  1.79 -0.25 *:
 0  1.72 -0.37  .
 3  1.63 -0.50 *:*
 2  1.52 -0.62 *:
 1  1.39 -0.75 :
 2  1.26 -0.87 :*
 0  1.12 -1.00 .
 1  0.98 -1.12 :
 2  0.85 -1.25 :*
 0  0.72 -1.37 .
 0  0.60 -1.50 .
 1  0.49 -1.62 *
 0  0.40 -1.75
 0  0.32 -1.87
 0  0.25 -2.00
 0  0.19 -2.12
 1  0.15 -2.25 *
 0  0.11 -2.37
 0  0.08 -2.50
 0  0.06 -2.62
 0  0.04 -2.75
 0  0.03 -2.87
 0  0.02 -3.00
 0  0.04   OUT
```

FILE NONAME (CREATION DATE = 02/08/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



```
FILE   NONAME   (CREATION DATE = 02/08/84)

STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +    SYMBOLS:
    I                                     I
    I                                     I       MAX N
  2 +                                     +
    I                    .                I    .     1.
    I             . ...                   I    :     2.
  1 +             . .   .  .              +
    I           :                         I
    I               .    ..               I
  0 +          .      .   : .  : .        +
    I         .      .     .              I
    I                 .  ...   ..         I
 -1 +                     .               +
    I   .          .         .   .        I
    I               .                     I
 -2 +                                     +
    I        .                            I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

1977

CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.358	0.499	-0.115	-0.109	-0.28
AGE	-0.358	1.000	-0.187	-0.022	0.149	0.30
LOC1	0.499	-0.187	1.000	-0.257	-0.305	-0.39
LOC2	-0.115	-0.022	-0.257	1.000	-0.187	-0.24
LOC5	-0.109	0.149	-0.305	-0.187	1.000	-0.02
LOC6	-0.285	0.307	-0.397	-0.243	-0.024	1.00
FLAR	0.891	-0.242	0.429	-0.200	-0.132	-0.27
LFAST	-0.094	-0.137	-0.018	-0.017	0.155	-0.38
LNOST	0.658	-0.292	0.360	-0.088	-0.098	-0.12
LLOT	0.700	-0.441	0.024	0.045	-0.046	-0.17
DM2	0.006	0.229	0.051	0.054	-0.024	-0.03
DM3	0.025	0.185	0.017	-0.112	0.082	0.16
DM4	-0.073	-0.236	-0.173	0.054	-0.024	-0.14
LGIM	-0.185	-0.399	0.074	0.154	0.076	-0.37

LGIM

LINC9	-0.185
AGE	-0.399
LOC1	0.074
LOC2	0.154
LOC5	0.076
LOC6	-0.371
FLAR	-0.158
LFAST	0.309
LNOST	-0.109
LLOT	0.012
DM2	-0.128
DM3	-0.019
DM4	-0.116
LGIM	1.000

MULTIPLE R	0.76927
R SQUARE	0.59178
ADJUSTED R SQUARE	0.46807
STANDARD ERROR	0.12720

ANALYSIS OF VARIANCE

	DF
REGRESSION	10
RESIDUAL	33

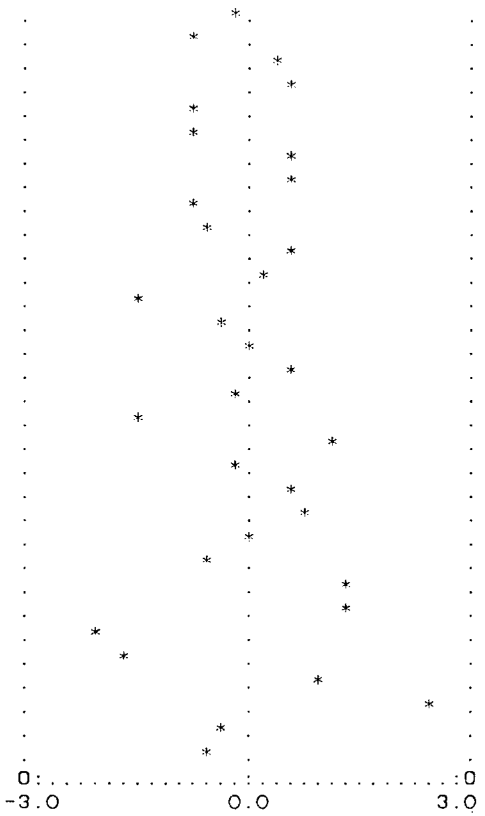
F = 4.78382

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.28105	0.08095	-1.02887	-3.472	0.00
DM2	-0.12906	0.06572	-0.33339	-1.964	0.05
LOC5	0.08384	0.06175	0.18756	1.358	0.18
LOC2	0.08085	0.07436	0.16093	1.087	0.28
DM4	-0.21147	0.06535	-0.54626	-3.236	0.00
LOC6	-0.11286	0.06061	-0.29154	-1.862	0.07
AGE	-0.00502	0.00127	-0.55034	-3.967	0.00
DM3	-0.08481	0.06421	-0.22443	-1.321	0.19
LOC1	0.05914	0.06613	0.15649	0.894	0.37
FLAR	0.11862E-04	0.6071E-05	0.55324	1.954	0.05
(CONSTANT)	5.06615	0.79465		6.375	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
           -3.0            0.0            3.0
  SEQNUM    O:..............:..............:O          LGIM
       1    .              *.               .        2.0558
       2    .               .  *            .        2.1847
       3    .          *    .               .        1.9060
       4    .                .  *           .        2.1238
       5    .                .  *           .        2.2795
       6    .            *   .              .        2.0817
```



SEQNUM	LGIM
7	2.0915
8	1.9933
9	2.1585
10	2.0219
11	1.8664
12	1.8659
13	1.9092
14	2.0860
15	2.0121
16	2.0867
17	2.1273
18	1.9190
19	1.7938
20	2.0433
21	1.9150
22	1.9351
23	2.0030
24	1.7253
25	2.2564
26	1.8516
27	2.1316
28	2.1263
29	2.1155
30	1.9851
31	1.8481
32	2.1564
33	1.3499
34	1.8145
35	2.1375
36	2.4353
37	2.0082
38	1.9967

FILE NONAME (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
            -3.0            0.0            3.0
  SEQNUM     O:..............:..............:O          LGIM
      39      .            * .              .         1.9728
      40      .              .       *      .         2.0952
      41      .              . *            .         1.8040
      42      .              *              .         1.9063
      43      .              .*             .         1.9403
      44      .              .*             .         2.0849
  SEQNUM     O:..............:..............:O          LGIM
            -3.0            0.0            3.0
```

* * * * * * * * * * * * *

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.6364	2.2023	2.0046	0.1234	44
*ZPRED	-2.9842	1.6021	-0.0000	1.0000	44
*SEPRED	0.0267	0.0705	0.0423	0.0108	44
*ADJPRED	1.6225	2.1943	2.0047	0.1231	44
*MAHAL	0.8592	11.7819	3.9091	2.5115	44
*COOK D	0.0000	0.5879	0.0357	0.0934	44

TOTAL CASES = 44

DURBIN-WATSON TEST = 2.02370

FILE NONAME (CREATION DATE = 02/06/84)

