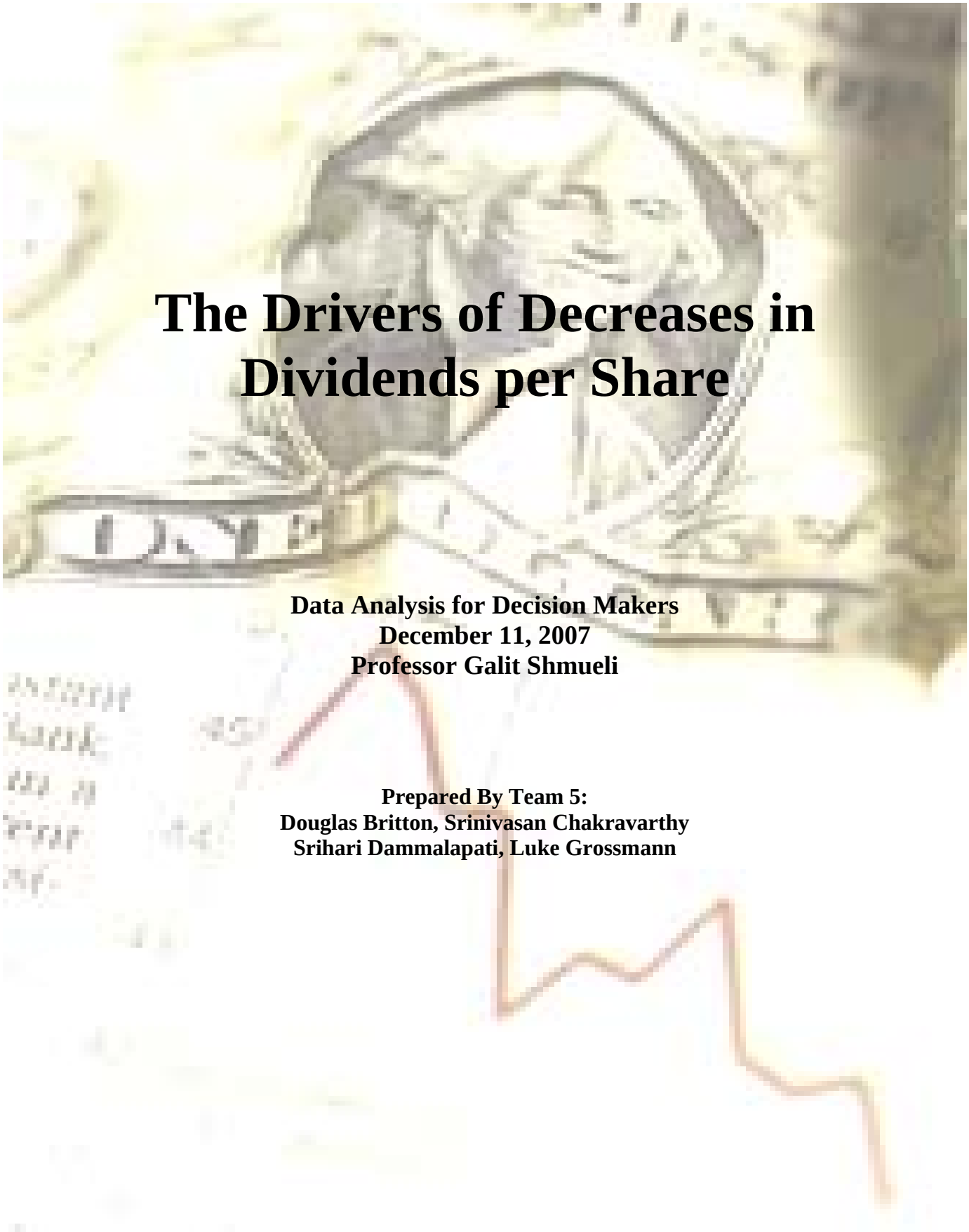

# The Drivers of Decreases in Dividends per Share

**Data Analysis for Decision Makers**
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## EXECUTIVE SUMMARY

Dividend payouts are one of the two ways that stock investors are compensated for their investments in the stock market. As such, changes in dividends are extremely important to investors. Financial literature has shown that a decrease in dividend payouts on a dividend per share basis have a negative impact that is solely explainable by the decrease in expected future cash flows. Decreasing dividends is a negative signal to the market.

The ability to understand what makes up decisions to decrease dividends will help investors accurately evaluate the risk of an investment and help managers to articulate financial objectives that keep their firms from falling into this category.

