# *AN ANALYSIS OF THE FINANCIAL CHARACTERISTICS OF FIRMS THAT EXPERIENCED HEAVY BUYING AND SELLING BY INSIDERS DURING A PERIOD OF ECONOMIC RECESSION*

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**ABSTRACT**

Firms that have experienced heavy insider trading have been of interest to financial analysts, academicians, and investors for years. Differences in the variables that establish value, are expected between companies that experienced heavy buying by insiders, and those that experienced heavy selling. Of particular interest is the buying and selling behavior of company insiders during a period of economic recession. The purpose of this study is to identify the nature and magnitude of the differences in financial variables that establish value, and to establish a financial profile for companies that may in the future experience heavy insider buying and those that will experience heavy insider selling during a period of economic recession. If the two groups of firms have unique financial profiles, it is suggested that the unique profiles may be used as a tool to forecast companies that in the future will experience either heavy insider buying or heavy insider selling during such a period.

## INTRODUCTION

The period from March 2001 to November 2001 was identified by the National Bureau of Economic Research's Business Cycle Dating Committee as a period of economic recession in the United States (Associated Press, 2003). Financial data collected during this period and behavior observed during this period are empirical evidence of the behavior and financial characteristics of firms during such a period. Thus, this period provides a "workshop" for the study of the behavior of firms during a recession. Firms that have experienced heavy insider trading both during recessions, and in years of prosperity have been of interest to regulatory agencies, financial analysts, academicians, and investors for years. Recently, because of unusual corporate scandals, the emphasis has been on illegal trading, and most studies since 2001 have been concerned with illegal insider selling when those insiders used information that was not available to the public. In the year prior to this writing, illegal insider activity at companies such as Enron, Worldcom, Quest, Global Crossing, AOL Time Warner, and others reached such proportions that it made a significant contribution to the 2002 market decline and loss of investor confidence (Fortune, September 2, 2002). The difference between legal and illegal trading is defined in the somewhat complex rules of the Securities and Exchange Commission (SEC)[1]. The subject of illegal inside trading has been so pervasive and the effects so devastating that the more mundane subject of legal trading has been largely ignored since the corporate scandals of 2001-2002. On an empirical basis however, analysts, academicians, and investors follow the reporting of

the legal buying and selling of shares by those inside the firm. Indeed, *Value Line* reports every week on insiders decisions to buy or sell on every firm in their database. The implication is that the legal trading activity is a source of information about the future direction of the firm. Of course, in perfect capital markets this information would have little value to the investor because it would be factored in prices before the investor could act on it. However, since these transactions are of interest to investors, investment analysts, financial counselors, and company managers, and since *Value Line* and other investment services find it necessary to report inside transactions, it follows that they may contain valuable information about the future direction of the company (Robbins, 2000).

There have been thus far, no studies that sought to identify the differences in the financial variables that determine value between two groups of firms: those that have experienced heavy insider buying, and those that have experienced heavy insider selling during a recession. Since insiders are selling their shares in one group of firms, and insiders are buying their company's shares in another group of firms, differences in the variables that establish value, such as standard quantitative measures of risk and return, are expected.

The purpose of this study is to identify the nature and magnitude of those differences, and to determine whether or not each group has a unique financial profile. More specifically, the study is concerned with those variables that are indicators of the firm's risk-return tradeoff, and how that risk-return tradeoff is perceived by professional analysts and investors at the margin (those willing and able to buy). If the two groups of firms have unique financial profiles, it suggests that those financial profiles may be used as a tool to forecast companies that in future economic downturns will experience heavy inside buying, and those that will experience heavy inside selling. The use of such a tool to forecast insider trading during such a period would have implications for investors, managers, lenders, investment counselors, and academicians. As in previous studies of this nature Multiple Discriminant Analysis (MDA) is used.

