

Changes in Financial Variables and Altman's Z Score on Stock Price: Consideration of Firm Size and Market Risk

Reza Rahgozar and Mary Tichich

Abstract

The valuation of common stock can be approached in several ways. Some models, known as dividend valuation models, rely solely on expected dividends and other models rely on long-run historical relationships between stock prices, financial variables, and market risk factors. This study, through correlation and regression analyses, identifies the most relevant variables affecting stock price changes of the Standard & Poor's 500 Index firms. Moreover, by applying the Altman financial stress model, the significance of changes in financial stress measures on stock prices is tested. In addition, the study investigates whether the effects of financial factors on stock prices depend on company size. Also, through mean and variance analysis, the equality of means and variances of larger and smaller firms exposed to market risks are examined. Among all financial variables considered, the changes in operating income and the financial stress measure are the most relevant factors affecting stock price variations. The results showed no strong positive relationship between changes in stock prices and dividends. The tests of equality of means and variances failed to support the notion that correlations between changes in stock prices and operating income, financial leverage, and total assets for small and large size firms differ. However, it rejected the hypothesis that variances of market risk of small and large firms are equal.

I. Introduction

To estimate common stock prices, valuation models rely solely on expected dividends and/or focus on long-run historical fundamental variables such as earnings per share and valuation multiples; for instance, the Price/Earnings (P/E) ratio and technical factors, such as inflation, trends, liquidity, economic strength of markets, and the psychology of market participants. Models predicting the intrinsic value of stock prices show that a higher stable dividend paying policy leads to higher predicted prices. Although earnings per share (EPS) is often used as a predictor of dividends and thus stock prices, some models prefer cash-flow as being superior in predicting stock prices. Since dividends, P/E, free-cash flow, net-cash flow, and any other per share measurements of earnings are derived from a company's operating earnings and/or its net income, this study tests the effects of changes in operating income on the changes of stock prices of all firms included in the Standard and Poor's 500 Index. In addition to operating income, the analysis investigates relationships between differences in financial leverage, company size, financial strength, and market conditions on changes in stock prices. Firms employ financial leverage to increase the return on equity to their common stockholder. Increases in returns on equity may be achieved at the expense of increased financial risk, higher cost of capital, and lower net income, leading to lower stock prices. However, negative effects of a higher financial leverage on stock prices may depend on the company size and the amount of debt in a firm's capital structure. In addition to financial leverage, any unforeseen market conditions creating financial stress could negatively affect firms' operating earnings leading to stock price changes.

Reza Rahgozar is Professor of Finance, College of Business and Economics, University of Wisconsin-River Falls; reza.rahgozar@uwrfl.edu.

Mary Tichich is an Associate Professor of Accounting, College of Business and Economics, University of Wisconsin-River Falls; mary.c.tichich@uwrfl.edu

Therefore, the main objectives of this study are:

1. To identify the most relevant financial variables affecting stock price changes;
2. To test the relationships between changes in operating income, financial leverage, dividends, market risks, and financial stress variables on stock prices variations; and
3. To examine whether the effect of changes in financial variables on stock prices differ based on company size measured by total assets.

II. Literature Review

There have been several studies on identifying earnings, components of earnings, or explanatory variables specifically related to earnings that are deemed to be responsible for variations in stock price changes. Ball and Brown (1968), Beaver and Dukes (1972), Beaver, Clarke, and Wright (1979), Kormendi and Lipe (1987), and others provide evidence that earnings correlate to stock price and returns. This paper correlates the price impact of changes in operating income, total assets, debt, dividends, financial stress, and market risk and to determine which variables have the most relevance on stock price changes.

Within the models of firm valuation, some argue that a firm's best valuation is achieved by discounting earnings or some variant of earnings. The dividend discount model can be varied by using either accounting earnings or variants of earnings as proxies for potential dividends. Ohlson (1995) developed a dividend discount model but adds a "clean surplus" idea to it, and shows that stock value can be estimated by its book value and capitalized current earnings, with a dividend adjustment. Penman and Sougiannis (1997) advocate that earnings can be substituted for dividends in equity valuation. Penman and Sourgiannis (1998) compared the dividend discount model to one using GAAP earnings, concluding that earnings were predictive. Easton and Harris (1991) studied earnings, finding that changes in earnings adjusted for beginning of the period stock price predicted returns on earnings. Economic Value Added (EVA) has been studied in the context of it being a surplus of earnings on investments; Biddle, Bowen, and Wallace (1997) addressed EVA versus earnings, finding that earnings outdid EVA in predicting stock price. In a study by Chen and Guochang (2007), several variables were addressed including earnings yield, equity capital investment, and changes in profitability, growth opportunities and discount rates. Findings were that all had significance in predicting stock price. Altairah (2012) provided a review of extant literature and regressed different models to determine what factors were most important on dividend policy, and perhaps returns, finding a positive relationship with net cash flows, earnings before interest and tax, EPS, dividend yield, and firm size, with EPS having the highest effect.

