Pharmaceutical Company: Key metrics and Stock performance

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Chapter 1

1. The necessity of topic:

The State Board of Administration (SBA) sponsored an executive compensation research study by Farient Advisors LLC, covering 1,800 companies, 24 Industry groups, and fourteen years of data (from 1998-2011). The research project identifies the primary metrics used in executive compensation plans, overall and by industry, company size and valuation premiums, and then tests these metrics to determine whether the metrics used have the highest impact on total stock returns (or total shareholder returns – TSR). The study found that, in aggregate, performance metrics are generally well-aligned with shareowner value. Earnings growth, followed by returns and revenue growth, has the greatest impact on stock prices. This review also found that many industries have a number of metrics to choose from; with half of the 24 industrial groups studied having at least three metric categories with strong correlations to TSR. However, the optimal use of measures differs considerably by industry([1]).

The pharmaceutical industry discovers, develops, produces, and markets drugs or pharmaceutical drugs for use as medications.Pharmaceutical companies may deal in generic or brand medications and medical devices. They are subject to a variety of laws and regulations that govern the patenting, testing, safety, efficacy and marketing of drugs.In the era of aging populations andrising health care cost, the pharmaceutical companies become top performers in the health care sector by developing new and extremely profitable medicines.

Investors face a wide array of public traded pharmaceutical companies to choose the best one to invest.Pharmaceutical stocks often reward investors with dividends and growth, but they have risks. Drugs can fail to win the approval of the Food and Drug Administration, patents expire and competing drugs may drive an old standby out of the market.When investing in the pharmaceutical sector, it can be important to look for companies that have a firm hold on a narrow market. In order to make an informed choice, investors need to consider key metrics that are most helpful in analyzing and evaluating pharma firms.

For all these reasons, this study is quite necessary in finding out the relationship between key metrics and stock performance of the pharmaceutical companies.

2. The goal of topic:

- Key metrics of pharmaceutical company
- Annual data of key metrics and stock prices from some biggest pharmaceutical companies around the world
- Analysis of correlation between stock price and each key metric of these companies
- Multiple regression model

3. Research questions, methodology and scope of research

Research questions:

- What metrics have a positive/negative linear relationship with TSR for each pharmaceutical company?
- Find out a linear multiple regression model between TSR and key metrics when considering each analyzed company as a sample.

Methodology & scope of analysis:

- Qualitative: study key metrics for pharmaceutical companies such as Return on Research Capital, R&D Expense/Revenues, Selling Expense/Revenues([2], [3]).
- Quantitative: Analyze data from 15 biggest pharmaceutical companies in the United States, United Kingdom, Europe and Asia([4], [5], [6], [7], [8], [9], [10], [11], [12], [13]).

4. Facilities and the difficulty of the researching process

4.1. Facilities: We obtain 10 years of data (2008-2017) from annual reports of 10 pharmaceutical companies and their stock prices from Yahoo Finance.

4.2. Difficulty:Some companies do not have enough data to analyze**.**

Chapter 2: TSR and key metrics of pharmaceutical company

1. Total shareholder returns (TSR)

TSRis the total return of a stock to an investor, or the capital gain plus dividends. . TSR can be calculated with the following formula:

$$\frac{(EndingPrice - BeginningPrice) + Dividends}{BeginningPrice}$$

$$Endingajustedclosingprice - Beginningadjustedclosingprice$$

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The stock price used in this study is adjusted close price that already includes the dividend. We obtain stock price from Yahoo Finance ([14]).

2. Featured metrics for pharmaceutical companies:

Return on Research Capital Ratio (RORC) The return on research capital ratio (RORC) is a fundamental measure that reveals the gross profit that a company realizes from each dollar of R&D expenditures. Examining the RORC gives investors an idea of how profitably the company is managing to translate the previous year's R&D expenses into current year revenues.

$$RORC = \frac{Currentyear's grossprofit}{Previousyear's totalR \wedge Dexpense}$$

Research and Development Expense as a Percent of Revenue Most pharma companies have very high research and development (R&D) budgets because they can only survive and grow by discovering and developing new drugs. Knowing the R&D budget as a percent of revenue helps investors understand if the company is creating a strong pipeline of future drugs to come on the market. This metric can be calculated by dividing the R&D expense to the total sales/revenues

$$R \wedge DExpenseasaPercentofRevenue = \frac{R \wedge DExpense}{Totalrevenues}$$

Selling Cost Expense as a Percent of Revenue Even more costly than R&D is the cost to market and sell new and existing products. This metric can be calculated by dividing the Selling expense by the total sales/revenues.

$$SellingCostExpenseasaPercentofRevenue = \frac{SellingExpense}{Totalrevenues}$$

3. Standard corporate finance metrics:

We also take some standard metrics, which is usually used to evaluate the performance of the companies.

