

## Using financial statement variables to predict stock prices: Lessons from the 2007-2009 financial crisis

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### ABSTRACT

This analysis considers balance sheet, income statement, and cash flow account ratios in measuring the impact of the 2007-2009 financial crisis on the stock prices of American companies. Fourteen companies that trade on S & P 500 were selected for the model and data gathered for the ten years of the analysis, 2004-2013. Results indicate a mixed relationship on the predictive power of financial statement analysis on stock prices before and after the financial crisis. Size of the company and sales were both strong predictors. Liquidity has a small impact through net working capital, but the post intervention counter variable suggests that the general trend in stock was higher after the crisis. The model concludes that the existing predictive ability holds for the financial statement variables analyzed, and finds that changes in account variables did not foretell stock price correction nor concurrently signal directional price movement as a result of the crisis.

**Keywords:** Stock price, financial crisis, equity valuation, financial statements

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## INTRODUCTION

The financial crisis (Great Recession) of 2007 – 2009 was a shock to the financial system in the U.S. and abroad. Businesses failed, corporate profits plunged, and the fragility of the linkages between supply of and demand for money were brought to the fore. A primary impetus was the real estate bubble that arose from public policy initiatives in the 1970s, with roots going back to post Depression years deregulation that allowed many financial instruments to ultimately become toxic. Risk and risk aversion were rarely considered during boom years, as asset prices seemed to always increase, but became the epitome of the failures to consider wise financial strategies (Nordhaus, 2002).

Publicly traded firms are valued in a market exchange of buyers and sellers in considering the long term, intrinsic value of its share price. A market analysis is a function of the financial health of a company as stated on its financial statements. Typical financial statement variables include those accounts in an income statement, balance sheet, or statement of cash flows. Those accounts offer predictor variables that may be used in pricing a share of a firm's equity (Ehrhardt and Brigham, 2011, pp. 49-58).

As a result of the financial crisis the predictive capacity of these variables was questioned. Variables that were statistically significant predictors of stock price per share before the crisis may no longer be a viable predictor, and variables that were not statistically significant predictors may now have a correlation. To this extent that this relationship occurs suggests that the crisis disrupted basic valuation metrics that are used by analysts (Summers, 1986).

This research offers an analysis of financial statement variables in predicting stock prices. We contend that previous financial linkages may have been disrupted by the crisis and no longer offer the same predictive capacity or directional impact. This is not to say that fundamental analysis no longer has a place in corporate valuation, but rather reintroduces how analysts must consider each financial statement variable in developing a valuation model.

There are numerous possible approaches to this concern. Daghestani, Payne and Castater (2013) place emphasis on firm size. Giannikos, Guirguis, and Suen (2013) introduced pre and post crisis analysis with a measure of risk through Credit Default Swaps (CDS) spread. Macroeconomic effects also affect equity valuation (Velinov and Chen, 2015), but prices may revert to a mean price per share when considered with earnings yield (Bali, Demirtas and Tehranian, 2008). The focus of this research is more specifically on financial statement variables in a study of the firm, and less on larger effects from outside forces.

The research is arranged as follows: a literature review of relevant analyses that support the work of others and define the emerging field of research pre and post financial crisis; a methodology section that explains and develops a regression model to select and measure financial statement variable effects before and after the financial crisis; and analysis section that interprets the results and offers strengths and weaknesses of the research and possible directions for future analysis; and finally a list of references of works cited in the analysis.

## LITERATURE REVIEW

The economic crisis of 2008 followed the 2001 recession, both of which experienced a decline in economic activity over a period of time. However, both have differences in causation, duration, and impact. Nordhaus (2002) categorized economic downturns into five categories ranging from Category I as a "pause in economic activity" – and where he placed the 2001

recession – to Category V as the depression of the 1930s. The 2008 recession would probably be categorized as a Category IV – “deep and prolonged recession” similar to the 1980-1982 economic downturn (p. 206). Also, the 2008 crisis was caused by different factors in the financial market. Nordhaus discusses a contributing cause of the 2001 recession as the elusive concept of profit and how accounting procedures and “financial finagling” impacted company values. The real yield on equities was at its lowest in the previous 50 years due to overvaluation of real profits.