Several prior studies have argued for cash flows having a more significant impact on stock prices than accruals. Shivakumar (2006) found that the larger price impact of cash flows causes the cash flow component of earnings to be a better predictor of future returns than the accruals component. Also, they found that unexpected cash flows were found to predict future returns above that predicted. Callen and Segal (2004) addressed accruals, cash flow, and expected return news on firm-level equity returns. They found that all three factors of accruals, cash flows, and expected future discount rates were significant. They also disaggregated net income into cash flow and accrual earnings, finding both equal in driving firm level stock returns, with overall finding that the changes in expected future accruals was the primary driver

of stock returns. Some researchers argue that a firm's value is correlated to free cash flow, such as Hackel and Livnat (1992).

Modigliani and Miller (1958) argued that equity returns should not increase with financial leverage. However, empirical evidence on the relationship between financial leverage and stock returns are mixed and contradictory. Bhandari (1988) showed that the relationship between financial leverage and equity returns are positive. However, Fama and French (1992) found a negative relationship between leverage and stock returns. Penman, Richardson, and Tuna (2007) found that leverage is negatively related to returns. Zaher (2010) concluded that investors tend to reward firms that resist the urge to borrow and operate with a debt free balance sheet and penalize firms that have high levels of debt. Zaher and Hoque (2013), in their study, concluded that investors in portfolios of large cap debt free firms realized higher returns than investors in a portfolio with debt.

The financial health of a company has been studied by Beaver (1966) and Altman (1968), with the resulting Z-score, spawning a wealth of literature and research studies which verified that the Z-score closely correlates to predicting the financial distress of companies. The Z-score measures the correlation of a firm with those that have failed due to bankruptcy. Numerous studies have shown evidence of the effectiveness of Altman's Z - score in predicting corporate listings, for example Gerantonis, Vergos, and Christopoulos (2009) and Xu and Zhang (2009). Begley, Ming, and Watts (1996) indicated that the Altman Z-score model provided a more accurate prediction for U.S. companies in certain periods than others. Grice and Ingram (2001) found that the Z-score performs well in predicting financial distress for manufacturing companies.

Regarding the size effect of a company, in a study of New York Stock Exchange (NYSE) firms, Banz (1981) showed firms with the lowest market capitalization provided the largest returns after adjusting for risks. On average, small NYSE firms had significantly larger risk-adjusted returns than larger NYSE firms over a 40-year period. Van Dijk (2011) addressed the assertion that the size effect is correlated to systematic risk, and reviewed the size effect on equity returns, concluding more research is needed to evaluate the size effect. Keim (1983) and others have found the risk adjusted return for small firms is large in January and tapers off for the remaining year, with the returns showing seasonality. The study also addressed firm size as relating to beta, with smaller firms showing higher betas.

III. Data and Variable Definitions

Data utilized in this study were obtained from Compustat. The sample includes annual data for all firms in the Standard & Poor's 500 Index over 1980-2012 periods. Statistical analysis includes only those firms with complete data during the sample period.

Variable Definitions:

P = Stock price

EBIT = Operating income

TA = Total assets

DEBT = Total debt

DIV = Dividend

Z = Financial stress, measure of financial risk

B = Beta, measure of market risk (obtained from Compustat)

The following Altman (1968) financial stress model is applied to estimate Z-score values in Compustat:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + .999X_5$$

Where,

X₁ = Working Capital / Total Assets

X₂ = Retained Earnings / Total Assets

X₃ = Earnings before Interest and Taxes / Total Assets

X₄ = Market Value of Equity / Total Liabilities

X₅ = Sales/ Total Assets

The Altman model predicts that firms with Z - scores above 3 are unlikely to file for bankruptcy, firms with Z - scores below 1.81 are predicted to fail, and firms with Z – scores between 1.81 and 3 are considered in the “gray” area.