## METHODOLOGY

The issues to be resolved are first, classification of the firms, and then evaluation of the accuracy of that classification. More specifically, can firms be assigned, on the basis of selected variables, to one of two groups: (1) firms identified by *Value Line*, in the recession year of 2001, as companies that have experienced heavy selling by insiders (HIS), or (2) companies that have experienced heavy buying by insiders. (HIB)? Multiple discriminant analysis (MDA) provides a procedure for assigning firms to predetermined groupings based on variables or attributes whose values may depend on the group to which the firm actually belongs. If the model classifies the sample successfully, and that classification can be validated to eliminate bias, the ability of the model to predict future classifications is implied.

If the purpose of the study were simply to establish a financial profile of the two groups, simple ratios would be adequate. In a seminal paper on the use of MDA in finance, Altman (1968) showed that sets of ratios used in multivariate analysis were better descriptors of the companies and had more predictive power than individual ratios used in univariate tests. The use of MDA in the social sciences for the purpose of classification is widespread. In addition to its use in the Altman study to predict corporate bankruptcy, MDA was used to predict the credit worthiness of used car loan applicants as far back as sixty two years ago (Durand, 1941). In addition, it has been used

to predict financially distressed property-liability insurance firms (Trieschmann and Pinches, 1973), the failure of small businesses (Edmister, 1982), and company growth rates (Payne, Daghestani, and Hervitz, 2001). These studies all had one thing in common, the groups in which the firms were classified were nominally measured: good-bad, failing-nonfailing, likely to bankrupt-not likely to bankrupt, and the predictive variables were intervally measured. This study also employs nominally measured dependent variables and intervally measured predictive variables. Thus, MDA is appropriate for this analysis. The analysis was accomplished using SPSS 8.0 (SPSS Inc., 1988).

Since the objective of the analysis is to determine the discriminating capabilities of the entire set of variables without regard to the impact of individual variables, all variables were entered into the model simultaneously. (Hair et al, 1992, 99).

**SELECTION OF SAMPLE AND INDEPENDENT VARIABLES**

All data used in the analysis were gathered from *Value Line Ratings and Reports* for the year 2001 when the country was in an economic recession from March to November. Thus, these are cross sectional comparisons. The sample consists of two groups of fifty firms. The first group was randomly drawn from the companies identified by *Value Line* as HIS companies. The second group was randomly selected from the companies identified by *Value Line* as HIB companies. Previous studies using this and other statistical methods have chosen explanatory variables by various methods and logical arguments. In this study the group of explanatory variables chosen for analysis contains a measure of systematic risk, a measure of one year return to total capital, a measure of three year return to total capital, a measure of how investors at the margin value the company's earnings, a measure of the size of the firm, a measure of *Value Line's* ranking for the "timeliness of purchase," and a measure of return to the common shareholders. The rational for each explanatory variable as well as the specific measures chosen is discussed below.

Sharpe's beta is the standard measure of systematic risk. Systematic risk includes the effects of both operating and financial leverage. Thus, it is not necessary to include separate measures of financial and operating risk. In addition, systematic risk is the relevant risk in portfolio management and the only risk for which investors can expect to be rewarded. Unsystematic risk exists, but since it can be diversified away, investors or companies that incur unsystematic risk are simply not rewarded for it.

The measure of return chosen is return to total capital. Everything on the right hand side of the balance sheet except what is current is referred to as the capital structure of the firm. Return to total capital includes a return to all entities represented in that section of the balance sheet. That includes creditors, preferred stockholders, and common stockholders. The measure of return to total capital recognizes that the firm is financed by creditors as well as owners. It further recognizes that the value of the firm is affected by the cost of debt. It is not known how long insiders track returns, or whether or not those returns are used as proxies for future returns, but the purpose of this study involves building a financial profile of those characteristics that exist. Thus, returns to total capital are included for both a one year and a three year period.