The task in this case was to create a model that would produce a categorical value that indicates whether dividends per share will strictly decrease or not. The success class in this model was a value of 1, which indicated that the dividends per share stayed the same or increased. The source data in this model was technical performance data about 1022 publicly traded companies. These companies represented domestic and international companies across all US-based markets. The data were based on EOY numbers for 2004 and 2005. The raw data were transformed into year to year deltas. Furthermore, some of the variables were transformed into categorical variables that have a value of zero if the quantity strictly decreases or a value of one otherwise. These values helped the model in cases when the magnitude of a change didn't contain additional information, but only the direction of the change.

The most successful model resulted from a logistic regression of 8 technical performance indicators for each of the companies. Logistic regression was also ideal because it supported the explanatory objectives of the model. The model results indicated the most relevant drivers of dividend changes were year-to-year changes in the stock price, revenues, price/sales ratio, enterprise value/sales ratio, expected growth in EPS, and the beta. The model has an overall error or 16.55% with a cutoff score of 0.91.

This study simply sought to understand the underlying reasons that someone might choose to decrease their dividends per share. Since the source data was from a very finite time slice (2004-2005), the implications of the model are also limited. The first recommendation would be to see if the results generalized across larger slices of time and across other financial instruments. Specifically, does the model apply to the pricing of respective options contracts? The next recommendation would be to try to quantify the decreases in dividends per share. With a quantitative model, one could develop an arbitrage trading strategy. While the $R^2$ of 28.24% is low, the overall error rate of 16.55% is sufficient to trade on temporary price inefficiencies. This assumes that the arbitrageur could be highly levered and could have a relatively low cost of debt.

Another important implication of the model is that a senior manager at a publicly traded company could use the model as the basis for a management plan. The management could closely watch the performance of these indicators, in order to ensure that the market receives as few surprises as possible.

## TECHNICAL SUMMARY

The analysis was performed by manipulating spreadsheets of technical data from 1022 publicly traded companies. We had to ensure that we had the exact same information for all companies across both 2004 and 2005. We developed excel based software module to process the data and ensured that we had all companies represented in all years and the same data for each company in each year. With this many companies there were certainly issues cleaning up the data. Occasionally, data was missing out of the original data source. In many cases, we were able to supplement the original data source with data from CRSP and Research Insight. Where we were unable to find actual data, we used the data maintenance tools of XLMiner. Missing data were replaced with the mean value for the particular column.

Once we had perfectly structured data, we were able to create another spreadsheet, the delta sheet, that represented the change in value from one year to another. Each cell in this spreadsheet was the result of dividing the same cell on the 2005 spreadsheet by the same cell on the 2004 spreadsheet. In other words, the following formula was applied across all cells on the delta sheet: Delta!G5 = (Results_2005!G5/Results_2004!G5). This means that no year to year change had a value of 1.0 in the delta sheet.

The logistic regression model was chosen because it gave the highest $R^2$ and the lowest overall error rate. The differences between the discriminate analysis model and the logistic regression model weren't very great. The DA model is included in Appendix IV. The classification tree yielded good results too, but was less intuitive or self-explanatory as the logistic regression. The 8-variable tree became highly fractured and difficult to follow. Since this was an explanatory model, no data partitioning was performed.

Data exploration was performed on the variables that appeared to be driving the dividend increases and decreases most. These graphs can be seen in Appendices I and II. There is a clear relationship that can be seen, with the companies experiencing decreasing dividends separated from the rest of the companies within the graph. With this insight, a series of large regressions were run that included 30 of the 96 total variables. From each run, the most statistically significant variables were retained. Then another regression was run that combined just these "significant" variables. From this point, another group of variables became insignificant and they were removed. The resulting model is included in Figure 1. A series of categorical variables were introduced on the advice of Professor Mark Taranto of the Finance department at R. H. Smith School of Business. These categorical variables took a value of either zero or one. Zero indicated that the corresponding real number variable was less than 1.0 where one indicated that the variable had a value of greater than or equal to one. (See Appendix 3 for a description of each of the variables utilized for the logistic regression model).