IV. Research Method

Correlation and regression analyses are employed to determine the most relevant financial variables affecting stock price changes. Using correlations between changes in stock prices and changes in total assets, operating income, debt, dividends, financial stress, and market risk, the most important variables affecting prices were identified. Then, through regression analysis the significance of each variable influencing price was examined. Studies have shown that based on risk-adjusted returns, smaller firms’ returns outperform larger size firms’ returns. It can be argued that outperformance of smaller firms’ risk-adjusted returns are most likely from capital gains than from dividend yields. It is reasonable to assume that smaller firms, while in the early stages of their lifecycles, retain all or major portions of earnings for internal financing and investments, rather than distributing earnings as dividends. Whereas, large and mature firms reaching a steady and stable earnings level are able to establish a steady dividend payout policy. Therefore, it can be said that investment returns of small size companies are mostly generated from capital gains, and for larger firms gains are from the combination of both dividend and capital gain yields.

To examine whether the relationship between changes in stock prices with financial variables and market risk depends on company size, all firms included in the Standard and Poor’s 500 Index were ranked according to averages of the most recent five years of total assets. This ranking, based on a five year time period, could have been a longer or shorter time span, or, the size effect could have been based on market capitalization, as in Banz (1981). Firms with the highest and lowest ranked average total assets were selected as large and small size firms for statistical analysis. Applying correlation and regression analyses, the most significant factors affecting stock price volatility of large and small firms were examined. Change in stock prices are also believed to be influenced by changes in security market conditions. Using mean-variance analysis, the market risk exposures of large and small firms were compared.

Regression (1) tests the effects of changes in total assets (TA), operating income (EBIT), financial leverage (DEBT), dividends (DIV) and the financial stress measure (Z) on changes in stock prices.

$$\Delta P_t = a_1 \Delta TA_t + a_2 \Delta EBIT_t + a_3 \Delta DEBT_t + a_4 \Delta DIV_t + a_5 \Delta Z_t$$

V. Empirical Results

Table 1 includes the correlations between changes in stock price (ΔP) and changes in total assets (ΔTA), operating income ($\Delta EBIT$), leverage ($\Delta DEBT$), dividend (ΔDIV), financial stress measure (ΔZ), and beta (ΔB). To better understand the relationship between stock prices and financial variables, estimated correlations are assembled into firms having correlations above 70%, 51%, positive, and/or negative percentages. As it appears in Table 1, changes in operating income (EBIT) and the financial stress measure (Z) have the highest positive correlation; and dividend (DIV) and (B) have the most negative correlation with stock price variations. It is interesting to note that the changes in dividends have the lowest positive and the highest negative correlations with price changes. This could imply that increases in dividends have little or no effect on price movements, whereas its reductions or elimination greatly impacts price volatility. Firms with missing data during the entire sample period were eliminated.

Table 1 Correlations between Changes in Stock Prices and Changes in Variables Appearing in Table, 1990-2012

Correlations(1) With Variable	(2)>70%		(3)>51%		(4)>0%		(5)<0%		Total # of Firms
	N	%	N	%	N	%	N	%	
$\Delta(TA)$	2	0.66	27	8.75	217	64.06	88	27.18	305
$\Delta(EBIT)$	9	2.90	51	16.72	254	83.33	51	16.72	305
$\Delta(DEBT)$	0	0.00	14	4.65	156	51.83	145	48.13	301
$\Delta(DIV)$	0	0.00	0	0.00	47	15.93	249	84.40	295
$\Delta(B)$	57	18.62	93	30.40	164	53.59	142	46.40	306
$\Delta(Z)$	0	0.00	17	6.92	225	86.53	35	13.47	260

Note: TA is total assets, EBIT and DEBT are operating income and debt; DIV represents dividends, B is the measure of market risk and Z is the measure of financial stress. Correlations are calculated over the 1990-2012 period and firms with incomplete data are excluded from analysis.

Table 2 includes estimated correlations showing whether company size matters in evaluating stock prices. Considering company size, the correlations appearing in Table 2 show the relationship between changes in stock price with changes in total assets, operating income, debt, dividend, and the financial stress variable. Company size is determined by first averaging the most recent five years of total assets for each firm in the S&P Index. Then, all 500 firms in the index are ranked according to averages of their total assets. Firms with the largest and smallest average total assets are selected for statistical analysis. As shown in Table 2, the majority of large size firms are from financial institutions and the remaining are from oil, communication, and retail industries. The correlations between changes in operating income and stock prices of all financial institutions appearing in Table 2 are positive except for one firm which is negative (Wells Fargo). This shows that variations of operating income are a significant factor in determining stock price changes of financial institutions. However, effects of changes in total assets (TA), financial leverage (DEBT), and dividend (DIV) on prices varies from positive to negative. The last column in Table 2 shows correlations between price variations and the

financial stress variable (Z). Because of the unavailability of the Z-score for financial institutions in the database, correlations between price and Z are missing. As it appears in the table, correlations between price and Z for all nonfinancial companies are positive. Furthermore, as shown in Table 2, changes in the total assets and the financial stress variables have the most positive effects on the changes in stock prices of small size companies. Only three small size firms have data for dividends. Correlations between dividends and prices are small for these small size firms and they range from positive to negative.