The price earnings ratio is included in the analysis to provide a rough idea of how investors at the margin view the quality of the earnings of the company. Researchers are understandably reluctant to use the price earnings ratio in academic research since accounting methods can greatly influence the denominator in this variable. The ratio can be used for comparative purposes only when the earnings are computed in exactly the same manner for all firms in the sample. *Value Line* and other reputable data sources take great care to compute all data using the same methods. Thus, *Value Line's* price earnings ratios may be used for comparative purposes among their firms. It would not be appropriate to compare a *Value Line* price earnings ratio with the same variable from another reporting source such as *Moody's* or *Standard and Poor's*.

There is no indication in the literature on whether or not heavy inside trading is in any way associated with size. It will be informative to include a measure of size. The measure of size used in the analysis is total capitalization.

*Value Line* rates every company in their database as to the timeliness of purchase. That is, they assign a numerical rating from one to five that indicates whether or not the present is a good time to invest in that firm's common stock. The number one is the highest rating for timeliness, and the number five is the lowest. If insiders are better able to discern the best times to buy and sell, then it may be expected that the number one will be associated with the HIB companies, and the number five will be associated with the HIS companies. If the association is weak, then it may be concluded that insiders have no better idea of when to buy and when to sell than the general public. The *Value Line* timeliness rankings are thus included.

A measure of common equity is included since this is the actual return to shareholders, and the return that potential shareholders will "trade off" (Van Horne, 2001, 207).

In sum, there are seven explanatory variables in the multiple discriminant model. They are as follows:

X1 – Sharpe's Beta ( Systematic Risk )

X2 – One Year Return to Total Capital

X3 – Three Year Return to Total Capital

X4 – The Price Earnings Multiple

X5 – Market Capitalization ( Size )

X6 – Value Line's Timeliness Ranking

X7 – Return to Common Equity

The explanatory variable profile contains basic measures of common financial variables. They were chosen, as in any experimental design, because of their consistency with theory, adequacy in measurement, the extent to which they have been used in previous studies and their availability from a reputable source.

**TEST AND RESULTS**

The discriminant function used has the form:

$$Z_j = V_1X_{1j} + V_2X_{2j} + ..... + V_nX_{nj} \quad (1)$$

where:

$X_{ij}$ is the company's value for the ith independent variable.

$V_i$ is the discriminant coefficient for the ith variable.

$Z_j$ is the jth individual's discriminant score.

The function derived from the data in this study in equation 1 is:

$$Z_j = - 3.173 + .427X_1 - .002X_2 + .006X_3 + .041X_4 + .001X_5 - .076X_6 + .138X_7 \quad (2)$$

Classification of firms is relatively simple. The values of the seven variables for each firm are substituted into equation (2). Thus, each firm in both groups receives a Z score. If a firm's Z score is greater than a critical value, the firm is classified in group two (HIS). Conversely, a Z score less than the critical value will place the firm in group one (HIB). The only exception is the measure for timeliness. The values for this variable are descending as securities are perceived to be more timely. Since the two groups are heterogeneous, the expectation is that randomly selected HIS firms will fall into one group and the randomly selected HIB firms will fall into the other. One of the assumptions of the MDA model is that the matrices of data are equal. The SPSS program tests for equality of matrices by means of Box's M statistic. In this study Box's M transformed to the more familiar F statistic of 2.341 is less than the critical $F_{05}$ 18.51 with 1 and 2 degrees of freedom. Thus, the null hypothesis that the two matrices are equal cannot be rejected, and the midpoint value between the two group means can be defined as the critical Z value. Interpretation of the results of discriminant analysis is usually accomplished by addressing four basic questions:

1. Is there a significant difference between the mean vectors of variables for the two groups of firms?
2. How well did the discriminant function perform?
3. How well did the independent variables perform?
4. Will this function discriminate as well on any random sample of firms as it did on the original sample?

To answer the first question, SPSS provides a Wilk's Lambda – Chi Square transformation (Cooper and Schindler, 2001, 581). The calculated value of Chi-Square is 27.67. That exceeds the critical value of Chi-Square $_{05}$ 14.07, with 7 degrees of freedom. The null hypothesis that there is no significant difference between the financial profiles of the two groups is therefore rejected, and the first conclusion drawn from the analysis is that the two groups have significantly different financial characteristics. This result was of course, expected since one group's shares are being purchased by insiders and the other group's shares are being sold by insiders.