Figure 1 - The Model

| Input variables | Coefficient | Std. Error | p-value | Odds |
|---|---|---|---|---|
| Constant term | 5.40905237 | 1.47002482 | 0.00023363 | * |
| Stock Price | 6.35628414 | 0.5874483 | 0 | 576.1015015 |
| Revenues: Last yr | -3.07913756 | 0.61567312 | 0.00000057 | 0.04599891 |
| PS Ratio | -6.13924789 | 1.27187204 | 0.00000139 | 0.00215654 |
| PS Ratio_BIN | -6.0798049 | 1.22230399 | 0.00000066 | 0.00228862 |
| PS_Interaction | 4.7447648 | 1.31647348 | 0.00031318 | 114.9807358 |
| EV/Sales_BIN | 1.13364589 | 0.41077492 | 0.00578414 | 3.1069634 |
| Expected Growth in EPS: next 5 years | -0.1544888 | 0.05462378 | 0.00468056 | 0.85685307 |
| 3-yr Regression Beta | 0.12941729 | 0.05056436 | 0.0104836 | 1.138165 |

Classification Confusion Matrix

| | Predicted Class | |
|---|---|---|
| Actual Class | 1 | 0 |
| 1 | 770 | 138 |
| 0 | 31 | 82 |

Error Report

| Class | # Cases | # Errors | % Error |
|---|---|---|---|
| 1 | 1 | 0 | 0.00 |
| 0 | 908 | 770 | 84.80 |
| Overall | 909 | 770 | 84.71 |

The challenge in a model like this is that the relationships aren't going to be obvious or straightforward. Otherwise, market efficiency would have already priced out this pattern. According to Prof. Taranto, the efficient market hypothesis says that the expected value of $R^2$ for any financial model should be zero.

Since this is an explanatory model, it is important to interpret the meaning of each variable. Stock price is a commonly accepted proxy for performance of a firm. Our value here indicates the firm's change in stock price. It is intuitive that a decrease in the stock price could mean that the firm isn't doing well. If the firm isn't doing well, it might be hard to pay dividends. More tangibly, a decrease in stock price can also decrease a firm's borrowing power, which might provide the necessary cash for a dividend disbursement. Changes in revenue similarly indicate firm performance. If a firm's revenue sharply declines, that will decrease funds available for paying dividends.

Price to Sales ratio, taken collectively as the raw P/S ratio, a binary conversion of that value, and an interaction variable from the two, describes the year to year change in the price that someone is paying for a dollar of sales. The interaction variable says that if the change in year to year P/S is positive, its magnitude is important. If the change in P/S is negative, the magnitude of P/S doesn't matter. The Enterprise Value per Sales binary variable simply returns a zero if the EV/Sales has strictly decreased or a one otherwise. This variable can be interpreted as saying that increases in the total value of assets and debt for each dollar in sales decrease the likelihood of a decrease in dividends. This is because the firm has a larger value base from which to pay dividends when necessary. The binary nature of the variable means that it only matters that the ratio has strictly increased or decreased. The magnitude doesn't matter.

In a pure sense, stock prices represent the present value of future dividends and earnings for the company in question. Thus, changes in expected earnings per share speak directly to the value of a share of stock. Decreases in expected future EPS will decrease a stock's value, and lead to likely decreases in dividends. The 3-year regression beta describes the stock's movement relative to the market. If the beta decreases, this means that the firm becomes less risky relative to the market and earns a lower return. A decrease in the return means that the stock becomes less attractive and the dividend is likely to be decreased.