OUTLIERS - STANDARDIZED RESIDUAL

SEQNUM	SUBFILE	*ZRESID
36	NONAME	2.52101
33	NONAME	-2.21352
34	NONAME	-1.79239
24	NONAME	-1.68049
40	NONAME	1.67215
19	NONAME	-1.63291
32	NONAME	1.41938
31	NONAME	1.36120
25	NONAME	1.13806
3	NONAME	-1.03646

```
FILE   NONAME   (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N      ( * = 1 CASES,     . : = NORMAL CURVE)
 0  0.05   OUT
 0  0.02  3.00
 0  0.04  2.87
 0  0.05  2.75
 0  0.07  2.62
 1  0.10  2.50 *
 0  0.13  2.37
 0  0.18  2.25
 0  0.23  2.12
 0  0.30  2.00
 0  0.38  1.87
 0  0.48  1.75
 1  0.59  1.62 :
 0  0.71  1.50 .
 2  0.85  1.37 :*
 0  1.00  1.25 .
 1  1.17  1.12 :
 1  1.33  1.00 :
 1  1.50  0.87 :
 0  1.66  0.75  .
 6  1.80  0.62 *:****
 4  1.94  0.50 *:**
 1  2.04  0.37 *.
 1  2.13  0.25 *.
 2  2.18  0.12 *:
 3  2.19  0.00 *:*
 1  2.18 -0.12 *.
 3  2.13 -0.25 *:*
 1  2.04 -0.37 *.
 3  1.94 -0.50 *:*
 3  1.80 -0.62 *:*
 2  1.66 -0.75 *:
 2  1.50 -0.87 :*
 1  1.33 -1.00 :
 0  1.17 -1.12 .
 0  1.00 -1.25 .
 0  0.85 -1.37 .
 0  0.71 -1.50 .
 2  0.59 -1.62 :*
 1  0.48 -1.75 *  .
 0  0.38 -1.87
 0  0.30 -2.00
 0  0.23 -2.12
 1  0.18 -2.25 *
 0  0.13 -2.37
 0  0.10 -2.50
 0  0.07 -2.62
 0  0.05 -2.75
 0  0.04 -2.87
 0  0.02 -3.00
 0  0.05   OUT
```

FILE   NONAME   (CREATION DATE = 02/06/84)

```
NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL
  1.00 +-------------------+-------------------+-------------
       I
       I
       I
       I
       I
       I
       I
       I
       I
   .75 +
       I
       I
       I
       I
       I                                                 ****
       I                                               **
 O     I                                            ***
 B     I                                           *
 S     I                                        ***
 E .50 +                                       *
 R     I                                     .*
 V     I                                   ***
 E     I                               ****
 D     I                               .
       I                             **
       I                          ***
       I                         *
       I                       **
       I                     .*
   .25 +                   .**
       I
       I               . ***
       I             .
       I           .    *
       I         . *****
       I    *******
       I   * .
       I  *.
       I *
       +*------------------+-------------------+-------------
                         .25                  .5
```

```
FILE   NONAME   (CREATION DATE = 02/06/84)

STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                       .             I
    I                                     I     MAX N
  2 +                                     +
    I            .           .            I   .    1.
    I  .             .                    I   :    2.
  1 +                  .    .             +   *    3.
    I          ..   .  ..*       .        I
    I      .     .          ..            I
  0 +             .:      . :             +
    I            .      .....             I
    I                :    :.   :          I
 -1 +                    .   .            +
    I                                     I
    I               .  . .                I
 -2 +                                     +
    I.                                    I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

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CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.297	0.528	-0.116	-0.256	-0.16
AGE	-0.297	1.000	-0.029	-0.004	0.216	0.00
LOC1	0.528	-0.029	1.000	-0.214	-0.304	-0.41
LOC2	-0.116	-0.004	-0.214	1.000	-0.172	-0.23
LOC5	-0.256	0.216	-0.304	-0.172	1.000	-0.12
LOC6	-0.169	0.007	-0.416	-0.235	-0.121	1.00
FLAR	0.572	-0.158	0.258	-0.128	-0.190	0.03
LFAST	0.075	-0.014	0.039	0.051	0.089	-0.20
LNOST	0.658	-0.223	0.528	-0.137	-0.192	-0.14
LLOT	0.281	-0.257	0.120	-0.001	-0.285	-0.14
DM2	-0.110	0.046	0.058	0.243	-0.224	-0.04
DM3	0.019	-0.089	-0.109	0.048	0.101	-0.14
DM4	0.103	0.053	0.023	-0.161	0.103	0.15
LGIM	-0.275	-0.377	-0.200	0.186	0.245	-0.18

LGIM

LINC9	-0.275
AGE	-0.377
LOC1	-0.200
LOC2	0.186
LOC5	0.245
LOC6	-0.182
FLAR	-0.128
LFAST	0.127
LNOST	-0.037
LLOT	-0.045
DM2	-0.167
DM3	-0.006
DM4	0.120
LGIM	1.000

MULTIPLE R	0.73732
R SQUARE	0.54363
ADJUSTED R SQUARE	0.49348
STANDARD ERROR	0.10056

ANALYSIS OF VARIANCE

	DF
REGRESSION	10
RESIDUAL	91

F = 10.84013

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.14632	0.02443	-0.64055	-5.989	0.00
DM3	-0.01471	0.03066	-0.04304	-0.480	0.63
LFAST	0.03072	0.01491	0.15100	2.061	0.04
LOC2	0.12925	0.03524	0.28513	3.667	0.00
AGE	-0.00380	0.5300E-03	-0.55465	-7.164	0.00
LOC5	0.09586	0.02894	0.27067	3.312	0.00
DM4	0.04962	0.02807	0.16231	1.768	0.08
LOC1	0.03087	0.02956	0.09799	1.045	0.29
DM2	-0.06115	0.02998	-0.18708	-2.039	0.04
LNOST	0.09775	0.03242	0.30950	3.015	0.00
(CONSTANT)	3.31802	0.25113		13.212	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
          -3.0           0.0           3.0
SEQNUM     O:.............:.............:O          LGIM
     1     .              *.             .        1.8635
     2     .           *   .             .        2.1455
     3     .        *      .             .        1.9643
     4     .               .        *    .        2.3855
     5     .               *             .        1.9184
     6     .              *.             .        2.0580
```

```
     7  .           *  .              .      2.0543
     8  .             *.              .      1.9699
     9  .             *.              .      1.8976
    10  .              .      *       .      1.9574
    11  .              .*             .      2.0177
    12  .             *.              .      1.9400
    13  .    *         .              .      1.7267
    14  .              .*             .      2.0719
    15  .            * .              .      1.8842
    16  .              .      *       .      2.2166
    17  .              .  *           .      2.0130
    18  .              .*             .      2.0517
    19  .              .    *         .      1.9892
    20  .              *              .      2.0359
    21  .       *      .              .      2.0537
    22  .      *       .              .      1.8955
    23  .       *      .              .      1.8319
    24  .              .  *           .      2.0883
    25  .              *              .      1.9216
    26  .        *     .              .      1.9492
    27  .        *     .              .      1.9273
    28  .          *   .              .      1.9088
    29  .             *.              .      2.0158
    30  .              . *            .      1.9568
    31  .   *          .              .      1.7751
    32  .             *.              .      2.1349
    33  .         *    .              .      1.8247
    34  .              .     *        .      2.1577
    35  .              *              .      2.0065
    36  .              .  *           .      1.8993
    37  .             *.              .      1.8057
    38  .         *    .              .      1.8089
SEQNUM  0:.............:.............:0        LGIM
      -3.0            0.0            3.0
```

FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
       -3.0            0.0             3.0
SEQNUM  O:...............:...............:O      LGIM
    39  .               . *             .      2.0173
    40  .               .    *          .      2.0371
    41  .             * .               .      1.9140
    42  .               .    *          .      2.0491
    43  .               .   *           .      1.9633
    44  .               .*              .      1.8597
    45  .              *.               .      1.8647
    46  .               .   *           .      1.8763
    47  .             * .               .      2.0614
    48  .               .     *         .      2.1230
    49  .        *      .               .      1.7086
    50  .           *   .               .      1.9585
    51  .               *               .      1.8787
    52  .               *               .      2.0130
    53  .               .     *         .      2.1799
    54  .               *               .      2.0505
    55  .           *   .               .      1.9719
    56  .             * .               .      2.1483
    57  .               .*              .      2.0969
    58  .               . *             .      2.1344
    59  .            *  .               .      2.0262
    60  .               .  *            .      2.1371
    61  .          *    .               .      1.7253
    62  .               *               .      2.0335
    63  .    *          .               .      1.6172
    64  .               .  *            .      1.9277
    65  .               .*              .      1.9615
    66  .               . *             .      1.9418
    67  .               . *             .      2.0012
    68  .               . *             .      1.9817
    69  .               *               .      1.7537
    70  .               *               .      1.8756
    71  .             * .               .      1.9335
    72  .               .       *       .      2.0994
    73  .               .*              .      2.0931
    74  .               .         *     .      2.2290
    75  . *             .               .      1.4500
    76  .              *.               .      1.7532
    77  .               .*              .      2.0229
    78  .         *     .               .      1.8075
    79  .               *               .      2.1344
    80  .               . *             .      1.9892
SEQNUM  O:...............:...............:O      LGIM
       -3.0            0.0             3.0
```

FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
          -3.0           0.0            3.0
  SEQNUM  O:..............:..............:O        LGIM
      81  .               .*              .      2.0089
      82  .         *     .               .      1.9024
      83  .               .   *           .      2.0074
      84  .             * .               .      2.0801
      85  .               .*              .      2.0940
      86  .               .       *       .      2.3066
      87  .               .   *           .      2.0650
      88  .               .    *          .      2.1754
      89  .               .   *           .      1.9174
      90  .               .    *          .      2.1274
      91  .               .           *   .      2.1673
      92  .             * .               .      2.0665
      93  .             * .               .      2.0154
      94  .              *.               .      2.1322
      95  .             * .               .      2.0178
      96  .               .*              .      2.1040
      97  .               . *             .      2.1577
      98  .               *               .      1.9793
      99  .               .   *           .      2.0316
     100  .               .    *          .      2.0930
     101  .               . *             .      2.0256
     102  .              *.               .      2.0894
  SEQNUM  O:..............:..............:O        LGIM
          -3.0           0.0            3.0
```

FILE NONAME (CREATION DATE = 02/06/84)

* * * * M U L T I P L E

DEPENDENT VARIABLE.. LGIM

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.7381	2.2280	1.9911	0.1035	102
*ZPRED	-2.4434	2.2881	-0.0000	1.0000	102
*SEPRED	0.0167	0.0939	0.0284	0.0088	102
*ADJPRED	1.5648	2.2380	1.9874	0.1117	102
*MAHAL	1.8144	87.7467	7.9216	8.6595	102
*COOK D	0.0000	1.4943	0.0246	0.1481	102

TOTAL CASES = 102

DURBIN-WATSON TEST = 1.96949

* * * * * * * * * * * * *

OUTLIERS - STANDARDIZED RESIDUAL

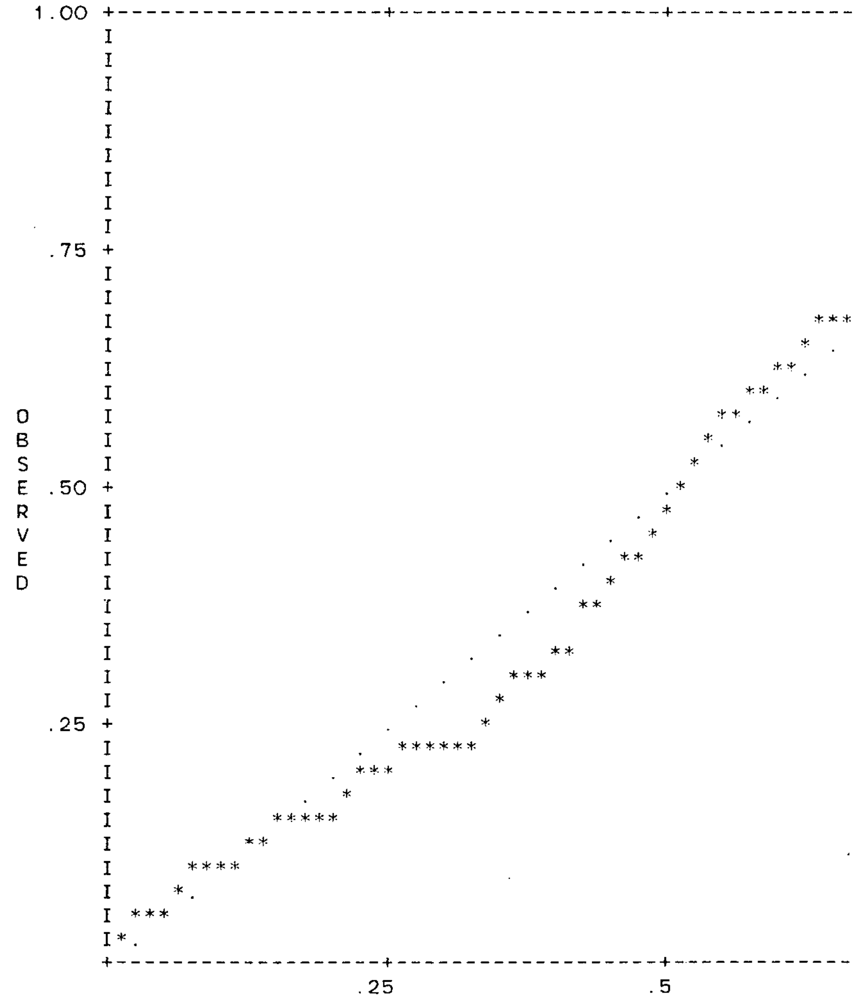
SEQNUM	SUBFILE	*ZRESID
75	NONAME	-2.87535
91	NONAME	2.30526
13	NONAME	-2.29006
63	NONAME	-2.28546
4	NONAME	2.20049
31	NONAME	-2.12382
74	NONAME	1.93259
22	NONAME	-1.83584
21	NONAME	-1.64928
23	NONAME	-1.63006

```
FILE   NONAME   (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N      ( * = 1 CASES,    . : = NORMAL CURVE)
 0  0.11   OUT
 0  0.06  3.00
 0  0.08  2.87
 0  0.12  2.75
 0  0.16  2.62
 0  0.22  2.50
 0  0.30  2.37
 2  0.41  2.25 **
 0  0.53  2.12 .
 0  0.69  2.00 .
 1  0.88  1.87 :
 0  1.10  1.75 .
 2  1.36  1.62 :*
 1  1.65  1.50 *.
 2  1.98  1.37 *:
 1  2.33  1.25 *.
 2  2.70  1.12 **.
 5  3.09  1.00 **:**
 2  3.47  0.87 **.
 5  3.84  0.75 ***:*
 2  4.18  0.62 **  .
 5  4.49  0.50 ***:*
 6  4.74  0.37 ****:*
 6  4.93  0.25 ****:*
 6  5.04  0.12 ****:*
11  5.08  0.00 ****:******
 6  5.04 -0.12 ****:*
 7  4.93 -0.25 ****:**
 4  4.74 -0.37 ****.
 4  4.49 -0.50 ***:
 1  4.18 -0.62 *   .
 2  3.84 -0.75 **  .
 3  3.47 -0.87 **:
 1  3.09 -1.00 * .
 3  2.70 -1.12 **:
 3  2.33 -1.25 *:*
 0  1.98 -1.37   .
 2  1.65 -1.50 *:
 2  1.36 -1.62 :*
 0  1.10 -1.75 .
 1  0.88 -1.87 :
 0  0.69 -2.00 .
 1  0.53 -2.12 :
 2  0.41 -2.25 **
 0  0.30 -2.37
 0  0.22 -2.50
 0  0.16 -2.62
 0  0.12 -2.75
 1  0.08 -2.87 *
 0  0.06 -3.00
 0  0.11   OUT
```

