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The Predictive Nature of Financial Ratios

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Abstract

This paper will attempt to systematically relate financial ratios to short term stock performance. In this study I hope to succeed where others have failed. Using an ordinary least squares (OLS) regression, I will attempt to find a robust model for the prediction of short term stock prices.

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Introduction

Investment in financial securities is an important aspect of the American economy. Each day, 1.46 billion shares of stock are traded on the New York Stock Exchange. The average daily value of shares traded is roughly $46.1 billion (NYSE, 2005). People depend on securities markets for their jobs, their livelihoods, and their retirements. For some households, the only source of income lies in returns from financial securities. Because these instruments are so important, they are studied on a regular basis.

Each day, people decide to take risks by entering the securities market. Some investors rely on public information to choose which securities they should buy; others use sophisticated models that they hope will give them a money-making edge in this strictly competitive market. Using their models, these investors continually evaluate securities and the companies they represent. With these strategies, some people become rich; many more lose everything. "About two-thirds of all active investors will under perform index funds every year" (Taylor, 2004). Many of these investors' stock portfolio choices will perform more poorly as a whole, than a market basket, or selection of stock from across the market. Obviously, the low success rate in financial markets indicates it is quite difficult to find a robust model for making financial predictions. In fact, many financial analysts say that the stock market is an efficient mechanism. This idea, commonly known as the efficient market hypothesis, says that there is no money to be made within a financial market because all advantageous information will already be reflected in the price of a security.

Historically, there are few comparative tools for use in financial analysis. Companies vary in size, purpose, and industry. However, the field of accounting has provided us with financial ratios that have proved quite valuable in not only determining a company's relative performance; they have also proved valuable in predicting future performance. This paper will attempt to systematically relate financial ratios to short term stock performance. In this study I hope to succeed where others have failed. Using an ordinary least squares (OLS) regression, I will attempt to find a robust model for the prediction of short term stock prices.

I. Literature Review

For as long as people have been able to buy and sell financial securities, there have been those who have attempted to analyze the market in order to gain a competitive advantage over other investors. During the 1920s, financial ratios developed as a comparative tool for banks to assess their short term lending. However, financial analysts soon learned that they could predict a company's success with the same ratios. Unfortunately, due to exogenous factors, financial ratios never developed into a general theory for predicting company success. In fact, their value has been somewhat lost in the literature. Financial ratios have been somewhat taken for granted as an aspect of analysis that everyone knows how to use effectively (Horrigan, 1965). James O. Horrigan, in his landmark paper attempts to bring analysts back to their roots. He proves through an empirical study that ratios and the factors behind them play a significant role in the market over the long term (5 years or more).

While Horrigan proves his thesis about the significance of the financial ratios, he cautions against three problems that may arise with their use. The first problem is deciding which distribution financial ratios will tend to follow. Does each company in a given industry tend to have high cash holdings? If this is the case, selection bias may be a problem (Horrigan, 1965). Also, there is a danger of other statistical problems such as colinearity because most financial ratios are correlated to one another in some way. Finally, Horrigan says to incorporate time into the model as a way to allow the market to adjust to the new information in the ratios. Horrigan recommends the use of indicator ratios such as the price-book and price-earnings ratio. While Horrigan does make predictions as to which ratios may be the most valuable to a model to predict corporate success, he does not attempt to test his theories. He is satisfied in showing general trends in ratios over a given industry and how they relate to general trends in the overall market.

In 1997, John H. Cochrane conducted an OLS study involving ratios. In his study's findings, he shows dividend ratios are able to predict long-run dividend growth and stock returns. According to his study, his findings will empirically hold only over horizons longer than 5-10 years. His findings are particularly relevant because they show that ratios aside from typical indicator ratios still can accurately predict the price of a security (Cochrane, 1997). He never considers earnings-per-share, price-earnings, or price-book ratio in his analysis, yet he gets valid results.

Like Horrigan, Jonathon Lewellan attempts to assess the merit of using financial ratios. Lewellan's is the most recent attempt at finding a model to predict stock prices through financial ratios. Citing Horrigan's advice, Lewellan uses the price-book ratio extensively in his study attempting to predict stock prices over a long term. His model proved successful despite some statistical problems that resulted from his common denominator, share price (Lewellan, 2004). Lewellan's study shows that ratios are still a valid tool for predicting stock prices in a more recent economic environment. After the Enron scandal and others like it, it would have been quite possible that investors are no longer using the same strategies in determining which stocks to buy or sell. Lewellan, himself, hypothesizes that other factors aside from traditional financial ratios, such as moral integrity have an effect on stock price. However, his study shows that even in an economy plagued by scandal, financial ratios are still good indicators of what a company's stock price will be in the future (Lewellan, 2004).