The discriminant function thus, has the power to separate the two groups. However, this does not mean that it will in fact separate them. The ultimate value of a discriminant model depends on the results obtained. That is, what percentage of firms were classified correctly and is that percentage significant?

To answer the second question a test of proportions is needed. Of the 50 firms in the HIB group, 41 were classified correctly. Of the 50 firms in the HIS group, 33 were classified correctly. Thus, 74 firms or 74 percent were classified correctly. The results are shown in Table 1.

Table 1

Classification Results
Predicted Results

| Actual Results | Insider Buying | Insider Selling |
|---|---|---|
| Insider Buying | 33 | 17 |
| Insider Selling | 9 | 41 |

It may be obvious that 74 percent is statistically significant, and it is not surprising given the differences in how insiders are trading their common shares. However, a test of statistical significance is required in any formal study. To test whether or not 74 percent correct classification rate is statistically significant, Press's Q test is appropriate (Hair et al, 1992, 106). Press's Q is a Chi-square random variable.

$$\text{Press's Q} = [N- (n \times k)]^2 / N (k-1) \quad (3)$$

where:

N = Total sample size

n = Number of cases correctly classified

k = Number of groups

In this case:

$$\text{Press's Q} = [100-(74 \times 2)]^2 /100(2-1) = 23.04 \text{ is greater than } \chi^2_{.05} \ 3.84 \text{ with one d.f.} \quad (4)$$

The null hypothesis that the percentage classified correctly is not significantly different from what would be classified correctly by chance is rejected. The evidence suggests that the discriminant function performed well in separating the two groups.

The arithmetic signs of the adjusted coefficients in Table 2 are important to answer question number three. A positive sign indicates that the greater a firm's value for the variable, the more likely it will be an HIS company. Conversely, a negative sign for an adjusted coefficient signifies that the greater a firm's value for the variable, the more likely it will be classified as a HIB company. As stated earlier, the measure for timeliness is an exception because the values for this variable are descending as securities are perceived to be more timely. Thus, according to Table 2 the greater the level of systematic risk, the greater the three year return to total capital, the greater the price earnings multiple, the greater the size of the firm, the greater the return on equity, and the smaller the value for timeliness the more likely there would be heavy inside selling. Conversely, the greater the return to total capital for one year the more likely there would be heavy inside buying.

The relative contribution of each variable to the total discriminating power of the function may be obtained by standardizing (pooled within group variances) the canonical coefficients of the discriminant function. These coefficients are given in the output of the SPSS 8.0 program. Alternatively, the coefficient weights may be obtained

by adjusting the discriminant coefficients for differences in the units of measure of the original variables. This adjustment is made arithmetically by multiplying the square root of the diagonal elements of the variance-covariance matrix for each variable by the discriminant coefficient of that variable. The product of this multiplication also gives the relative contribution of each variable to the total discriminating power of the function (Altman, 1968). Standardized canonical coefficients are shown in Table 2.

**Table 2**
**Relative Contribution Of The Variables**

| Adjusted Variables | Coefficient | Rank |
|---|---|---|
| Systematic Risk | .156 | 4 |
| One Year Return to Total Capital | -.073 | 6 |
| Three Year Return to Total Capital | .641 | 2 |
| Price Earnings Multiple | .412 | 3 |
| Total Capitalization (Size) | .111 | 5 |
| Timeliness | -.057 | 7 |
| Return on Equity | .801 | 1 |

An examination of Table 2 reveals that return on equity is the variable with the greatest contribution to the overall discriminating function, followed by the three year return to total capital, the price earnings multiple, systematic risk, the size of the firm, the one year return to total capital, and *Value Line's* measure for timeliness. Some multicollinearity exists between the variables, because the numerator in the price earnings ratio may depend on all the other variables, return on total capital and return on equity will obviously contain multicollinearity. Hair, et al (1992) wrote that this consideration becomes critical in stepwise analysis and may be the factor determining whether a variable should be entered into a model. However, when all variables are entered into the model simultaneously, the discriminatory power of the model is a function of the variables evaluated as a set and multicollinearity becomes less important.