FILE NONAME (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



```
FILE    NONAME    (CREATION DATE = 02/06/84)

STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED     DOWN - *ZRESID
OUT ++-----+-----+-----+-----+-----+-----++
  3 +                                     +   SYMBOLS:
    I                                     I
    I               .            .        I      MAX N
  2 +                     .               +
    I               .           .         I   .    1.
    I        .         ..  ..             I   :    2.
  1 +         .  .  : .. .  .             +   *    4.
    I       . ..  .  .:   .  .            I
    I            .. .:.* .  :. .          I
  0 +    .    . :  : ....*..* ..:         +
    I      .  .  : : :.   .: : .  .       I
    I                  . .   . .     .    I
 -1 +         .   ...      .              +
    I          .         . .. .           I
    I                  .            .     I
 -2 +                  .    .             +
    I          .     .                    I
    I                                     I
 -3 +   .                                 +
OUT ++-----+-----+-----+-----+-----+-----++
    -3    -2    -1     0     1     2     3 OUT
```

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CORRELATION

	LINC9	AGE	LOC1	LOC2	LOC5	LOC
LINC9	1.000	-0.441	0.434	-0.111	-0.230	-0.14
AGE	-0.441	1.000	0.011	0.209	0.159	-0.19
LOC1	0.434	0.011	1.000	-0.191	-0.229	-0.42
LOC2	-0.111	0.209	-0.191	1.000	-0.131	-0.24
LOC5	-0.230	0.159	-0.229	-0.131	1.000	-0.29
LOC6	-0.141	-0.193	-0.429	-0.246	-0.295	1.00
FLAR	0.746	-0.314	0.334	-0.170	-0.227	-0.10
LFAST	0.113	0.058	0.016	0.037	-0.078	-0.03
LNOST	0.606	-0.271	0.422	-0.042	-0.128	-0.21
LLOT	0.829	-0.535	0.136	-0.061	-0.227	0.02
DM2	0.034	-0.066	-0.065	0.042	0.101	-0.04
DM3	-0.052	-0.023	-0.049	0.077	-0.051	0.02
DM4	0.010	0.043	0.175	-0.123	-0.116	0.03
LGIM	-0.170	-0.092	0.114	0.086	0.159	-0.23

LGIM

LINC9	-0.170
AGE	-0.092
LOC1	0.114
LOC2	0.086
LOC5	0.159
LOC6	-0.237
FLAR	-0.073
LFAST	-0.046
LNOST	0.099
LLOT	-0.113
DM2	-0.011
DM3	-0.038
DM4	0.131
LGIM	1.000

MULTIPLE R	0.55209
R SQUARE	0.30481
ADJUSTED R SQUARE	0.24108
STANDARD ERROR	0.12837

ANALYSIS OF VARIANCE

	DF
REGRESSION	11
RESIDUAL	120

F = 4.78305

------------------ VARIABLES IN THE EQUATION ----------------

VARIABLE	B	SE B	BETA	T	SIG
LINC9	-0.19729	0.04249	-0.93869	-4.644	0.00
DM4	0.05256	0.03730	0.15178	1.409	0.16
LOC6	-0.04454	0.03388	-0.14527	-1.315	0.19
LOC2	0.07398	0.04671	0.15016	1.584	0.11
DM3	0.00714	0.03543	0.02185	0.202	0.84
LOC5	0.08334	0.04239	0.19482	1.966	0.05
AGE	-0.00231	0.7581E-03	-0.29411	-3.043	0.00
LNOST	0.12975	0.04318	0.32555	3.005	0.00
DM2	-0.00266	0.03473	-0.00849	-0.077	0.93
LOC1	0.10682	0.04110	0.31510	2.599	0.01
LLOT	0.13359	0.05563	0.41759	2.401	0.01
(CONSTANT)	2.84831	0.28504		9.993	0.00

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
         -3.0            0.0            3.0
 SEQNUM   O:..............:..............:O        LGIM
      1   .               .     *        .       2.1480
      2   .               .      *       .       2.3284
      3   .             * .              .       2.0818
      4   .              *.              .       2.1619
      5   .               .           *  .       2.3617
      6   .    *          .              .       1.7894
```

```
     7  .                       .           *           .      2.2517
     8  .                       *                       .      2.1973
     9  .                       . *                     .      1.9663
    10  .                       .    *                  .      2.1679
    11  .                   *   .                       .      2.0854
    12  .                    *  .                       .      2.0798
    13  .                   *   .                       .      2.0276
    14  .                       *                       .      2.1904
    15  .                *      .                       .      1.9652
    16  .                *      .                       .      1.9719
    17  .             *         .                       .      1.9432
    18  .                       *                       .      2.0756
    19  .                       .          *            .      2.3657
    20  .                       *                       .      2.0410
    21  .                       .    *                  .      1.9976
    22  .                    *  .                       .      2.1022
    23  .                *      .                       .      2.0395
    24  .                   *   .                       .      2.0707
    25  .                       . *                     .      2.1648
    26  .                       .  *                    .      2.0231
    27  .                       .  *                    .      2.2226
    28  .                       *                       .      2.2450
    29  .                       .            *          .      2.3792
    30  .             *         .                       .      1.8770
    31  .                       .     *                 .      2.1230
    32  .                       .      *                .      2.2453
    33  .             *         .                       .      1.9131
    34  .                       . *                     .      2.1828
    35  .                       .     *                 .      2.2338
    36  .                 *     .                       .      1.9811
    37  .                 *     .                       .      1.9597
    38  .                       .        *              .      2.3368
SEQNUM 0:.......................:.......................:0       LGIM
      -3.0                     0.0                     3.0
```

FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
        -3.0            0.0            3.0
SEQNUM   0:..............:..............:0        LGIM
    39   .             * .               .      1.9468
    40   .              *.               .      2.0408
    41   .               . *             .      2.1084
    42   .         *     .               .      2.0186
    43   .               .         *     .      2.5135
    44   .      *        .               .      1.8761
    45   .         *     .               .      2.0235
    46   .               .  *            .      2.1936
    47   .             * .               .      2.0067
    48   .           *   .               .      2.0020
    49   .               .        *      .      2.3712
    50   .               .   *           .      2.2017
    51   .               .  *            .      2.1235
    52   .          *    .               .      1.8907
    53   .               .   *           .      2.2150
    54   .            *  .               .      2.0133
    55   .               . *             .      2.1329
    56   .               .     *         .      2.3508
    57   .          *    .               .      1.9984
    58   .               .    *          .      2.1581
    59   .               .  *            .      2.0589
    60   .              *.               .      2.0823
    61   .               .   *           .      2.2454
    62   .               .  *            .      2.0954
    63   .               .     *         .      2.1941
    64   .            *  .               .      1.9753
    65   .               .   *           .      2.1255
    66   .               .   *           .      2.2566
    67   .               *               .      2.0051
    68   .              *.               .      2.0522
    69   .               .    *          .      2.1645
    70   .               .   *           .      2.1339
    71   .               .  *            .      2.0821
    72   .    *          .               .      1.8088
    73   .               .     *         .      2.1695
    74   .               .  *            .      2.0148
    75   .               .  *            .      2.0677
    76   .        *      .               .      2.0888
    77   .      *        .               .      2.0639
    78   .           *   .               .      2.0669
    79   .          *    .               .      1.8718
    80   .             * .               .      2.0681
SEQNUM   0:..............:..............:0        LGIM
        -3.0            0.0            3.0
```

```
FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

        -3.0            0.0             3.0
SEQNUM  O:...............:...............:O       LGIM
    81   .              *.               .      1.9356
    82   .               .    *          .      2.0848
    83   .             * .               .      2.0166
    84   .               *               .      2.0513
    85   .               .*              .      1.9244
    86   .           *   .               .      1.8893
    87   .              *.               .      1.9463
    88   .               . *             .      2.2281
    89   .               .  *            .      2.1138
    90   .               .      *        .      2.2961
    91   .             * .               .      2.0670
    92   .               .*              .      1.9822
    93   .               .*              .      2.0200
    94   .        *      .               .      2.0032
    95   .               . *             .      2.0610
    96   .             * .               .      1.9962
    97   .               *               .      1.9717
    98   .               .  *            .      2.0623
    99   .               .     *         .      2.1229
   100   .             * .               .      1.9402
   101   .            *  .               .      1.9752
   102   .               . *             .      2.1567
   103   .               .*              .      2.0653
   104   .      *        .               .      1.8486
   105   .       *       .               .      1.9141
   106   .            *  .               .      2.0348
   107   .        *      .               .      1.8535
   108   .               .   *           .      2.1122
   109   .              *.               .      2.0275
   110   .               . *             .      2.0859
   111   .               . *             .      2.1331
   112   .        *      .               .      1.9237
   113   .               *               .      2.1662
   114   .               .  *            .      2.2929
   115   .             * .               .      1.8907
   116   .              *.               .      1.8912
   117   .            *  .               .      1.7790
   118   .          *    .               .      1.8527
   119   .               .           *   .      2.4389
   120   .        *      .               .      1.9387
   121   .               .       *       .      2.2268
   122   .            *  .               .      1.8670
SEQNUM  O:...............:...............:O       LGIM
        -3.0            0.0             3.0
```