Other authors have tested several individual ratios against company success and have produced positive results. Several of their ratios have proved to be more relevant than others. It is these ratios that I will focus on for my own study.

First, Andrew Bary discusses the importance of the **cash ratio** (Total Cash/Total Assets). "Cash earnings will become the key measure of financial performance for many companies" (Bary, 2003). Cash is a non-depreciable asset, and as such, is excellent for comparing earnings over long periods of time.

Secondly, William H. Wiersema discusses the importance of the **inventory turnover ratio** (Cost of Goods Sold/Average Inventory) in his article. Wiersema suggests that a high inventory turnover ratio indicates that cash flow is high and the business is thriving. Wiersema does not directly relate the inventory turnover ratio stock returns. Rather, he relates the inventory turnover ratio to several other factors that indicate speedy cash flow. Theoretically speaking, high cash flow usually means the company is successful because they are actively using their cash, and they have the necessary cash to spend on new projects and investments. Conversely, a low inventory turnover means that the company is not producing at its potential level of efficiency (Wiersema, 1998).

Thirdly, in a paper on predicting stock returns, Ruben Trevino acknowledges that the **price-earnings ratio** (Stock Price/Average Net Income) is highly correlated with future stock returns. While the cash and inventory turnover ratios are fully objective measures of a company's success, the price-earnings ratio is somewhat more subjective in that it provides a picture of investor confidence in the company (Trevino, 2002). The price earnings ratio provides some insight into how eager or over exuberant investors are to buy a given stock. To test how his theory works over time, Trevino uses cross-sectional data over a five year period. He finds that a high price earnings ratio indicates that investors feel very good about the company's direction. They will therefore tend to invest more, and the demand for the stock will increase.

Finally, the payout ratio is examined by Robert D. Arnott in his article, "Surpirse! Dividends Yield Greater Returns." Arnott's study finds future earnings tend to be greater when current dividend payout is greater. The **payout ratio** (Total Dividends/Net Income) is another subjective measure of financial success. Arnott tests payout ratios against earnings per share of stocks over 10 year periods between 1946 and 2001. Arnott finds there is a high correlation between increasing earnings per share and increasing payout ratios over this period of time. Obviously, as investors see a company tending to payout dividends; they will be more willing to invest in the company. (Arnott, 2003).

While there are many more financial ratios examined in the literature, these few, in my opinion, are the most relevant. They manage to capture a complete picture of a company's projected future earnings while having very little relation between each other. Too many of the studies suffer from high colinearity because their ratios are composed of similar factors. For example, several authors would use both the cash and the current ratio in their studies. While both ratios may be relevant, cash is a large element of the current ratio. As the cash ratio increases, the current ratio must always increase as well. Therefore, these variables have a large effect on one another and can skew the model.

II. Theoretical Model

Conceptually, stock price has always been determined through trying to measure a stream of future earnings that a company may incur. From this, the following general formula for the present value of a future earnings stream can be derived:

$$\text{PV (earnings stream)} = \sum_{t=1}^{n} \frac{E_t}{(1+r)^t}$$

In this model, the present value of a future earnings stream is given as the sum of the future earnings ($\sum_{t=1}^{n} E_t$) over a given time (t). These future earnings are discounted to yield present values at a going interest rate. In order to find the price for a single share of stock, it is necessary to divide the equation by the total number of shares. As the literature shows, there are indeed more conceptual elements to a stock price than simply a future earnings steam. Because this paper is attempting to find a robust model, it is necessary to consider all aspects of a stock price. Unfortunately, these other factors that affect stock prices are not easily quantified. Therefore, I have a more complex equation that includes an element that I will entitle hype that will capture factors such as investor over exuberance or herding. This new variable is intended to capture any factor other than earnings that will positively or negatively affect stock price.