Table 2 Correlations between Stock Price Changes of the Largest and Smallest Size Companies in the Standard & Poor's 500 Index with Changes in Variables Appearing in Table, 1980-2012

Comp. Names	Variables	ΔTA	ΔEBIT	ΔDEBT	ΔDIV	ΔZ
Large Size S&P 500 Index Firms						
1. JPMORGAN CHASE & CO		-0.378	0.451	-0.397	-0.366	-----
2. BANK OF AMERICA CORP		-0.00	0.324	0.011	0.002	-----
3. CITIGROUP INC		0.222	0.671	0.223	0.259	-----
4. WELLS FARGO & CO		-0.071	-0.063	-0.075	0.025	-----
5. GOLDMAN SACHS GROUP INC		0.599	0.725	0.597	-0.049	-----
6. GENERAL ELECTRIC CO		0.097	0.266	0.044	-0.103	-----
7. MORGAN STANLEY		0.76	0.29	0.76	0.22	-----
8. PNC FINANCIAL SVCS GROUP INC		-0.36	0.28	0.36	-0.18	-----
9. HARTFORD FINANCIAL SERVICES		0.84	0.73	0.81	-0.06	-----
10. BERKSHIRE HATHAWAY		0.59	0.77	0.42	-----	-----
11. US Bancorp		-0.22	0.17	-0.23	0.06	-----
12. AT&T INC		0.30	0.19	0.24	0.10	0.68
13. EXXON MOBIL CORP		0.02	0.02	0.05	-0.30	0.45
14. FORD MOTOR CO		0.05	0.39	-0.02	0.36	-----
15. VERIZON COMMUNICATIONS INC		-0.39	-0.35	-0.41	-0.41	0.45
16. STATE STREET CORP		-0.27	-0.24	-0.26	-0.20	-----
17. SLM CORP		-0.48	-0.06	-0.47	0.73	-----
18. WAL-MART STORES INC		0.07	0.25	0.03	0.11	0.49
19. LINCOLN NATIONAL CORP		0.65	0.78	0.64	-0.01	-----
20. CHEVRON CORP		0.2	0.16	0.17	0.23	0.31
Small Size S&P 500 Index Firms						
MONSTER BEVERAGE CORP		0.345	0.687	0.207	-----	0.284
REGENERON PHARMACEUTICALS		0.760	0.849	0.048	-----	0.472
CHIPOTLE MEXICAN GRILL INC		0.31	0.22	0.40	-----	0.90
ALEXION PHARMACEUTICALS INC		0.596	0.578	0.606	-----	-0.038
ROBERT HALF INTL INC		0.503	0.275	0.221	0.05	0.70
F5 NETWORKS INC		0.59	0.34	0.33	-----	0.48
FOSSIL GROUP INC		0.79	0.66	0.81	-----	0.62
FASTENAL CO		0.54	0.45	0.60	0.20	0.22
NETFLIX INC		-0.60	-0.11	-0.59	-----	0.66
URBAN OUTFITTERS INC		0.60	0.50	0.62	-----	0.46
LINEAR TECHNOLOGY CORP		0.06	0.30	0.05	-0.12	0.74
FLIR SYSTEMS INC		0.12	0.43	-0.19	-----	0.51
VERTEX PHARMACEUTICALS INC		0.42	0.01	0.28	-----	-0.08
TERADYNE INC		0.04	0.06	-0.11	-----	0.90
PRICELINE.COM INC		0.65	-0.36	0.44	-----	0.60
EDWARDS LIFESCIENCES CORP		0.27	0.58	-0.19	-----	0.89
INTUITIVE SURGICAL INC		0.12	-0.10	0.26	-----	0.83
SALESFORCE.COM INC		0.08	0.28	0.16	-----	0.68
TOTAL SYSTEM SERVICES INC		0.00	-0.04	0.18	-----	0.56

Note: Company sizes are based averages of the most recent five years of total assets over 2008-2012.

Correlations between changes in stock prices and changes in listed variables are calculated using annual data over the 1980-2012 time periods.

Table 3 and Table 4 include regression results testing the relationship between changes in stock prices and the financial variables. Table 3 reveals that the majority of the selected large size firms are from the financial services sector and a few are from other sectors. Because of unavailability of the financial stress data (Z) for financial firms in the database, this variable is excluded from regression analysis. Among the variables of total assets, debt, operating income, and dividends, only the changes in operating income (EBIT) have the most significant effect on

the majority of financial institutions' stock prices. Effects of changes in total assets (TA), financial leverage (DEBT), and dividends (DIV) in price changes were significant only for few firms. Furthermore, changes in the financial stress variable Z (for firms with available Z-score data), had a strong and significant effect on the price changes. Additional regression results (not reported) showed that two variables, EBIT and Z, had the most significant relationship with stock price rather than variables TA and DEBT.