EPS growth is percentage change in a firm's earnings per share (EPS) in a period, as compared with the same period from the previous year.

$$EPSGrowth = \frac{Currentyear's EPS - Previousyear's EPS}{Previousyear's EPS}$$

In this study, we use the Diluted EPS Growth

Revenue growth is an increase of a company's sales when compared to a previous year's revenue performance. This helps to give analysts, investors and participants an idea of how much a company's sales are increasing over time.

$$RevenueGrowth = \frac{Currentyear's Revenue - Previousyear's Revenue}{Previousyear's Revenue}$$

Return on Equity (ROE) is the amount of net income returned as a percentage of shareholders equity. Return on equity measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested. ROE is expressed as a percentage and calculated as: Return on Equity = Net Income/Shareholder's Equity.

$$ROE = \frac{Netearnings}{TotalEquity}$$

Free cash flow growth (FCF growth): FCF is a measure of a company's financial performance, calculated as operating cash flow minus capital expenditures. FCF represents the cash that a company is able to generate after spending the money required to maintain or expand its asset base. FCF is important because it allows a company to pursue opportunities that enhance shareholder value. In this study we calculate the FCF growth to see the relationship between it and the TSR.

$$FCFGrowth = \frac{Currentyear's FCF - Previousyear's FCF}{Previousyear's FCF}$$

Net Margin lets the investor understand the impact from R&D to see if the program is bringing successful candidates to the market, whether the marketing and selling costs are having a positive impact on revenues (market share gains), and whether external factors are negatively impacting the company. It is calculated by dividing the net income by the total sales.

$$NetMargin = \frac{Netearnings}{TotalRevenues}$$

Liquidity and Debt Coverage Ratios

Because pharmaceutical companies must make large capital expenditures on R&D, they must be able to maintain adequate levels of liquidity and effectively manage their characteristically high levels of debt.

The quick ratio is a financial metric used to measure short-term liquidity. The quick ratio is a good indicator of a company's ability to effectively cover its day-to-day operating expenses.

$$Quickratio = \frac{Cash + MarketableSecurities + AccountReceivable}{CurrentLiabilities}$$

The D/E ratio measures the amount of leverage that a company has, and indicates the proportional amount of a company's equity that are financed through debt. Successfully managing debt obligations is a major factor in the long-term viability and profitability of any pharmaceutical company.

$$D/Eratio = \frac{Netearnings}{TotalEquity}$$

Dividend Payout Ratio: Investors have been increasingly looking to pharma stocks as defensive. Even with the costly R&D and selling expenses, pharma companies typically have strong cash positions on their balance sheets. Investors, therefore, expect these companies to redeploy capital back to shareholders in the form of dividends or other capital structure programs. High dividend yields and dividend growth rates are very attractive to pharma investors. Therefore, the ratio of dividends to earnings is a key metric.

$$DividendPayoutRatio = \frac{Dividendpershare}{DilutedEPS}$$

Chapter 3: Analyzing the data of pharmaceutical companies

We chose to analyze the data of 10 out of 50 biggest pharmaceutical companies in the world according to Pharm Exec's latest annual listing of the top pharmaceutical companies, which includes:

- Two companies from the United States
- Six companies from Europe
- Two companies from Asia and Australia

Beside correlation, we run the Pearson test in some cases to see if the data supports a linear relationship between two populations.

I. Analyzing the correlation of metrics with TSR:

1. Johnson & Johnson – the United States

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout Ratio
2017	23.75	-92.07	6.34	2.0	0.14	1.70	1.04	0.510	7.06
2016	17.90	8.21	2.59	23.4	-0.04	23.01	2.04	0.319	0.53
2015	1.19	-3.86	-5.73	21.9	0.07	21.99	1.77	0.18	0.54
2014	18.06	18.50	4.23	22.7	0.09	21.96	1.75	0.22	0.48
2013	33.22	24.61	6.08	19.9	0.11	19.40	1.59	0.18	0.54
2013	10.33	10.60	3.37	17.8	0.09	15.64	1.34	0.18	0.62
2011	8.20	-26.99	5.59	17.0	-0.19	14.87	1.88	0.23	0.64
2010	-1.02	8.64	-0.50	24.9	-0.01	21.65	1.62	0.16	0.44
2009	9.77	-3.72	-2.90	26.4	0.19	19.82	1.34	0.16	0.44
2008	-6.61	25.90	4.34	30.2	-0.01	20.31	1.08	0.19	0.39
Correlation with TSR		-0.23	0.50	-0.54	0.36	-0.33	0.11	0.44	0.37

The Revenue Growth ratio, FCF Growth, D/E ratios and Dividend Payout Ratios have the positive relationship with the TSR since their correlations with TSR are 0.5, 0.36, 0.44 and 0.37 respectively.

ROE is a standard financial metric that should have positive relationship with TSR. However, the correlation of ROE with TSR is approximately -0.54 so ROE has negative relationship with TSR. Therefore, this indicator is not useful in evaluating stock performance of this company.