Share Price$_t$=

$$[\sum_{t=1}^{n} \frac{E_t}{(1+r)^t} / (\#\text{ of shares})] + (\text{Hype})$$

Based on Bary's article about the importance of cash as related to other ratios, the **cash ratio** (Total Cash/Total Assets) is theoretically significant. Having a large reserve of cash signifies a strong company for many reasons. In light of the theoretical model, the cash ratio will indicate increased future earnings. Cash is the tool with which a company makes all purchases and all payments. A large cash reserves ensure that a company will at least be able to survive in the short run. Also a large reserve of cash may indicate that a company is ready to expand by acquiring another company. The problem with having too much cash lies in the economic concept of the opportunity cost. Cash is a stagnant asset. There is no money to be made by just holding cash. The cash can probably be put to better use through investment or acquisition. Due to these factors, increases in the cash ratio generally result in a higher future earnings stream which results in an increase in stock price.

The **inventory turnover ratio** (Cost of Goods Sold/Average Inventory) also can provide clues to company success. The inventory turnover ratio shows how long inventory waits before being sold. Like a high cash ratio, a high inventory turnover ratio in most cases, indicates an increased future earnings stream. Therefore, as the inventory turnover ratio increases, future stock prices will increase as well. Generally, companies want short periods between acquiring inventory and selling it. This indicates higher sales and higher demand for the company's product. An inventory turnover ratio that is too high can likewise be disadvantageous. This can be a signal of deep discounting in order to generate sales resulting in lower profits. Also, a high inventory turnover ratio could be a signal of carelessness in the manufacturing process in order to move inventory through a system as fast as possible.

The **price-earnings ratio** (Stock Price/ Net Income) is also important for its subjective qualities. This ratio provides some clues about the second element of the theoretical model: hype. As the literature demonstrated, as the price-earnings ratio goes up, investors will have increased confidence in the company. These investors are seeing an indicator of an increased future earnings stream. An increased price earnings ratio indicates that investors are over-exuberant about the company's stock. Hence, the price of the stock will move higher due to the herding effect. Also potential investors will mimic their exuberance and decide to also invest, further increasing the stock price. This herding effect is a direct result of the hype variable in the theoretical model.

Finally, the **payout ratio** (Total Dividends/ Net Income) measures what proportion of a company's profits get paid out to shareholders as dividends. Generally, having enough excess income to pay dividends means that a company is doing quite well. The issue of opportunity cost again makes itself evident with this ratio. As a company uses its income to pay back its shareholders, it does not have that money to "plow back" into the company for use on future projects. The payout ratio is another measure of the second variable: hype. As potential investors see an increase in the payout ratio, they will tend to buy that company's stock so they too can reap the benefits of increased dividend payout. This hype drives up the demand for the stock; and likewise, the security's price will increase.

These are the ratios that will most effectively complete a robust model in that they do not introduce any colinearity between the independent variables. Of course, many of these ratios vary across industries. For example, the inventory turnover ratio in a manufacturing company will be much lower than the same ratio in a foods company. This is simply due to the fact that producing manufactured goods takes longer than producing food related items. The payout ratio is another ratio that varies across industries. Many technology companies refuse to payout any dividends while many older and well established companies will do so on a regular basis. Due to this variance, I will control for industry sectors in my regressions.

III. Hypothesis

According to economic theory, changes in the cash, inventory turnover, price-earnings, and payout ratios should effectively predict future changes in stock prices. I will attempt to mimic this framework using a series of ratios that the literature says accurately reflect either future earnings or hype: specifically, the cash, inventory turnover, price-earnings, and payout ratios. These ratios provide the clearest picture of a company's strength while still eliminating statistical problems such as colinearity. Whereas Horrigan, Cochrane, and Lewellan attempted to use financial ratios over the longer periods, I will attempt to do so over a much shorter period. Because my results are timelier than those in other studies, they should be of greater value to investors.

IV. Empirical Model

I will use the change in stock price over time as my dependent variable. My independent variables will involve the cash ratio, the inventory turnover ratio, the price-earnings ratio, and the payout ratio. Because my data is cross sectional (taken from exactly the same time period), there is no need to control for the interest rate or other time sensitive information that may affect the price of a stock. For example, a sharp increase in energy prices would tend to make some investors more apprehensive to invest in the market as a whole. Hence, stock prices will remain low. However, my data is taken from the same time period in which each company should face the same factors and constraints. Therefore, these exogenous problems are controlled for in the model. I will first use the linear form to both express my regression. Also, recall the equation must control for industry. Therefore, I will create a dummy variable for the industry in which a particular company operates which will control for the differences in expected ratio values between industries. This yields a base equation of Equation 1:

The inherent problem in this first equation is that it does not take the magnitude of a ratio change into account. This oversight presents a problem because the degree to which a change in a ratio affects a company may be different. Given that a particular company that typically keeps the ratio at a certain level, a change in that ratio could be significant or insignificant. For example if a company usually has high cash ratio, the company needs to gain a large amount of cash to significantly increase the ratio. The problem can be addressed through the use of a linear-log functional form. This form is commonly called the first differences form of a regression equation. It shows the rate of change in each of the variables.