Table 3 Regression Results between Changes in Stock Prices of Large Size S&P 500 Index Firms with Changes in Major Financial Variables Appearing In Table, 1980-2012

$$\Delta P_t = a_1 \Delta TA_t + a_2 \Delta EBIT_t + a_3 \Delta DEBT_t + a_4 \Delta DIV_t + a_5 \Delta Z_t$$

Comp. Names	Variables	$\Delta(TA)$	$\Delta(EBIT)$	$\Delta(DEBT)$	(DIV)	(ΔZ)	R ²
1. JPMORGAN CHASE & CO		0.00026 (1.64)	0.00036 (1.72)	-0.00029 (1.67)	0.07867 (1.07)	-----	0.29 N=32
2. BANK OF AMERICA CORP		-0.00015 (1.19)	0.00043 (2.06)*	0.00017 (1.17)	0.00018 (0.22)	-----	0.15 N=32
3. CITIGROUP INC		0.00208 (1.43)	0.00562 (4.90)*	-0.00234 (1.54)	0.02580 (2.13)*	-----	0.55 N=26
4. WELLS FARGO & CO		0.00039 (1.93)	-0.00526 (4.90)	-0.00042 (1.93)	0.00071 (0.77)	-----	0.03 N=32
5. GOLDMAN SACHS GROUP INC		0.00055 (0.25)	0.00413 (1.80)	-0.00058 (0.26)	0.00612 (0.32)	-----	0.52 N=12
6. GENERAL ELECTRIC CO		0.00028 (2.13)*	0.00082 (2.64)*	-0.00031 (2.08)*	-0.00185 (1.64)	-----	0.27 N=32
7. MORGAN STANLEY		-0.00012 (0.34)	-0.00007 (0.32)	0.00020 (0.59)	0.00258 (0.27)	-----	0.57 N=26
8. PNC FINANCIAL SVCS GROUP INC		-0.00151 (0.744)	0.00692 (1.32)	0.00157 (0.71)	0.00477 (0.28)	-----	0.13 N=32
9. HARTFORD FINANCIAL SERVICES		0.00104 (0.53)	0.00357 (1.55)	-0.99976 (0.36)	0.01110 (0.277)	-----	0.66 N=16
10. BERKSHIRE HATHAWAY		0.00053 (0.78)	0.00179 (1.76)	-0.0071 (0.87)	-0.00023 (0.13)	-----	0.09 N=32
11. US BANCOP		0.00005 (0.30)	0.00157 (3.90)*	0.00010 (0.35)	-----	-----	0.66 N=32
12. AT&T INC		0.00035 (0.36)	-0.00036 (0.73)	0.00014 (0.81)	-0.00023 (0.15)	16.617 (5.55)*	0.62 N=28
13. EXXON MOBIL CORP		-0.00039 (2.67)*	-0.00464 (1.55)	0.00660 (3.20)*	-0.01055 (1.01)	57.261 (5.55)*	0.60 N=32
14. FORD MOTOR CO		0.00005 (0.38)	0.00023 (1.44)	-0.00004 (0.30)	0.00200 (2.31)*	-----	0.28 N=32
15. VERIZON COMMUNICATIONS INC		0.00074 (1.84)	-0.00011 (1.44)	-0.00067 (1.65)	-0.01512 (1.51)	8.7862 (1.26)	0.34 N=24
16. STATE STREET CORP		0.00399 (1.58)	-0.00305 (0.45)	-0.000442 (1.60)	0.03151 (0.75)	-----	0.10 32
17. SLM CORP		-0.00167 (0.40)	-0.00084 (0.65)	0.00167 (0.40)	0.07000 (4.40)*	-----	0.55 24
18. WAL-MART STORES INC		-0.00011 (0.21)	0.00246 (1.25)	0.00035 (0.64)	-0.00099 (0.16)	6.020 (3.65)*	0.38 32
19. LINCOLN NATIONAL CORP		0.00172 (1.27)	0.01499 (1.25)	-0.00179 (1.22)	-0.00778 (0.43)	-----	0.66 32
20. CHEVRON CORP		0.00043 (1.16)	-0.00044 (1.34)	-0.00010 (0.15)	-0.00178 (0.43)	8.538 (2.22)*	0.24 32

Note: Companies in Table 3 have the largest averages of total assets from 2008-2012.