FILE   NONAME   (CREATION DATE = 02/06/84)

CASEWISE PLOT OF STANDARDIZED RESIDUAL

```
            -3.0            0.0            3.0
  SEQNUM     O:..............:..............:O          LGIM
     123     .             * .               .        1.9804
     124     .               *               .        2.0334
     125     .          *    .               .        1.9784
     126     .               . *             .        2.1936
     127     .               . *             .        2.0756
     128     .               .               *        2.6285
     129     .           *   .               .        1.9948
     130     .               . *             .        2.1131
     131     .              *.               .        2.0503
     132     .              *.               .        1.9468
  SEQNUM     O:..............:..............:O          LGIM
            -3.0            0.0            3.0
```

* * * * * * * * * * * * *

RESIDUALS STATISTICS:

	MIN	MAX	MEAN	STD DEV	N
*PRED	1.8551	2.2865	2.0785	0.0799	132
*ZPRED	-2.7950	2.6025	-0.0000	1.0000	132
*SEPRED	0.0176	0.0640	0.0321	0.0090	132
*ADJPRED	1.8686	2.3162	2.0783	0.0801	132
*MAHAL	1.4813	31.9276	7.9394	4.9515	132
*COOK D	0.0000	0.1511	0.0095	0.0194	132

TOTAL CASES =   132

DURBIN-WATSON TEST =   2.36166

FILE NONAME (CREATION DATE = 02/06/84)

OUTLIERS - STANDARDIZED RESIDUAL

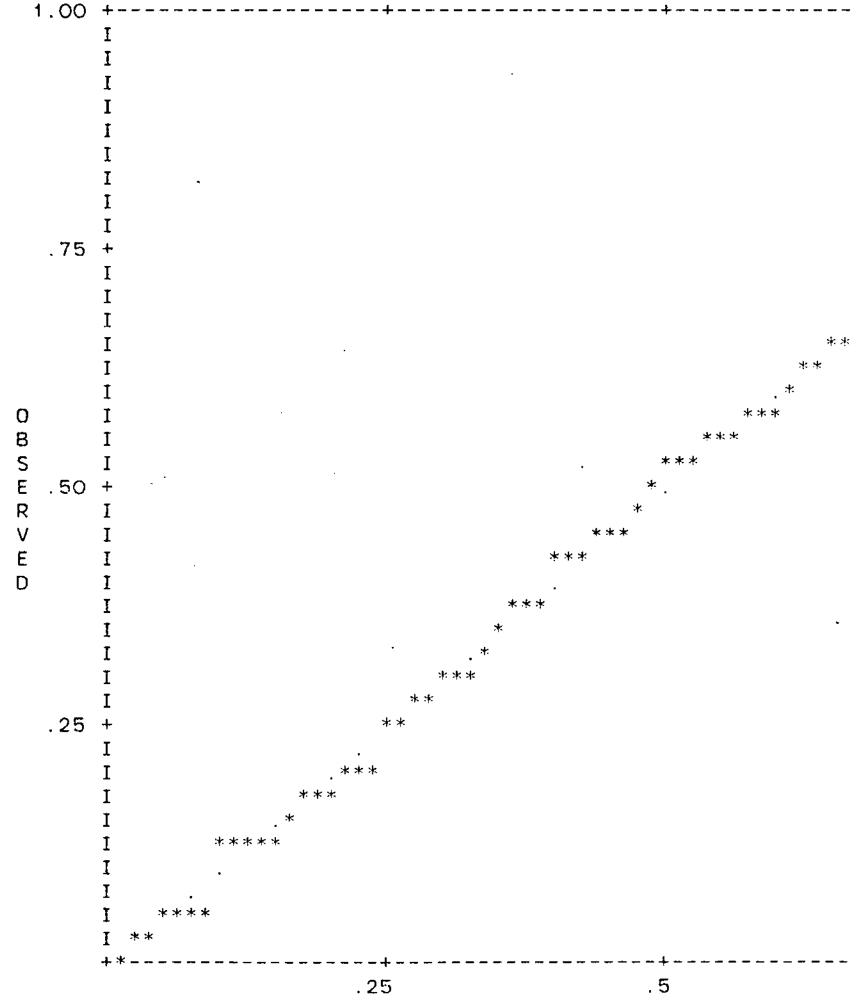
SEQNUM	SUBFILE	*ZRESID
128	NONAME	3.96254
119	NONAME	2.44258
5	NONAME	2.33148
72	NONAME	-2.18144
6	NONAME	-2.03590
43	NONAME	2.01268
29	NONAME	1.84273
49	NONAME	1.83932
44	NONAME	-1.83622
77	NONAME	-1.74171

```
FILE   NONAME   (CREATION DATE = 02/06/84)

HISTOGRAM - STANDARDIZED RESIDUAL
 N EXP N       ( * = 1 CASES,     . : = NORMAL CURVE)
 1  0.14   OUT *
 0  0.07  3.00
 0  0.11  2.87
 0  0.15  2.75
 0  0.21  2.62
 1  0.29  2.50 *
 1  0.39  2.37 *
 0  0.53  2.25 .
 0  0.69  2.12 .
 1  0.89  2.00 :
 2  1.14  1.87 :*
 0  1.43  1.75 .
 1  1.76  1.62 *.
 1  2.14  1.50 *.
 2  2.56  1.37 **.
 0  3.01  1.25  .
 3  3.50  1.12 **:
 5  3.99  1.00 ***:*
 3  4.49  0.87 ***.
 4  4.97  0.75 ****.
 8  5.41  0.62 ****:***
 9  5.81  0.50 *****:***
10  6.13  0.37 *****:****
 4  6.38  0.25 ****  .
 6  6.53  0.12 ******.
 7  6.58  0.00 ******:
 6  6.53 -0.12 ******.
 6  6.38 -0.25 *****:
 9  6.13 -0.37 *****:***
 5  5.81 -0.50 *****.
 6  5.41 -0.62 ****:*
 7  4.97 -0.75 ****:**
 2  4.49 -0.87 **  .
 6  3.99 -1.00 ***:**
 1  3.50 -1.12 * .
 5  3.01 -1.25 **:**
 3  2.56 -1.37 **:
 1  2.14 -1.50 *.
 1  1.76 -1.62 *.
 2  1.43 -1.75 :*
 1  1.14 -1.87 :
 1  0.89 -2.00 :
 1  0.69 -2.12 :
 0  0.53 -2.25 .
 0  0.39 -2.37
 0  0.29 -2.50
 0  0.21 -2.62
 0  0.15 -2.75
 0  0.11 -2.87
 0  0.07 -3.00
 0  0.14   OUT
```