## VALIDATION OF THE MODEL

Before any general conclusions can be drawn, a determination must be made whether the model would yield valid results for any group of randomly drawn firms. The procedure used here for validation is referred to as the Lachenbruch or, more informally, the "jackknife" method. In this method, the discriminant function is fitted to repeatedly drawn samples of the original sample. The procedure estimates (k - 1) samples, and eliminates one case at a time from the original sample of "k" cases (Hair et al, 1992, 98). The expectation is that the proportion of firms classified correctly by the jackknife method would be less than that in the original sample due to the systematic bias associated with sampling errors. The major issue is whether the proportion classified

correctly by the validation test differs significantly from the 74 percent classified correctly in the original test. That is, is the difference in the two proportions classified correctly by the two tests due to bias? The objective is to see if this bias is significant. The jackknife validation resulted in the correct classification of 69 percent of the firms. There were 100 companies and two groups in the original sample. Since there are only two groups for analysis the binomial test is appropriate:

$$69 - 100(.74)/ [100 (.74) (.26)]^{1/2} = -1.14 < t_{05}\ 1.645 \qquad (5)$$

Thus, the null hypothesis that there is no significant difference between the proportion of firms classified correctly in the original test and the proportion classified correctly in the validation test cannot be rejected. Therefore, it can be concluded that while there may be some bias in the original analysis, it is not significant. The procedure will classify new firms as well as it did in the original analysis, and prediction on the basis of the explanatory variables is possible.

To ensure that the model can be used in forecasting insider trading during a recession, further validation is needed. Thus, the split-sample method of validation was used. The sample of 100 firms was split into two samples, one of 75 and the other of 25. The larger sample was first used to 'train' the MDA model, and that was used to predict the group membership of the unseen 25 cases. The sample used in training allowed on average fifteen cases per predicting variable. Such case-to-variable ratio is close enough to the general recommendation of twenty per variable. The validation result is produced in Table 3

**Table 3**
**Classification Results**

| | | | | Predicted Group Membership | | Total |
|---|---|---|---|---|---|---|
| | | | SELLBUY | 0 | 1 | |
| Cases Selected | Original | Count | 0 | 26 | 11 | 37 |
| | | | 1 | 8 | 30 | 38 |
| | | % | 0 | 70.3 | 29.7 | 100.0 |
| | | | 1 | 21.1 | 78.9 | 100.0 |
| | Cross-validated | Count | 0 | 24 | 13 | 37 |
| | | | 1 | 9 | 29 | 38 |
| | | % | 0 | 64.9 | 35.1 | 100.0 |
| | | | 1 | 23.7 | 76.3 | 100.0 |
| Cases Not Selected | Original | Count | 0 | 10 | 3 | 13 |
| | | | 1 | 2 | 10 | 12 |
| | | % | 0 | 76.9 | 23.1 | 100.0 |
| | | | 1 | 16.7 | 83.3 | 100.0 |

a. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
b. 74.7% of selected original grouped cases correctly classified.
c. 80.0% of unselected original grouped cases correctly classified.
d. 70.7% of selected cross-validated grouped cases correctly classified.

The MDA model derived from the 75-case sample yielded a prediction rate of about 75%, and predicted 80% of the hold-out cases correctly. The leave-one-out cross validation procedure generated an accuracy rate of about 71%. The lowered prediction

rate of the discriminant function is not beyond reasonable expectation since the number of cases used in training was reduced by a quarter. According to the validation results, the financial profiles derived for the two groups of companies should be sufficiently reliable for predicting companies that may be identified as either HIB or HIS companies during a period of economic recession. Regardless of the fact that two legitimate and generally accepted validation procedures were used to identify variable bias, it remains possible, as in any statistical test that errors exist at least at the .05 level of significance.