Regressions between changes in stock prices and listed variables are estimated using annual data from 1980-2012. Some firms have a few years of missing data. * indicates 5% significance level.

Table 4 presents regression results for small size firms. Results show that the financial stress variable (Z) has the most significant and positive effect on stock price changes for small size firms. The estimated coefficients of the financial stress variable (Z) for almost all firms listed in table are positive and

significant at the 5 percent significance level. Similar to large size firms, the results show that changes in dividends has little or no effect on stock prices for small size firms. The minimal effects of dividends on stock prices supports the M&M (Modigliani and Miller, 1958) theory that corporate values are mostly dependent on the earnings produced rather than how they are distributed. It is interesting to note that the second important factor influencing stock prices of small size firms is financial leverage. As the regression outcome indicates, for most small size firms, a change in the variable DEBT has a positive and significant effect on stock price changes. This would imply that any additional leverage used by small size firms, as long as the cost of capital remains the same, increases return on equity and consequently share value.

Table 4 Regression Results between Changes in Stock Prices of Small Size S&P 500 Index Firms with Changes in Major Financial Variables Appearing In Table, 1980-2012

$$\Delta P_t = a_0 + a_1 \Delta TA_t + a_2 \Delta EBIT_t + a_3 \Delta DEBT_t + a_4 \Delta Z_t$$

Comp. Names	Variables	TA	EBIT	DEBT	DIV	Z	R ²
1. MONSTER BEVERAGE CORP		0.00396 (0.65)	0.07359 (5.97)*	0.03915 (2.76)*	-----	0.07867 (1.07)	0.72 N=21
2. REGENERON PHARMACEUTICALS		0.04411 (1.29)	0.09407 (2.29)*	0.02082 (0.36)	-----	0.89931 (2.87)*	0.87 N=22
3. CHIPOTLE MEXICAN GRILL INC		0.09518 (0.34)	-0.77599 (-1.41)	1.35353 (1.40)	-----	10.8628 (5.44)*	0.94 N=6
4. ALEXION PHARMACEU. INC		0.00951 (-0.65)	0.06503 (1.22)	0.10132 (2.45)*	-----	0.69389 (2.07)*	0.57 N=16
5. ROBERT HALF INTL INC		0.01977 (1.49)	-0.01766 (1.69)	0.04998 (1.50)	0.01217 (0.12)	1.3620 (5.04)*	0.68 N=25
6. F5 NETWORKS INC		0.11599 (1.52)	-0.05334 (0.21)	-0.10281 (0.38)	-----	0.62293 (1.67)	0.45 13
7. FOSSIL GROUP INC		0.00148 (0.05)	0.00346 (0.07)	0.157784 (2.29)*	-----	3.5249 (3.68)*	0.81 19
8. FASTENAL CO		0.01137 (1.29)	-0.02178 (1.28)	0.18609 (2.74)*	-0.01107 (0.71)	0.10984 (2.41)*	0.56 25
9. NETFLIX INC		-0.01205 (.06)	-0.03399 (0.24)	0.00093 (0.00)	-----	5.6975 (1.66)	0.43 12
10. URBAN OUTFITTERS INC		0.01218 (0.70)	0.00638 (0.14)	0.08805 (2.02)	-----	0.68019 (2.41)*	0.62 12
11. LINEAR TECHNOLOGY CORP		0.000031 (0.06)	0.2732 (2.77)*	0.01113 (2.73)*	0.01476 (0.21)	0.74409 (8.18)*	0.79 N=25
12. FLIR SYSTEMS INC		-0.00549 (0.57)	-0.00579 (0.29)	0.01070 (0.35)	-----	-0.07514 (0.13)	0.19 N=20
13. VERTEX PHARMACEUTICALS INC		0.2181 (1.4)	-0.00579 (0.29)	0.01070 (0.35)	-----	-0.07514 (0.13)	0.19 N=20
14. TERADYNE INC		0.00313 (1.01)	-0.00684 (2.00)*	0.02602 (3.17)*	-----	3.8633 (14.94)*	0.89 N=32
15. PRICELINE.COM INC		0.14530 (2.53)*	-0.13488 (2.35)*	-0.06722 (0.60)	-----	7.17000 (1.78)	0.86 N=13
16. EDWARDS LIFESCIENCES CORP		0.00096 (0.07)	0.08409 (2.09)*	0.04924 (2.16)*	-----	5.2025 (8.55)*	0.95 N=12
17. INTUITIVE SURGICAL INC		-0.01708 (0.16)	-0.07822 (0.43)	1.1677 (1.24)	-----	5.9813 (5.28)*	0.80 N=12
18. SALESFORCE.COM INC		-0.10389 (1.48)	0.08751 (1.56)	0.18104 (1.58)	-----	0.57721 (0.59)	0.72 N=12
19. TOTAL SYSTEM SERVICES INC		0.00526 (0.72)	-0.03372 (0.90)	0.04219 (2.40)*	-----	0.64009 (4.38)*	0.46 N=29

Note: Companies in Table 4 have the lowest averages of total assets from 2008-2012. Regressions between changes in stock prices and listed variables are estimated using annual data from 1980-2012.