FILE   NONAME   (CREATION DATE = 02/06/84)

NORMAL PROBABILITY (P-P) PLOT - STANDARDIZED RESIDUAL



```
FILE   NONAME   (CREATION DATE = 02/06/84)

STANDARDIZED SCATTERPLOT
ACROSS - *ZPRED      DOWN - *ZRESID
OUT ++-----+-----+-----+- . -+-----+-----++
  3 +                                     +   SYMBOLS:
    I                                     I
    I                 .    .              I      MAX N
  2 +                      ..       .     +
    I               :                     I   .    1.
    I                     .    :          I   :    2.
  1 +         ..  ... .   .    :   .      +   *    5.
    I      .   .  . ::. . .:   :   .      I
    I        .... * * ::.. :   :          I
  0 +     .  . .  :.. :   ...*    .       +
    I       ........ ::: . *.             I
    I .       . .   .:. .:: ...           I
 -1 +          . ..     .: . ..           +
    I               :  ... .  ..     .    I
    I                 .   .            .  I
 -2 +                .   .                +
    I                   .                 I
    I                                     I
 -3 +                                     +
OUT ++-----+-----+-----+-----+-----+-----++
     -3    -2    -1     0     1     2     3 OUT
```

$SIGNOFF

APPENDIX C

Return and Risk Statistics of Properties

	Return on Capital	St.Dev	Variance	Return on Equity	St.Dev	Variance
A 102	0.05551	0.14821	0.02197	0.03849	0.20794	0.04324
A 106	0.05716	0.12962	0.01680	0.08064	0.35527	0.12621
A 107	0.04951	0.12466	0.01554	0.03487	0.18241	0.03327
A 111	0.05325	0.12511	0.01565	0.09546	0.42183	0.17794
A 112	0.05526	0.12163	0.01479	-0.33608	1.09523	1.19953
A 113	0.05501	0.11694	0.01368	0.07753	0.42323	0.17912
A 115	0.05902	0.19733	0.03894	0.05231	0.31010	0.09616
A 116	0.05814	0.12309	0.01515	0.15615	0.68062	0.46325
A 119	0.04638	0.12220	0.01493	-0.81649	1.66354	2.76735
A 122	0.04941	0.12225	0.01494	0.04461	0.17397	0.03027
A 124	0.06152	0.12299	0.01513	0.04980	0.15049	0.02265
A 125	0.04237	0.11643	0.01356	0.13322	0.94332	0.88984
A 126	0.04406	0.12668	0.01605	0.03357	0.28978	0.08397
A 127	0.04407	0.13549	0.01836	0.07865	0.32855	0.10794
A 128	0.04432	0.12776	0.01632	0.14501	0.76902	0.59139
A 129	0.04523	0.11986	0.01437	0.04663	0.25798	0.06656
A 130	0.04511	0.11913	0.01419	0.05115	0.29307	0.08589
A 132	0.04296	0.11970	0.01433	0.02369	0.16472	0.02713
A 133	0.04480	0.12552	0.01576	-0.00062	0.63334	0.40112
A 134	0.04642	0.12082	0.01460	0.03149	0.26341	0.06938
A 137	0.06216	0.20285	0.04115	0.07694	0.44796	0.20067
A 138	0.06975	0.23581	0.05561	-0.04027	0.56889	0.32363
A 139	0.05203	0.13547	0.01835	0.10092	0.49798	0.24798
A 140	0.04884	0.13551	0.01836	0.06646	0.38719	0.14992
A 141	0.04576	0.13346	0.01781	0.04228	0.22585	0.05101
A 142	0.04642	0.12254	0.01502	0.81960	4.76605	22.71527
A 143	0.06675	0.23380	0.05466	0.15451	0.71622	0.51297
A 144	0.05762	0.12753	0.01626	0.10532	0.36617	0.13408
A 145	0.05028	0.11125	0.01238	0.05028	0.11125	0.01238
A 146	0.04468	0.13510	0.01825	0.05470	0.28863	0.08331
A 147	0.05018	0.16469	0.02712	0.08457	0.37759	0.14258
A 149	0.04756	0.12778	0.01633	0.01219	0.25220	0.06360
A 150	0.05505	0.12520	0.01568	0.13267	0.67089	0.45009
A 201	0.04666	0.15997	0.02559	-0.03041	0.42502	0.18064
A 202	0.05247	0.20497	0.04201	0.11501	0.55050	0.30304
A 203	0.04993	0.14596	0.02130	0.09062	0.54272	0.29455
A 204	0.04579	0.15042	0.02263	-0.03861	0.92670	0.85878
A 205	0.04794	0.14289	0.02042	0.06124	0.31806	0.10116
A 207	0.04077	0.13004	0.01691	0.04407	0.33507	0.11227
A 209	0.04949	0.12318	0.01517	-0.00373	0.81690	0.66732
A 210	0.06973	0.25507	0.06506	0.31222	1.49131	2.22402
A 211	0.04566	0.12988	0.01687	0.02539	0.17806	0.03170
A 212	0.04697	0.12982	0.01685	0.02876	0.21676	0.04699

A 213	0.04891	0.12608	0.01590	0.07791	0.38212	0.14601
A 214	0.04844	0.12602	0.01588	0.03378	0.24630	0.06067
A 215	0.04417	0.11809	0.01395	0.04731	0.13067	0.01708
A 217	0.05533	0.13362	0.01785	0.16905	0.87696	0.76906
A 218	0.04760	0.13587	0.01846	0.09667	0.40352	0.16282
A 219	0.04850	0.12235	0.01497	0.04082	0.18763	0.03520
A 220	0.04394	0.12653	0.01601	0.03425	0.25577	0.06542
A 221	0.04931	0.12079	0.01459	0.14426	1.50177	2.25533
A 222	0.04273	0.13358	0.01784	-0.06153	1.20741	1.45784
A 223	0.04218	0.19144	0.03665	-0.06481	0.97603	0.95263
A 224	0.04545	0.14368	0.02064	0.07223	0.32116	0.10314
A 225	0.06323	0.25382	0.06443	0.08907	1.00811	1.01628
A 226	0.05967	0.23678	0.05607	-0.60970	2.62339	6.88219
A 227	0.06123	0.26547	0.07047	0.15876	0.68010	0.46253
A 229	0.04394	0.14151	0.02003	-1.33565	7.13495	50.90747
A 231	0.04175	0.12687	0.01610	0.01791	0.20570	0.04231
A 232	0.04974	0.12507	0.01564	0.02563	0.95044	0.90334
A 233	0.05286	0.13102	0.01717	0.01100	0.45970	0.21133
A 234	0.06326	0.26074	0.06799	0.77912	6.02329	36.27998
A 235	0.04548	0.14021	0.01966	0.06898	0.32574	0.10611
A 238	0.04345	0.12685	0.01609	0.07933	0.29256	0.08559
A 301	0.05545	0.16547	0.02738	0.09962	0.31978	0.10226
A 302	0.04728	0.17015	0.02895	0.13623	0.59096	0.34923
A 304	0.05036	0.17844	0.03184	0.07402	0.33352	0.11124
A 306	0.05201	0.17171	0.02948	0.06033	0.27535	0.07582
A 309	0.04949	0.17125	0.02933	0.05073	0.49119	0.24127
A 310	0.05041	0.16455	0.02708	0.04642	0.27061	0.07323
A 311	0.04935	0.17246	0.02974	0.07378	0.26718	0.07138
A 312	0.06209	0.17993	0.03237	0.16877	0.61094	0.37325
A 313	0.04825	0.17039	0.02903	0.13015	0.52738	0.27813
A 314	0.05945	0.18544	0.03439	0.09157	0.85754	0.73537
A 315	0.05028	0.17363	0.03015	-0.00368	0.48966	0.23976
A 402	0.04459	0.12174	0.01482	0.04970	0.25234	0.06367
A 403	0.03839	0.13901	0.01932	0.03733	0.22990	0.05285
A 404	0.04802	0.13627	0.01857	-0.12509	0.74984	0.56225
A 405	0.03944	0.13371	0.01788	0.24183	1.62515	2.64112
A 408	0.04703	0.13591	0.01847	0.55692	2.07627	4.31088
A 410	0.04022	0.13655	0.01865	0.04415	0.37377	0.13970
A 413	0.04329	0.13303	0.01770	0.14443	1.03403	1.06921
A 414	0.05083	0.13459	0.01812	0.06038	0.68330	0.46689
A 416	0.04817	0.11375	0.01294	0.05190	0.30856	0.09521
A 417	0.04702	0.12476	0.01556	-0.02711	0.78973	0.62367
A 418	0.04486	0.10897	0.01187	0.60778	2.20052	4.84229
A 419	0.04360	0.11430	0.01306	0.03121	0.21368	0.04566
A 420	0.04140	0.15958	0.02547	-0.01537	0.37639	0.14167
A 422	0.04527	0.11887	0.01413	0.06796	0.32872	0.10806
A 423	0.03811	0.13769	0.01896	0.30973	1.93694	3.75172
A 424	0.04420	0.12825	0.01645	0.03737	0.21006	0.04413
A 425	0.04711	0.14395	0.02072	0.12123	0.78775	0.62055
A 426	0.04647	0.10303	0.01062	0.06222	0.76389	0.58352
A 427	0.04737	0.12429	0.01545	0.07680	0.33103	0.10958
A 428	0.04175	0.12906	0.01666	0.06070	0.38775	0.15035