In the years prior to 2008, Spiegel (2011) noted that lenders began issuing higher-risk mortgages where income verification was not required, no or little down payments were collected, and adjustable mortgages that would result in a future high loan-to-value ratio. Housing prices went up as demand increased. But then the rate of default increased as housing prices started to decline, adjustable mortgages increased beyond the capacity of the borrower to pay, and unemployment increased. Many lenders originated the low-cost loans, then sold them into the financial market using the proceeds to repeat the process (p. 1775). Another contributing factor was the 1977 Community Reinvestment Act whereby banks were encouraged to make loans in low- to moderate-income area, which were more likely to default during the crisis (p.1775). While the financial crisis had a significant impact on lenders and investors, it also affected corporate borrowers as the banks tightened their lending policies on long- and short-term credit. From a corporate viewpoint, the CFO must find ways to manage the firm’s liquidity. Larger firms that use the bond market for their capital found that the pricing was problematic (p. 1777).

Demyanyk and Van Hemert (2011) found that the belief that the mortgages that caused the subprime mortgage crisis were mostly limited to the low-documentation mortgages was not the case. The poor performing loans were across all segments – fixed-rate, cash-out, refinancing, full-documentation, etc. – and that it was the timing of these loans in 2006 and 2007 that showed a much higher delinquency rate (p. 1849). The “sub-prime” mortgages are those that characterize the borrower’s credit ability (FICO score of less than 660), the lender’s specialty (high-cost loans), and type of mortgage contract (no money down or no documentation required). All of which were at high risk to default (p. 1853). As investors demanded more private mortgage-backed securities, this led to an increase in the subprime share of the mortgage market (from about 8% in 2001 to 20% in 2006) and in the securitized share of the subprime mortgage market (from 54% in 2001 to 75% in 2006). Home prices continued to escalate even though there were indications of a boom-bust possibility (p, 1875).

Looking at the causes of the crisis, Brunnemeir (2008) explains that it began with the transformation from the traditional “buy and hold” mortgage lending to an “originate and distribute” system where the mortgages were then placed into pools, segregated into tranches based upon the loan quality and then resold through securitization (p. 2). Investors purchased these short-term assets since they were backed by a pool of mortgages as collateral (p. 4). Demand increased and housing prices followed. Purchasers of the securitized bonds could protect themselves through the purchase of credit default swaps (p. 4). The increase in subprime mortgage defaults first observed in February 2007 was the beginning of the liquidity crisis – both market and funding liquidity (p. 8).

Daghestani, Payne and Castater (2013) studied the risk-return profiles of certain firms rated by Value Line as having the strongest price growth persistence during the year 2008. They concluded that “the greater the firm’s values for financial strength, and the greater the size of the firm, the more likely the firm would have a very high level of price growth persistence” (p. 8).

Their research found that the ratio of market value to book value of firms was not indicative of price growth continuation (p. 9). Most investors use as one of many determinants for the value of a company stock the expected growth in price of the common stock. The actual continuation rather than the size of growth has become important in the selection of securities by institutional investors and managers. However, studies of the continuation of growth have sometimes ignored macroeconomic factors such as an economic recession that can cause inventories to remain stagnant, expenditures to decrease, and revenues and cash flow cannot meet current obligations.

Also Payne, Wiggernhorn, and Daghestani (2008) determined that the Value Line Safety Rating of stocks was the leading variable of common stock price level stability during the 2000 and 2001 recession. Even though the causes of the 2000 recession were different from the 2008 recession, they evaluated stock price stability during a recession period in general. Other contributing variables that indicated a likeliness of stock price stability included price earnings growth ratio, the degree of operating leverage or long-term debt to capital. They also determined that earnings predictability was not associated with price stability (p. 89).

Estrella and Mishkin (1998) utilized certain financial variables – interest rates, interest rate spreads, stock price indices, and monetary aggregates - to predict a recession of the U.S. economy and compared them with results from leading macroeconomic indicators. Their results indicate that using the yield curve spread and stock prices can be useful in macroeconomic predictions and are the most useful financial indicators (p. 46).