Equation 2 captures the effects of increased demand due to larger increases in a company's ratio; however, in cases where companies typically have different ratios, it could well be that the percentage change in ratios influences demand more than the simple change. Therefore, first differences are necessary in the dependent variable as well (Equation 3).

Equation 1

$$\Delta StkP_{(t)-(t-1)} = \alpha_0 + \alpha_1(Cash_t - Cash_{t-1}) + \alpha_2(IT_t - IT_{t-1}) + \alpha_3(PE_t - PE_{t-1}) + \alpha_4(PO_t - PO_{t-1}) + \alpha_5(Tech) + \alpha_6(Foods) + \alpha_7(Retail)$$

$$Omitted\ \ Variable: \alpha_7(Manufacturing)$$

Equation 2

$$\Delta StkP_{(t)-(t-1)} = \alpha_0 + \alpha_1 \ln(Cash_t - Cash_{t-1}) + \alpha_2 \ln(IT_t - IT_{t-1}) + \alpha_3 \ln(PE_t - PE_{t-1}) + \alpha_4 \ln(PO_t - PO_{t-1}) + \alpha_5(Tech) + \alpha_6(Foods) + \alpha_7(Retail)$$

$$Omitted\ \ Variable: \alpha_7(Manufacturing)$$

Equation 3

$$\ln(\Delta StkP_{(t)-(t-1)}) = \alpha_0 + \alpha_1 \ln(Cash_t - Cash_{t-1}) + \alpha_2 \ln(IT_t - IT_{t-1}) + \alpha_3 \ln(PE_t - PE_{t-1}) + \alpha_4 \ln(PO_t - PO_{t-1}) + \alpha_5(Tech) + \alpha_6(Foods) + \alpha_7(Retail)$$

$$Omitted\ \ Variable: \alpha_7(Manufacturing)$$

V. Data

My data will be a selection of 50 well established companies taken from a variety of industries. The data for the financial ratios will be taken from Hoovers Online (www.hoovers.com), whereas the data for the stock price at time: *t* will be taken from Yahoo! Finance (finance.yahoo.com). As I mentioned earlier, I will use cross sectional data. I will then run the three different regressions using ratios that are measured over the three months prior to the ending stock price date. My time frame is the quarter ending September 30, 2005. Data are taken on September 30, 2005 as well as on June 30, 2005. More explicitly, the base stock price and ratios will be taken on September 30, 2005, whereas the ratios and the stock price from (t-1) will be taken from June 30, 2005. I will then test how robust the equation is by examination of the adjusted R-square figure. Table 1 gives some summary statistics of the data.

Table 1

Variable	Description	MEAN	STDEV	Pred. Sign
Dependent Variable				
DSP01	Change in Stock Price (Period 0-1)	1.848	3.610	n/a
Independent Variable(s)				
DCash01	Change in Cash Ratio (Period 0-1)	-0.004	0.023	(+)
DIT01	Change in Inventory Turnover Ratio (Period 0-1)	0.020	0.383	(+)
DPE01	Change in Price-Earnings Ratio (Period 0-1)	39.5289	115.3762	(+)
DPO01	Change in Payout Ratio (Period 0-1)	0.1227	1.685	(+)
Tech	(1) if company belongs to the tech sector (0) otherwise	n/a	n/a	n/a
Retail	(1) if company belongs to the retail sector, (0) otherwise	n/a	n/a	n/a
Food	(1) if company belongs to the foods sector, (0) otherwise	n/a	n/a	n/a
Omitted Variable				
Manu	(1) if company belongs to the manufacturing sector, (0) otherwise	n/a	n/a	n/a

VI. Results

Unfortunately, my results did not yield any valuable information as far as the predictive nature of stock prices. I ran the three regressions as described in my empirical model. Each time, an extremely low adjusted R-square remained. The results of the regressions are reproduced below in Table 2.1-2.3.

Regression 1 failed outright; however, Regression 2 showed some marked improvement. Regression 2 had a relatively higher R-square; however, it still remained too low to draw any conclusions. Regression 3, the log-log transformation, had worse results than Regression 2. Also almost none of my variables proved to be significant, and those that did, had an incorrect sign on the coefficient.