A 429	0.04738	0.12474	0.01556	0.04642	0.31972	0.10222
A 430	0.04264	0.12840	0.01649	0.03196	0.21950	0.04818
A 431	0.04894	0.12296	0.01512	0.06842	0.51979	0.27018
A 432	0.04373	0.13069	0.01708	0.07768	0.40531	0.16428
A 434	0.04547	0.11971	0.01433	0.12284	0.57328	0.32865
A 435	0.05278	0.14034	0.01970	0.12750	0.48873	0.23886
A 436	0.04203	0.11257	0.01267	0.02880	0.22108	0.04888
A 437	0.04353	0.12731	0.01621	0.40346	1.91763	3.67731
A 439	0.04925	0.13367	0.01787	-0.02576	0.75021	0.56282
A 440	0.04880	0.15772	0.02488	0.06122	0.29628	0.08778
A 441	0.04204	0.12331	0.01521	-0.85293	6.34741	40.28963
A 443	0.05512	0.12732	0.01621	0.01141	0.22346	0.04994
A 444	0.04731	0.11994	0.01439	0.05600	0.22799	0.05198
A 501	0.06204	0.22207	0.04932	0.16736	0.82018	0.67270
A 601	0.06775	0.21655	0.04689	0.05234	0.83485	0.69697
A 602	0.06227	0.22341	0.04991	0.35340	1.93324	3.73742
A 604	0.06044	0.19867	0.03947	1.57423	9.63870	92.90453
A1004	0.05825	0.18538	0.03437	0.05806	0.35743	0.12775
A1005	0.05602	0.12568	0.01579	-0.29646	1.57856	2.49185
A1006	0.04835	0.13312	0.01772	0.13234	0.71235	0.50744
A1009	0.04094	0.11829	0.01399	-0.00307	0.51396	0.26415
A1010	0.04745	0.12230	0.01496	0.07122	0.48672	0.23690
A1013	0.04925	0.12641	0.01598	0.09986	0.34710	0.12048
A1015	0.04456	0.12681	0.01608	0.08445	0.31608	0.09990
A1016	0.04020	0.13579	0.01844	0.06832	0.28358	0.08042
A1018	0.05117	0.12275	0.01507	0.06998	0.18973	0.03600
A1019	0.04196	0.12528	0.01569	0.03428	0.19824	0.03930
A1021	0.05246	0.12696	0.01612	0.07867	0.33700	0.11357
A1022	0.04912	0.12506	0.01564	0.05788	0.27557	0.07594
A1023	0.04899	0.12562	0.01578	1.11320	6.81740	46.47696
A1027	0.05782	0.23958	0.05740	0.09929	0.53946	0.29101
A1031	0.04641	0.14197	0.02015	0.08070	0.36252	0.13142
A1032	0.04527	0.17149	0.02941	0.06482	0.21026	0.04421
A1037	0.05513	0.19110	0.03652	0.13758	0.56254	0.31645
A1038	0.05787	0.19024	0.03619	0.05787	0.19024	0.03619
A1039	0.06607	0.13570	0.01842	0.17871	1.02813	1.05705
A1041	0.05913	0.12145	0.01475	-0.49298	2.74992	7.56206
A1042	0.06403	0.10903	0.01189	0.09331	0.51764	0.26795
A1044	0.04320	0.12332	0.01521	0.02093	0.26282	0.06907
A1046	0.05747	0.18418	0.03392	0.05735	0.18463	0.03409
A1049	0.04547	0.12649	0.01600	0.04544	0.12654	0.01601
A1052	0.04303	0.12123	0.01470	0.06672	0.26267	0.06900
A1053	0.04181	0.12208	0.01490	0.04817	0.15580	0.02427
A1054	0.05897	0.20387	0.04156	-1.52234	8.29928	68.87808
A1055	0.04404	0.12467	0.01554	0.06272	0.31683	0.10038
A1056	0.04736	0.12127	0.01471	0.06625	0.25464	0.06484
A1057	0.04299	0.12493	0.01561	0.02816	0.17646	0.03114
A1058	0.05217	0.12725	0.01619	0.06307	0.23760	0.05646
A1061	0.04980	0.13078	0.01710	4.22609	22.39479	501.52661
A1066	0.04491	0.16894	0.02854	0.09873	0.50293	0.25293
A1067	0.04478	0.12881	0.01659	0.05186	0.15352	0.02357
A1069	0.05929	0.18942	0.03588	0.02794	0.35878	0.12872