Stock price movements have previously been categorized into changes in expectations about future dividends and returns. Low-frequency movement information in both is found in the stock prices and not the series themselves. Balke and Wohar (2006) found that movements in the price-dividend ratio are very persistent yet neither real dividend growth nor excess returns are persistent (p 77). Using a five-variable VECM/VAR analysis, they concluded that there was evidence the real dividend growth or excess returns if non-stationary, but both are not. They acknowledge that market expectations about possible changes in the future real dividend growth may be more important in stock price determination than previously thought (p. 77).

Bali, Demirtas and Tehranian (2008) analyzed earnings and expected returns at the firm level, industry level and market level and found that there is a significantly positive relation at the firm level but flat at the market level. When tested at the industry level of 17 portfolios, there is no significant relation. Yet when tested at 48 portfolios of the industry, the weak positive relation of earnings and expected returns of the 17 then becomes strongly positive for the 48 portfolios. Thus there is no market-level predictability when the market is decomposed in 17 portfolios but a significantly positive relation between earnings and expected returns in the 48 industry portfolios. Additionally, the strong positive relation is the same when the market is decomposed into individual firms. Their conclusion is that the “mean reversion of stock prices as well as the earnings’ correlation with expected stock returns are responsible for the forecasting power of earnings yield (p. 682).

Velinov and Chen (2015) examined the issue that the fundamental value of stock prices should be based upon macroeconomic activities. Using a bivariate SVAR model, they captured the fundamental and non-fundamental shocks to stock prices in six countries. Their data showed a rise in equity prices throughout the mid-1990s as a result of a correction to an undervaluation. Then after the correction, there was an overvaluation with respect to their fundamentals. Since the 2008 crisis, they observed that equity prices fell in line with their fundamental values (p. 16).

Price discovery is an area of research on the process by which new information is incorporated into a group of related markets –such as the stock market, the bond market, and the CDS market – and how the equilibrium is restored in the future (p. 27). Giannikos, Guirguis, and Suen (2013) examined price discovery and found that prior to the crisis, stock prices were dominant in price discovery while during the crisis, the price of stocks dominance was reduced as the CDS spread increased in importance. Additionally, government trading regulations during the crisis were participatory in this change (p. 28).

Because the global financial crisis emanated from the US, many studies focused on the global affects. Tong and Wei (2011) examined the crisis from a global standpoint looking at emerging markets and Foreign Direct Investment vs non-Foreign Direct Investment. Their study on the volume and composition of capital flows during the crisis were dependent upon their need for external finance for working capital. While volume of capital flows had little effect, the composition was significant (p. 2024).

Aizenman and Pasricha (2012) reviewed internal and external financial stress which they define as the “pressure of capital outflows and pressure inducing declines in stock markets and expansions in central banks’ balance sheets” (p. 347).

## METHODOLOGY

The model consists of randomly selected, publicly traded firms that are listed on the S & P 500. The analysis covers the years 2004 to 2013, inclusive, and consists of a sample of the annual, end of year stock prices for fourteen firms. Firms were selected irrespective to size, revenues, or any other characteristics other than age of existence. All firms in the model were publicly traded during each year that the analysis covers. The stock price for the firm is the dependent variable.

The predictor variables were disaggregated based on their relevance to a specific financial statement – Balance Sheet, Income Statement, and Statement of Cash Flows. Each predictor variable consists of an account within one of these financial statements. Pearson R correlation identified bivariate relationships between each financial statement variable and the dependent variable, stock price. From those relationships a multivariate model was developed.

With the focus of this research to identify to what extent that the 2007-2009 financial crisis disturbed normal, predictive relationships between the aforementioned financial categories, the model considered the time period of the analysis as follows: the years 2004 to 2007; and 2009 to 2013. The year 2008 is omitted from the multivariate analysis. The time period from 2007 to 2009 spans the years of the financial crisis, with 2008 roughly the middle of the downturn. Omitting 2008 allows the model to represent two distinct datasets for before and after the analysis without the use of dummy variables.