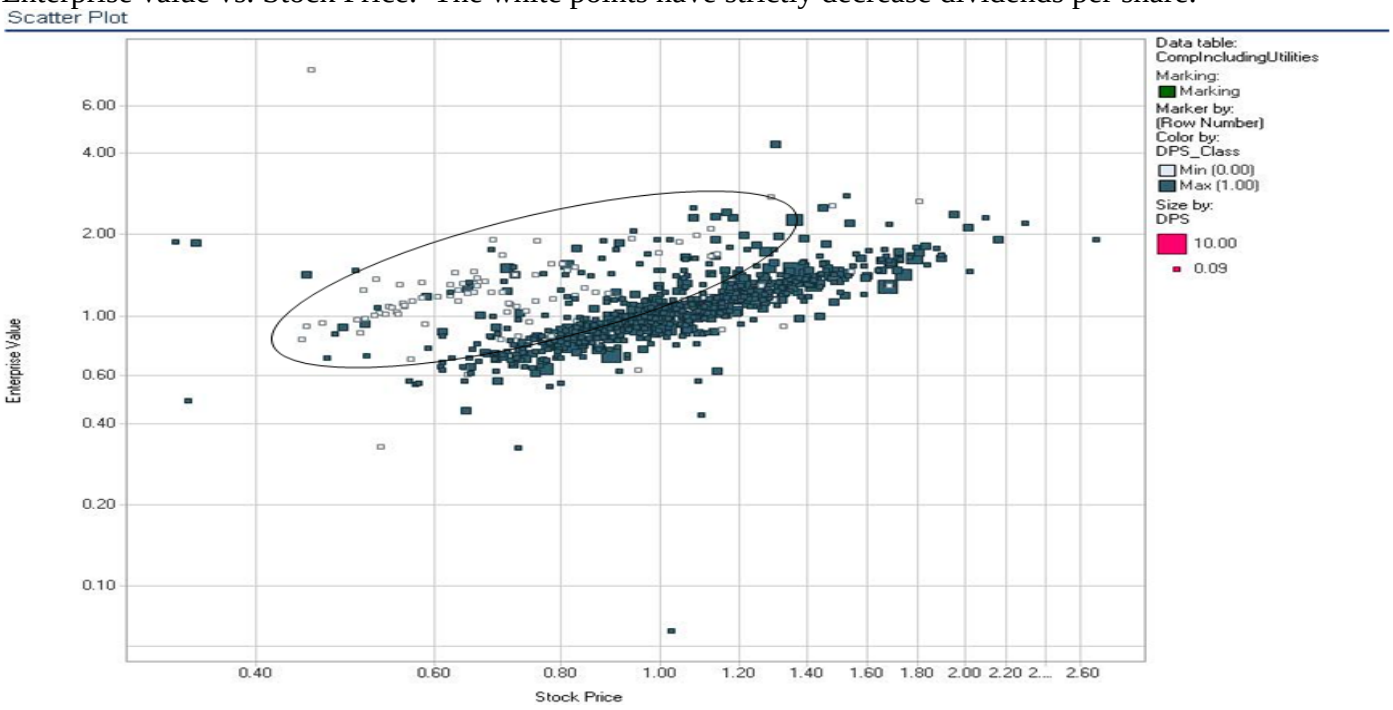
The recommendations of this project are easily supported by the analyses. Since this was an explanatory model on a very specific time period, the results can't be extrapolated outside of that period. Thus, for the results of the model to be useful in the current, an effort must be undertaken to test the results against a variety of time periods. Once the model has been validated during any arbitrary time period, it can be used for either arbitrage purposes or management purposes. Similarly, if a researcher can validate that the model holds when using options prices, this extends the range of instruments an investor has at his or her disposal to create arbitrage positions.

A model that quantified the decrease in dollars per share would allow arbitrageurs to measure the risk and reward of a potential arbitrage position. For an arbitrageur to enter into a highly leveraged position, he or she must know how much they expect something to move in a particular direction. This will let the investor rate the risk of the position. Certain positions won't have enough of a spread between the long position and short position to be worth the risk.

As a senior manager at a publicly traded company, this model could be used to assess the health of the company. Furthermore, it could be used to measure the company's financial direction. Knowledge of the impact of these variables means that the company could focus very closely on the factors that influence this metrics. For example, the company may face a choice to take on additional debt, thus increasing the company's enterprise value. The company could weigh that decision against the future EV/Sales value and determine if it has gone outside of tolerances. If so, you consider that the expected increase sales that will be enabled by the debt. If the debt isn't likely the increase sales enough to keep the metric steady, you could consider that the project isn't worthwhile.