## SUMMARY AND CONCLUSIONS

The purpose of this study was to establish a financial profile of firms characterized by *Value Line* as having experienced heavy inside selling, and those having experienced heavy inside buying during a period of economic recession. Significant differences were found between the two groups of firms and it is suggested that the financial variables unique to the two groups of firms may be used to forecast or identify companies that may experience the same inside trading activity during future recessions.

The fact that there were significant differences between the two groups of firms is not surprising since insiders were selling one group's stock, and insiders were buying the other group's stock. However, the nature and magnitude of these differences is certainly informative. There were seven explanatory variables used in the analysis. Four of the results may have been expected, and are consistent with previous studies. One had no prior expectation, and two were a mild surprise and defy explanation.

The result that had no prior expectation was that the larger the company, the more inside selling they experienced. Although illegal inside selling has gotten much attention in very large firms, it simply was not known whether or not legal trading was characteristic of either large or small firms. It has been suggested by reviewers of this study that an alternative explanation of why firm size was positively related to inside selling may be that as firm size increases, variability in the value of the firm becomes less transparent. Thus, increases in size would add to risk. This suggestion seems at least plausible.

The four results that may have been expected were: First, insiders were selling shares in firms characterized by high levels of systematic risk. This is logical because investors simply do not like volatility, and high levels of volatility will cause any rational investor to sell. Secondly, insiders were selling at high price earnings multiples. A fundamental objective of every company is to earn money. If price is a partial function of those earnings, then there is a point at which investors at the margin will feel that the multiple is too high and not justified by earnings. As that point is approached, it may be expected that all rational investors will start to sell. Third, insiders were buying shares that had high one year returns to total capital. Again, this is logical, because just as investors do not like risk, they do like high rates of return, and in fact, trade off measures of risk and return to establish the value of any investment. Finally, the most obvious potential outcome did occur. Inside investors were buying and selling rationally, and in accordance with the implied recommendations in *Value Line's* timeliness rating. In other words, they were buying when it was timely to purchase and selling at what was perceived as right time to sell. This is the only indication in the study that raises a question as to whether or not the insiders were acting on information that was not available to the public. If indeed, that were the case their trading would be illegal.

Two of the results were unexpected, and cannot be explained without a great deal of further research. However, a few comments may be appropriate. First, inside

investors sold their shares in companies that had high three year returns to total capital. Given that they were buying shares in firms that were showing high one year returns, it may be concluded that inside investors were valuing short term returns more highly than returns over a three year period. Neither past short term nor past long term returns are relevant for investment decision making. The investor is interested in marginal returns, and to the extent, if any, that one year returns are a better indicator of marginal returns, it may aid in explaining a result that was unexpected. Secondly, insiders were selling shares in companies that showed high returns on equity. This defies logic unless the levels of systematic risk in those companies were high enough to offset the higher returns to equity. In the eight month recession period under study, systematic risk generally increased, and there was a general feeling of pessimism among investors as the market declined.

There will be no attempt here to analyze why the variable profile is as it is, but given the interest and timeliness of the subject of inside trading, both in the literature and in practice, it is an area that certainly deserves further study.

This study has resulted in a contribution toward the construction of a theory that describes the risk-return characteristics of companies that are identified by *Value Line* as experiencing either heavy inside buying, or heavy inside selling during a period of economic recession. Construction of a complete theory would aid managers, investors, and investment counselors in identifying the merits, or lack of merits in using profiles such as the one developed here for investment and other managerial decisions.

## ENDNOTES

[1]Essentially, illegal trading occurs when; 1) issuers of nonpublic information make selective disclosure, 2) with the use or "knowing possession" of nonpublic information, and 3) when the breach of a duty of trust gives rise to a liability under the misappropriation theory (SEC Fact Sheet, August 10, 2000).

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