A1072	0.05950	0.15369	0.02362	-0.46889	1.47979	2.18979
A1073	0.05214	0.11964	0.01431	0.48186	2.66377	7.09567
A1074	0.04838	0.10276	0.01056	0.04357	0.17703	0.03134
A1075	0.05296	0.12610	0.01590	0.15405	1.43526	2.05997
A1076	0.05842	0.11307	0.01278	0.07068	0.33150	0.10989
A1077	0.04601	0.12327	0.01519	0.06853	0.41949	0.17597
A1078	0.05158	0.12524	0.01569	-0.00227	0.96642	0.93396
A1080	0.05747	0.11205	0.01256	0.05747	0.11205	0.01256
A1082	0.06511	0.13455	0.01810	0.04848	0.58038	0.33684
A1083	0.04446	0.11213	0.01257	0.04446	0.11213	0.01257
A1084	0.05773	0.17448	0.03044	-0.04956	0.62395	0.38932
A1085	0.05028	0.11246	0.01265	-0.14897	5.87818	34.55304
A1087	0.06482	0.11129	0.01239	-99.00	0.00	0.00
A1090	0.05470	0.12673	0.01606	0.51108	2.40114	5.76548
A1095	0.05254	0.13184	0.01738	0.62055	2.22081	4.93198
A1098	0.05726	0.11048	0.01221	0.07867	0.44983	0.20235
A1100	0.04841	0.10774	0.01161	-0.08290	0.53355	0.28468
A1103	0.04981	0.13298	0.01768	0.09380	0.31635	0.10008
A1104	0.22470	1.14599	1.31330	0.22470	1.14599	1.31330
A1105	0.04325	0.11570	0.01339	0.03740	0.32250	0.10401
A1106	0.04178	0.11887	0.01413	0.04874	0.15007	0.02252
A1107	0.04528	0.11469	0.01315	0.04155	0.19944	0.03978
A1114	0.04241	0.12540	0.01573	0.12100	0.60976	0.37181
A1115	0.04160	0.12841	0.01649	0.74830	4.59437	21.10828
A1117	0.05057	0.11745	0.01380	0.07233	0.47278	0.22352
A1118	0.04176	0.11731	0.01376	0.22819	1.12128	1.25727
A1121	0.04090	0.13493	0.01821	0.05594	0.19380	0.03756
A1122	0.04507	0.12505	0.01564	0.04507	0.12505	0.01564
A1124	0.04405	0.11251	0.01266	0.03937	0.13838	0.01915
A1127	0.03770	0.15800	0.02496	0.04363	0.28780	0.08283
A1129	0.05431	0.11617	0.01350	0.23219	0.80084	0.64135
A1130	0.04530	0.10711	0.01147	0.01346	0.49763	0.24763
A1132	0.06296	0.17090	0.02921	0.05262	0.19962	0.03985
A1133	0.05638	0.18523	0.03431	0.01080	0.35644	0.12705
A1135	0.05614	0.18976	0.03601	0.05614	0.18976	0.03601
A2003	0.05056	0.11896	0.01415	0.05056	0.11896	0.01415
A2011	0.04921	0.12793	0.01637	0.04573	0.13916	0.01937
A2012	0.04793	0.12228	0.01495	0.05937	0.15430	0.02381
A2016	0.03994	0.12647	0.01600	0.18757	0.87602	0.76741
A2018	0.04692	0.11527	0.01329	-0.05630	1.00587	1.01178
A2019	0.04745	0.12110	0.01466	0.06536	0.26663	0.07109
A2025	0.04611	0.12875	0.01658	0.03337	0.24477	0.05991
A2027	0.03649	0.14125	0.01995	0.04840	0.19267	0.03712
A2033	0.03561	0.12335	0.01522	-0.46232	2.11797	4.48578
A2035	0.05409	0.17026	0.02899	2.40101	10.93716	119.62144
A2036	0.05408	0.16776	0.02815	0.45458	2.18556	4.77669
A2039	0.04533	0.13692	0.01875	0.03817	0.63873	0.40798
A2041	0.04303	0.11871	0.01409	0.04971	0.24498	0.06002
A2045	0.04538	0.14598	0.02131	0.09786	0.83045	0.68965
A2047	0.04755	0.12882	0.01660	0.51689	2.30664	5.32061
A2048	0.04640	0.12591	0.01585	0.09310	0.49861	0.24861
A2049	0.04494	0.12461	0.01553	0.03304	0.15173	0.02302

A2051	0.03870	0.11877	0.01411	0.04699	0.16722	0.02796
A3002	0.04655	0.11766	0.01384	0.08211	0.38635	0.14926
A3003	0.04349	0.11555	0.01335	-0.27003	1.68789	2.84898
A3005	0.04736	0.11713	0.01372	0.06580	0.40148	0.16119
A3009	0.04884	0.11945	0.01427	0.07147	0.32977	0.10875
A3010	0.04619	0.13166	0.01733	0.05051	0.64051	0.41025
A3012	0.04477	0.12316	0.01517	0.04211	0.20260	0.04105
A3029	0.04939	0.12560	0.01577	0.96577	5.28492	27.93034
A3033	0.04281	0.12901	0.01664	0.05593	0.94121	0.88587
A3035	0.04624	0.12829	0.01646	-0.12733	0.69216	0.47909
A3036	0.04823	0.13033	0.01699	0.09047	0.33302	0.11090
A3037	0.04621	0.12869	0.01656	0.06197	0.18370	0.03375
A3039	0.04512	0.12745	0.01624	0.18708	0.97709	0.95470
A3040	0.05144	0.12827	0.01645	0.21872	2.35339	5.53842
A3041	0.04860	0.12325	0.01519	0.06132	0.34205	0.11700
A3042	0.04248	0.12609	0.01590	0.02781	0.74066	0.54857
A3043	0.04517	0.12673	0.01606	0.06184	0.37031	0.13713
A3044	0.04500	0.12731	0.01621	0.21247	1.01623	1.03273
A3046	0.04575	0.13430	0.01804	0.07757	0.21934	0.04811
A3049	0.04493	0.12924	0.01670	0.10640	0.58995	0.34804
A3050	0.06170	0.25381	0.06442	-0.19057	1.05782	1.11899
A3051	0.04621	0.13518	0.01827	0.04660	0.24272	0.05891
A3052	0.04077	0.13928	0.01940	0.10606	0.60677	0.36817
A3054	0.04706	0.14122	0.01994	0.06394	0.20770	0.04314
A3055	0.04376	0.14904	0.02221	0.04513	0.22208	0.04932
A3056	0.04511	0.14479	0.02096	0.23389	1.15224	1.32765
A3058	0.04478	0.14287	0.02041	0.14060	0.58183	0.33852
A3059	0.05624	0.10877	0.01183	0.04483	0.18397	0.03385
A3061	0.05046	0.14064	0.01978	0.76491	6.98121	48.73727
A3063	0.05040	0.11844	0.01403	0.09248	0.34956	0.12219
A3064	0.05852	0.18056	0.03260	-0.09990	1.71620	2.94535
A3069	0.05798	0.10992	0.01208	0.12134	0.48542	0.23563
A3077	0.04574	0.11140	0.01241	0.02862	0.16162	0.02612
A3080	0.04089	0.13322	0.01775	0.23016	1.58148	2.50107
A3084	0.04458	0.12761	0.01628	0.06260	0.29280	0.08573
A3085	0.04551	0.12687	0.01610	0.05812	0.95096	0.90433
A3088	0.04934	0.13027	0.01697	0.05943	0.30037	0.09022
A3089	0.04581	0.10994	0.01209	0.06967	0.31310	0.09803
A3091	0.04115	0.11417	0.01303	0.11407	0.61432	0.37738
A3093	0.04779	0.10819	0.01171	0.03347	0.18840	0.03549
A3094	0.06107	0.18875	0.03563	0.10830	0.46962	0.22055
A3096	0.05938	0.19496	0.03801	0.07308	0.31786	0.10104
A3097	0.05854	0.18420	0.03393	0.16831	0.71845	0.51617
A3101	0.05585	0.17202	0.02959	0.21329	0.73926	0.54651
A3102	0.05778	0.19924	0.03970	-0.32231	2.24813	5.05408
A3104	0.05994	0.20065	0.04026	0.06212	0.30041	0.09025
A3105	0.05194	0.12731	0.01621	0.04952	0.31722	0.10063
A3106	0.05123	0.12104	0.01465	0.05880	0.37096	0.13761
A3107	0.04636	0.12496	0.01561	0.04733	0.17661	0.03119
A3108	0.05175	0.13045	0.01702	0.02624	0.20669	0.04272
A3110	0.04902	0.12301	0.01513	0.05031	0.21960	0.04822
A3114	0.04500	0.12281	0.01508	0.05809	0.47613	0.22670

A3115	0.06173	0.19505	0.03804	0.07764	0.33455	0.11193
A3116	0.04623	0.12427	0.01544	0.03552	0.16104	0.02593
A3117	0.04175	0.11901	0.01416	0.03838	0.29427	0.08660
A3118	0.06145	0.21162	0.04478	2.85418	12.96216	168.01765
A3123	0.04062	0.12315	0.01517	0.05817	0.68513	0.46941