What can be said about this model? Were Horrigan, Cochrane, and Lewellan incorrect in their analyses? While my results are disappointing as they contradict my theory, I am not entirely disheartened. There could be several viable reasons for the failure of my model. The number of data points I could achieve with my model was limited. Perhaps a greater number of companies would have yielded different results. Perhaps the time frame was too short. Horrigan, Cochrane, and Lewellan all conducted studies over greater periods than five years. Several other researchers decry any attempts to predict short term stock prices due to inherent short term volatility in the market. These researchers maintain that there are too many factors acting on a stock price over a short period of time to possibly express this information in a set of variables (Lewellan, 2004).

These researchers may well be correct. My model does control for industry, however, there a number of other factors that differentiated the companies in my model that could have come into play. Also, several researchers say that the sort of prediction I am attempting will only work in periods of expansionary monetary policy because there will be a general increase in stock prices during these periods. These same researchers contend that prices during periods of

Table 2.1: Regression 1

Variable	Coefficient	T-Statistic (Sigma)	Significance
Dependent Variable			
DSP01			
Independent Variable(s)			
DCash01	26.393	.746 (.460)	
DIT01	0.743	.304 (.763)	
DPE01	0.002	.277 (.783)	
DPO01	-0.366	-.643 (.524)	
Tech	1.426	.645 (.522)	
Retail	2.327	1.058 (.296)	
Food	-0.224	-.114 (.910)	
Omitted Variable			
Manu	n/a	n/a	
Adjusted R-Square	-0.096		

Table 2.2: Regression 2

Variable	Coefficient	T-Statistic (Sigma)	Significance
Dependent Variable			
DSP01			
Independent Variable(s)			
ln(DCash01)	0.002	.033 (.974)	
ln(DIT01)	-1.208	-1.735 (.093)	*
ln(DPE01)	0.625	.916 (.367)	
ln(DPO01)	-1.838	-.496 (.020)	**
Tech	2.121	.805 (.427)	
Retail	-0.215	-.018 (-.093)	
Food	1.874	-.051 (-.285)	
Omitted Variable			
Manu	n/a	n/a	
Adjusted R-Square	0.062		

Table 2.3: Regression 3

Variable	Coefficient	T-Statistic (Sigma)	Significance
Dependent Variable			
ln(DSP01)			
Independent Variable(s)			
ln(DCash01)	-0.109	-.480 (.635)	
ln(DIT01)	-0.511	-2.228 (.034)	*
ln(DPE01)	0.259	1.15 (.26)	
ln(DPO01)	-0.56	-2.271 (.031)	*
Tech	0.621	.715 (.480)	
Retail	-1.054	-1.387 (.176)	
Food	-0.268	-.434 (.667)	
Omitted Variable			
Manu	n/a	n/a	
Adjusted R-Square	0.039		

recessionary monetary policies investor habits somehow go awry (Cavaletti, 2004). I am less willing to believe these researchers; however, my model certainly cannot dispute their claim.

VII. Conclusions and Future Research

I am unwilling to say that my model proves an efficient market hypothesis; this would be a logical fallacy. I will say that my model lends support to the strong form of the efficient market hypothesis in which all valuable information about a stock is already contained within the price. A reason that no financial information is reflected in the change in stock price could certainly be that the information had already been reflected before my period of consideration. A comparative study conducted using data derived from insider information would be more successful in determining if information was already reflected in a stock price. Of course, this type of study is impossible because the data is unavailable.

Obviously future research is needed. As an experiment, I ran the following regression:

$$\Delta StkP_{(t)-(t-1)} = \alpha_0 + \alpha_1(Cash_t - Cash_{t-1}) + \alpha_2(IT_t - IT_{t-1}) + \alpha_3(PE_t - PE_{t-1}) + \alpha_4(PO_t - PO_{t-1}) + \alpha_5(Tech) + \alpha_6(Foods) + \alpha_7(Retail) + \alpha_8\Delta StkP_{(t-1)-(t-2)}$$

$$Omitted\ \ Variable : \alpha_9(Manufacturing)$$

The change past stock price proved to be highly significant in determining the change in current stock price. This implies that investors will change their investment strategy given an increase or a decrease in past stock prices. This idea clearly needs to be followed with further research as does the idea of efficient markets. But for now, due to the poor results of my study, it is best for investors to assume that all information that is available to an outsider in a market will already be contained in a company's stock price, and there is no real money to be made on investing in that company's stock.

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