Size Effect: Test of Equality of Means and Variances of Small and Large Size Firms Exposures to Market Risk

Table 5, Panel A, presents a list of large and small size companies with their betas. Beta for each firm is the average of all betas available in the database during the 2008-2012. To compare the market risk exposures of small and large size firms, mean and variance analysis are applied. As is shown under

Table 5 Average Betas of Large and Small Size S&P 500 Firms, and Test of Equality of Means and Variance of Betas, 2008-2012

Panel A			
<u>Largest size S&P 500 Index Firms</u>	<u>Beta</u>	<u>Smallest Size S&P 500 Index Firms</u>	<u>Beta</u>
1. JPMORGAN CHASE & CO	1.10	MONSTER BEVERAGE CORP	0.73
2. BANK OF AMERICA CORP	2.03	REGENERON PHARMACEUTICALS	1.22
3. CITIGROUP INC	2.4	CHIPOTLE MEXICAN GRILL INC	1.08
4. WELLS FARGO & CO	1.13	ALEXION PHARMACEUTICALS INC	0.68
5. GOLDMAN SACHS GROUP INC	1.4	ROBERT HALF INTL INC	1.03
6. GENERAL ELECTRIC CO	1.5	F5 NETWORKS INC	1.36
7. MORGAN STANLEY	1.54	FOSSIL GROUP INC	1.76
8. PNC FINANCIAL SVCS GROUP INC	1.12	FASTENAL CO	0.97
9. HARTFORD FINANCIAL SERVICES	3.0	NETFLIX INC	0.73
10. BERKSHIRE HATHAWAY	0.50	URBAN OUTFITTERS INC	1.12
11. US Bancorp	0.92	LINEAR TECHNOLOGY CORP	1.02
12. AT&T INC	0.63	FLIR SYSTEMS INC	0.90
13. EXXON MOBIL CORP	0.50	VERTEX PHARMACEUTICALS INC	0.62
14. FORD MOTOR CO	2.30	TERADYNE INC	1.90
15. VERIZON COMMUNICATIONS INC	0.59	PRICELINE.COM INC	1.07
16. STATE STREET CORP	1.31	EDWARDS LIFESCIENCES CORP	0.53
17. SLM CORP	1.40	INTUITIVE SURGICAL INC	1.71
18. WAL-MART STORES INC	0.31	SALESFORCE.COM INC	1.73
19. LINCOLN NATIONAL CORP	2.50	TOTAL SYSTEM SERVICES INC	0.95
20. CHEVRON CORP	0.74		

Panel B			
<u>Method</u>	<u>df</u>	<u>t-Value</u>	<u>Probability</u>
Test for Equality of Means Betas			
t-test	37	1.194689	0.2398
Satterthwaite-Welch t-test*	29.53348	1.212045	0.2351
Anova F-test	(1, 37)	1.427283	0.2398
Test for Equality of Variances of Betas			
F-test	(18, 19)	3.423327	0.0107
Levene	(1, 37)	5.634399	0.0229
Brown-Forsythe	(1, 37)	5.260606	0.0276

Note: Large and small firms are selected according to averages of the most recent five years' total assets values. The Satterthwaite-Welch t-test is an adaptation of the Student's t-test intended for use with two samples having possibly unequal variances. Levene's test is used to assess the equality of variances in different samples. The Brown-Forsythe test is a statistical test for the equality of group variances based on performing an ANOVA on a transformation of the response variable.

Panel B, Tests of Equality of Means, fails to reject the hypothesis that market risk exposure of small and large firms on the average are different, indicating that the market risk exposures of large and small firms on average are “equal.” However, test results shows that the variances of small and large firms’ betas are dissimilar, indicating that small and large firm’s stock prices do not react to security markets variations similarly. The coefficient of variations of small and large firms’ betas showed that smaller firms, on average, have more volatile betas than larger firms (not reported in this study). These results support the finding of Keim (1983) that small firms have higher betas than larger firms.