Two separate Ordinary Least Squares (OLS) regression equations were developed for each of the two time periods. Based on the variables chosen from the bivariate analysis of Pearson R coefficients the predictor or independent variables were selected. The independent variables used in the model are: Cash from operating activities; cash from financial activities; net sales; basic earning power; total current liabilities; and net working capital. The dependent variable for each time period was price per share of common equity from a randomly selected pool of S & P 500 firms.

## RESULTS

The first regression model was created using stock prices from the years 2009-13 as the response variable and utilized six predictor variables to explain the relationship. Of the independent variables employed to the model, two were selected from the cash flow statement, income statement, and balance sheet, respectively. Although more variables were available, these two variables from each of the financial statements creates a proxy to make the model a more manageable size.

The analysis of variance (ANOVA) created as part of the multiple linear regression results indicated the model was robust and significant ( $p < .01$ ) when tested at a significance level of .05. The complete results of the one-way ANOVA are presented in Table 1.

A closer examination of the regression results reveal which independent variables contribute to the overall strength of the model in predicting stock price from the years 2009-13. Although the overall model is significant, only one of the six predictor variables were found to contribute significantly to the overall model. The lone robust independent variable (Net Working Capital) appears in the balance sheet portion of the financial statements.

Additionally, the multiple regression results show a coefficient of determination (R-square) of .251. This indicates that approximately 25.1% of the variance in stock prices from 2009-13 is explained by the model. Complete results of this regression model are presented in Table 2.

The second regression model was created using stock prices from the years 2004-07 as the response variable and utilized the same six predictor variables presented in the first model to explain the relationship. The analysis of variance created as part of the multiple linear regression results indicated the model was robust and was significant ( $p < .01$ ) when tested at a significance level of .05. The complete results of the one-way ANOVA is presented in Table 3.

A closer examination of the regression results reveal which independent variables contribute to the overall strength of the model in predicting stock price from the years 2004-07. Although the overall model is significant, only two of the six predictor variables were found to contribute significantly to the overall model. The first robust independent variable (Cash from operating activity) is from the cash flow statement while the second significant variable (Basic earning power) appears in the income statement portion of the financial statements.

Additionally, the multiple regression results show a coefficient of determination (R-square) of .514. This indicates that more than one-half (51.4%) of the variance in stock prices from 2004-07 is explained by the model. Complete results of this regression model is presented in Table 4.

## ANALYSIS

The results of the analysis offer an interesting comparison of the effects associated with the financial crisis and underlying relationships in financial markets. By analyzing effects before and after the financial crisis these relationships are isolated and identified. Three important effects are considered as follows when comparing each result in the model.

The coefficient of determination after the financial crisis is approximately twice the level as before the financial crisis, indicating that the predictive power of the model is much better now than before the crisis. This is contrary to logically expected results but not without merit. Similarly, Summers (1986) found a disruption in valuation metrics occurs after financial crises and may alter such correlation. Existing explanations for stock prices may no longer hold, such

that model effectiveness changes. For this model the relationship is stronger, suggesting a better predictive capacity but also revealing underlying disruptions.

Second, the statistical significance of specific independent or predictor variables has changed. In the output before the financial crisis, net working capital was statistically significant but not afterwards. The 2009-2013 output found that cash from operating activity and basic earning power were significant. Daghestani, Payne and Castater (2013) considered similar impacts when analyzing price growth persistence and firm size. Our analysis suggests that firm size as measured via total assets in the basic earning power formula plays a role, but only to the extent when measured with EBIT. Interestingly, a variation of earnings was not significant in the model until after the crisis (evidenced by the impact of basic earning power in supporting results reported by Bali, Demirtas and Tehranian in 2008), but turning on its head the purported relationship found by that research before the crisis.