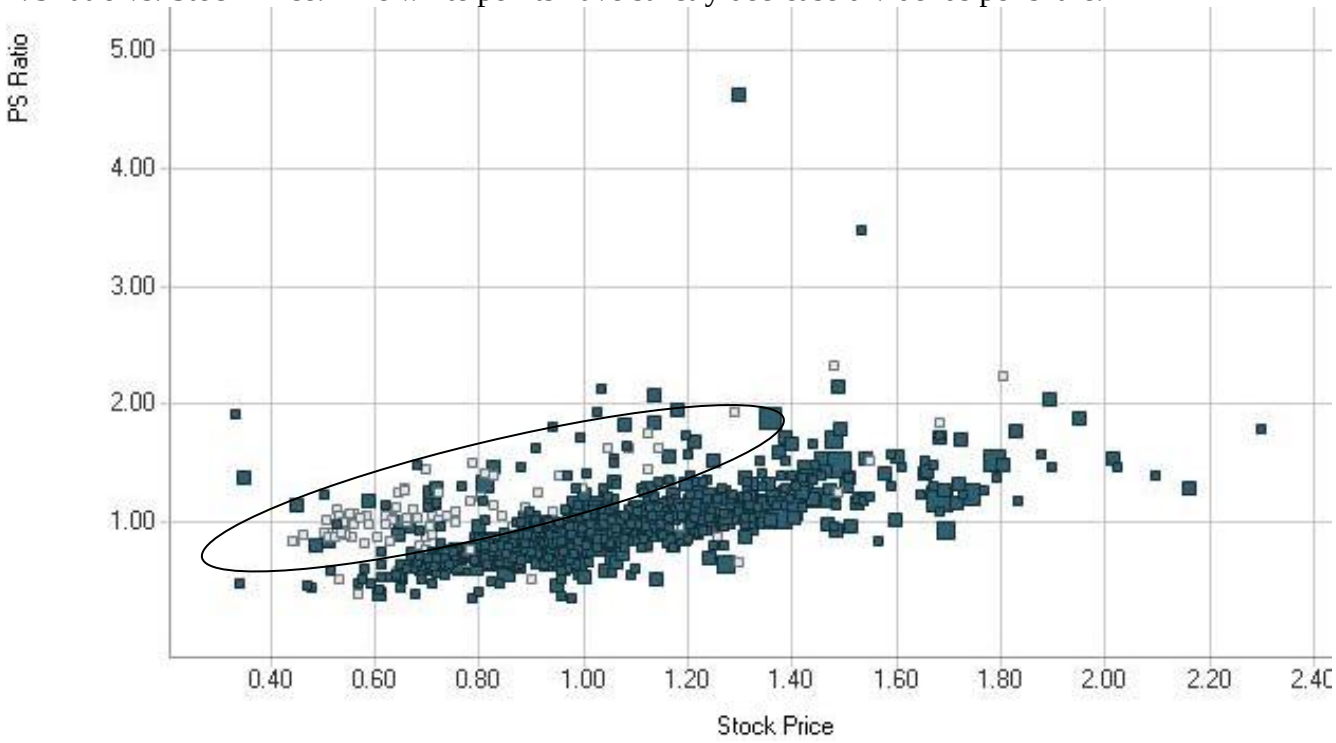
## APPENDIX I

Enterprise value vs. Stock Price. The white points have strictly decrease dividends per share.




## APPENDIX II

P/S ratio vs. Stock Price. The white points have strictly decrease dividends per share.



## APPENDIX III: Description of Variables

| Variable | Description | Interpretation |
|---|---|---|
| Stock Price | 2005 Stock Price / 2004 Stock Price | If the stock price has risen, the ratio will be greater than 1 |
| Revenues: Last yr | 2005 Revenues / 2004 Revenues | If revenues have risen, the ratio will be greater than 1 |
| PS Ratio | 2005 P/S Ratio / 2004 P/S Ratio | If the P/S ratio has risen, the ratio will be greater than 1 |
| PS Ratio_BIN | If P/S Ratio < 1, 0 else 1 | If the P/S Ratio is less than 1, this will be 0, otherwise 1 |
| PS_Interaction | PS Ratio * PS Ratio_BIN | An interactive term |
| EV/Sales_BIN | If Ratio of EV/Sales < 1, 0 else 1 | If the EV/Sales has risen, the ratio will be greater than 1 |
| Expected Growth in EPS: next 5 years | 2005 Expected Growth / 2004 Expected Growth | If the expected growth rate has risen, the ratio will be greater than 1 |
| 3-yr Regression Beta | 2005 3-Yr Regression Beta / 2004 3-Yr Regresion Beta | If the 3-Year Regression Beta has risen, the ratio will be greater than 1 |

## APPENDIX IV: Discriminant Analysis Model.

**Classification Function**

| Variables | Classification Function | |
|---|---|---|
| | 1 | 0 |
| Constant | -78.42139435 | -87.19621277 |
| Stock Price | -11.47467804 | -20.63153458 |
| Revenues: Last yr | 58.53385544 | 64.59300995 |
| PS Ratio | 118.9703217 | 129.4924164 |
| PS Ratio_BIN | 100.5220108 | 110.1039047 |
| PS_Interaction | -112.5456162 | -120.27742 |
| EV/Sales_BIN | -4.06227255 | -5.11120844 |
| Expected Growth in EPS: next 5 years | 0.41874954 | 0.64947057 |
| 3-yr Regression Beta | 0.52848738 | 0.32317266 |

**Training Data scoring - Summary Report**

| Cut off Prob.Val. for Success (Updatable) | | | 0.76 |
|---|---|---|---|
| **Classification Confusion Matrix** | | | |
| | Predicted Class | | |
| Actual Class | 1 | 0 | |
| 1 | 713 | 195 | |
| 0 | 32 | 81 | |
| **Error Report** | | | |
| Class | # Cases | # Errors | % Error |
| 1 | 908 | 195 | 21.48 |
| 0 | 113 | 32 | 28.32 |
| Overall | 1021 | 227 | 22.23 |