Tests of Equality of Means and Variances of Correlations between Changes in Stock Prices (P), Operating Income (EBIT), Debt, and Total Assets of Small and Large S&P 500 Firms

Table 6 presents test results of equality of means and variances of correlations between changes in stock prices of large and small size firms with changes in the financial variables under study. Results in Panel A show whether means and variances of correlations between changes in stock prices and operating incomes of large and small size firms differ.

Table 6 Tests of Equality of Means and Variances of Correlations between Changes in Stock Prices (P), Operating Income (EBIT), Debt, and Total Assets of Small and Large S&P 500 Firms

<u>Method</u>	<u>df</u>	<u>t-Value</u>	<u>Probability</u>
Panel A: Test for Equality of Means of EBIT			
t-test	37	-0.071888	0.9431
Satterthwaite-Welch t-test*	36.98854	-0.071955	0.9430
Anova F-test	(1, 37)	0.005168	0.9431
Test for quality of Variances of EBIT			
F-test	(18, 19)	1.072678	0.8784
Levene	(1, 37)	0.000150	0.9903
Brown-Forsythe	(1, 37)	0.000418	0.9838
Panel B: Test for Equality of Means DEBT			
t-test	37	-0.798294	0.4298
Satterthwaite-Welch t-test*	36.79809	-0.800955	0.4283
Anova F-test	(1, 37)	0.637273	0.4298
Test for Equality of Variances of Debt			
F-test	(18, 19)	1.289347	0.5870
Levene	(1, 37)	0.693047	0.4105
Brown-Forsythe	(1, 37)	0.472238	0.4962
Panel C: Test for Equality of Means TA			
t-test	37	-1.783060	0.0828
Satterthwaite-Welch t-test*	36.42243	-1.791430	0.0815
Anova F-test	(1, 37)	3.179303	0.0828
Test for Equality of Variances of TA			
F-test	(18, 19)	1.432652	0.4437
Levene	(1, 37)	0.755252	0.3904

Note: EBIT is operating income, DEBT represents debt, and TA is total assets. The Satterthwaite-Welch t-test is an adaptation of the

Student's t- test intended for use with two samples having possibly unequal variances. Levene's test is used to assess the equality of variances in different samples. The Brown–Forsythe test is a statistical test for the equality of group variances based on performing an ANOVA on a transformation of the response variable.

Panel B and Panel C report test results showing the effects of changes in debt (DEBT) and total assets (TA) on changes in stock prices. As it appears in Table 6, Panels A and B tests of equality of means and variances fail to support the conclusion that means and variations of the changes in operating income and financial leverage on changes in stock prices are dissimilar among large and small size firms. However, results under Panel C reject the hypothesis that mean effects of total assets of large and small firms on stock prices are similar at the 10 percent significance level. The results fail to reject the hypothesis that their variances are different.

VI. Conclusion

The question of what factors influence stock price variations has been of interest to many investors and studies. This study, through correlation and regression analyses, identifies the most relevant variables affecting stock price changes of the Standard & Poor's 500 Index firms. Applying the Altman financial stress model, the significance of changes in the financial stress measures on stock prices is also tested. In addition, it investigates whether effects of financial factors on stock prices depend on company size. Through mean and variance analysis, effects of market risk exposure of large and small firms are investigated. Moreover, the tests of equality of means and variance analysis are performed to see whether the correlations between changes in stock prices with changes in financial variables, including operating income, financial leverage, and total assets among large and small size firms, differ.

Among large and small size firms and financial variables considered in this study, changes in operating income and the financial stress measure are the most relevant factors in affecting stock price changes of large and small firms. The results showed that there is no strong positive correlation between changes in stock prices and dividends. However, correlations for the majority of firms in the sample were negative. It can be said that dividend reductions may lead to higher price variations than dividend increases. Stock prices might decline more from dividend cuts than it would increase for dividend enhancements.

The tests of equality of means and variances failed to support the hypothesis that correlations between changes in stock prices and operating income, financial leverage, and total assets for small and large size firms differ. However, it rejected the idea that variances of market risk of small and large firms are equal. Such results showed market risk exposures of small and large size firms are dissimilar.

The major contribution of this study to the current literature is to reinstate the idea that operating earnings, regardless of company size, is an important variable to be considered while evaluating stock prices. Other variables such as dividends, free cash flow, net income, return on equity, etc. are in one way or another derived from the earnings and/or somehow is dependent on them. Moreover, the analysis showed that the correlation between changes in stock prices and dividends are not positive and that the majority of small size firms considered in this study do not pay dividends. For the small size firms, stock price variation was mostly impacted by their total assets and amount of leverage carried. These conclusions can vary and may depend on the

sample size, period of study, firms included, and the approach of choosing large and small size firms.

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