Lastly, the directional impact of the statistically significant predictor variables suggests a mixed, but important effect when measuring before and after relationships. While the research of Giannikos, Guirguis, and Suen (2013) found that a pre-crisis and post-crisis measurable impact of credit default swaps existed, this research suggests that more risk was perhaps being taken rather than less risk during and after the crisis. A negative relationship between cash associated with operating activities indicates that lower levels of cash on hand as part of operations is associated with higher stock prices, and higher levels of cash with lower stock prices. This relationship extends to the relationship of total current liabilities, where higher levels denote more risk, and stock prices, where the correlation is almost statistically significant at the .10 level.

## RECOMMENDATIONS FOR FUTURE RESEARCH

Comparing the regression results and models between the two time periods provided a quantitative method to examine any similarities and differences upon stock price. One regression model indicated a more robust association between the chosen independent variables and stock. However, with any quantitative-based research study, certain limitations and parameters are accepted and followed. One of the most important limitations is the length of the study which must adhere to space regulations in a respective academic journal or publication. Future studies can include other considerations to enhance this subject area and contribute to the existing literature.

First, additional predictor variables can be utilized and added to the regression model to predict stock price. For this research study, two independent variables were chosen as a proxy from each of the three financial statements (cash flow, income, and balance sheet) leading to a model employing six independent variables. These additional variables are readily available and could be added to the model to examine if the strength of the model is increased. This action would lead to a significantly larger model with more predictor variables.

Second, this research study utilized a multiple linear regression format to examine the data but other regression techniques are available. Examples of other regression models that could be employed in future models to assist in predicting stock price could include stepwise or time series regression. One of the strengths of a model created from a stepwise regression analysis is that variables are added or removed from a model based solely on the *t*-statistics of their respective estimated coefficients, which in many cases leads to a more robust model. In a time-series model, the analysis is performed on the same observational unit (stock price) at

multiple time periods. This would be very useful at identifying changing associations over various data years.

Third, as more historical data becomes available it would be prudent to add to the years collected and perform identical regression procedures employing more current time periods. In many cases, historical data becomes outdated rather quickly when the time of completing an article, lead time for review, and lag time for publication is considered. Diligence in finding and collecting the most current data is crucial in time-sensitive areas such as stock prices and financial statement variables.

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## APPENDIX

**TABLE 1 – ANOVA RESULTS FOR STOCK PRICE (2009-13)**

SOURCE	DF	SUM OF SQUARE	MEAN SQUARE	F	p-VALUE
Regression	6	18,201.2	3,033.54	3.53	$p < .01$
Error	63	54,195.4	860.25		
Total	69	72,396.6			

**TABLE 2 – REGRESSION RESULTS FOR STOCK PRICE (2009-13)**

REGRESSION VARIABLES	COEFFICIENT	t-STATISTIC	p-VALUE	R-SQUARE
Stock Price (2009-13)				.251
Constant	70.50	6.35	$p < .01$	
Cash – Operating Activity	-0.0017	-0.09	.927	
Cash – Financing Activity	-0.0046	-0.28	.778	
Net Sales	-0.00046	-0.13	.895	
Basic Earning Power	-8.20	-0.30	.768	
Total Current Liabilities	0.0040	0.26	.799	
Net Working Capital	-0.00305	-2.29	.025*	

\* significant at the .05 level

**TABLE 3 – ANOVA RESULTS FOR STOCK PRICE (2004-07)**

SOURCE	DF	SUM OF SQUARE	MEAN SQUARE	F	p-VALUE
Regression	6	8,214.9	1,369.1	8.62	$p < .01$
Error	49	7,782.1	158.1		
Total	55	15,997.0			

**TABLE 4 – REGRESSION RESULTS FOR STOCK PRICE (2004-07)**

REGRESSION VARIABLES	COEFFICIENT	t-STATISTIC	p-VALUE	R-SQUARE
Stock Price (2004-07)				.514
Constant	37.36	9.22	$p < .01$	
Cash – Operating Activity	-0.00321	-2.68	.01*	
Cash – Financing Activity	-0.000855	-0.86	.392	

Using financial statement variables

Net Sales	0.000219	1.32	.194	
Basic Earning Power	25.30	2.65	.011*	
Total Current Liabilities	0.00169	1.64	.107	
Net Working Capital	-0.000873	-1.02	.312	

\* significant at the .05 level