Other standard metrics have the correlations with TSR that is very close to 0 so we can understand that they do not have any significant relationship with the stock performance of this company.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	23.75	5.62	13.81	28.02
2016	17.90	5.55	12.65	27.74
2015	1.19	5.71	12.91	30.26
2014	18.06	6.30	11.43	29.54
2013	33.22	6.39	11.47	30.61
2013	10.33	6.04	11.40	31.04
2011	8.20	6.53	11.61	32.25
2010	-1.02	6.13	11.11	31.54
2009	9.77	5.73	11.29	31.99
2008	-6.61	5.89	11.89	33.71
Correlation with TSR		0.13	0.19	-0.63
P-value				0.02

Selling Expense as a Percent of Revenue - one of three pharmaceutical featured metrics has negative relationship with TSR because the correlation is -0.64. With the P-value 0.0236 (less than 0.05), there is sufficient evidence to support to the relationship between Selling Expense as a Percent of Revenue and TSR. Therefore, in this case, the Selling Cost Expense as a Percent of Revenue is useful in evaluating the TSR of Johnson and Johnson.

Other featured metrics including RORC and R&D Expense as a Percent of Revenue have the correlation that is close to 0 indicate that there is no significant relationship between these metrics to TSR.

2. Gilead Science – United States

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratio	D/E ratio
2017	-0.57	-64.69	-14.33	22.6	-30.62	18.03	2.52	1.50
2016	-25.25	-16.54	-6.84	69.7	-20.50	45.07	1.78	1.36
2015	7.89	62.04	31.37	94.6	67.22	56.32	2.07	1.11
2014	25.32	306.08	126.53	76.5	320.62	49.44	2.56	0.75
2013	100.14	10.37	14.96	26.2	4.18	28.46	0.67	0.34
2013	75.40	-54.70	16.00	27.1	-20.22	27.58	0.85	0.74
2011	11.91	6.78	9.63	40.8	26.52	34.61	4.71	1.11
2010	-16.30	16.49	14.24	47.4	-2.74	39.26	1.51	0.46
2009	-17.07	35.35	27.22	40.5	40.53	40.75	1.62	0.18
2008	12.78	25.73	36.22	44.3	27.55	38.92	2.30	0.25
Correlation with TSR		-0.014	0.12	-0.39	0.024	-0.375	-0.38	-0.28

The correlation between ROE, Net Margin and Quick ratio and TSR are -0.39, -0.375,-0.38 respectively. The negative relationships here are also against the normal hypothesis that these metrics should have positive relationship with TSR.

Other standard metrics have the correlation close to zero. Therefore, these metrics do not show any linear relationship with TSR.

All the standard metrics in corporate finance is not effectively in estimate the stock performance of this pharmaceutical company.

Year	TSR	RORC	R&D Expense/ Revenue(%)	SellingExpense/ Revenue (%)
2017	-0.57	4.18	14.55	15.11
2016	-25.25	8.52	17.02	11.34
2015	7.89	9.86	9.37	10.66
2014	25.32	9.76	11.66	12.19
2013	100.14	4.51	19.62	15.73
2013	75.40	5.64	18.73	15.55
2011	11.91	5.57	15.17	15.33
2010	-16.30	5.87	14.52	14.13
2009	-17.07	6.75	14.53	14.64
2008	12.78	6.70	14.20	15.67
Correlation with TSR		-0.34	0.52	0.43

RORC has a negative correlation with -0.34 so their linear relationship is also negative. R&D Expense/Revenue and Selling Expense/ Revenue expected to have positive relationship with TSR show a negative correlation in this case. Therefore, all three featured metrics are not effective in evaluating the stock performance of Gilead Science.

3. Novartis – Switzerland:

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	17.65	16.07	1.22	10.38	10.29	15.69	0.77	0.31	0.84
2016	-6.53	-2.78	-1.86	8.94	2.12	13.81	3.56	0.24	0.97
2015	-0.98	-33.18	-5.68	23.07	-15.32	35.99	0.57	0.21	0.93
2014	37.72	16.49	0.63	14.51	9.94	19.61	0.82	0.19	0.63
2013	31.04	-2.37	-8.09	12.48	-12.63	17.84	0.73	0.15	0.68
2013	16.29	2.43	-3.23	13.55	-8.96	16.56	0.76	0.20	0.65
2011	6.66	-13.15	15.69	14.02	1.27	15.79	0.67	0.21	0.64
2010	8.34	15.45	14.36	14.29 %	30.70	19.69	0.73	0.21	0.46
2009	14.77	3.65	6.77	14.71	23.54	19.10	1.32	0.15	0.46
2008	-7.52	27.14	8.90	16.18	20.24	19.69	0.80	0.04	0.43
Correlation with TSR		0.2	-0.311	-0.19	-0.11	-0.17	-0.37	0.17	-0.12

EPS Growth and Quick ratio are two metrics that have largest negative correlation with TSR while they are expected to have positive linear relationship with stock returns.

The correlation of other metrics are close to zero so they indicate that there no linear relationship between EPS Growth, ROE, FCF Growth, Net margin, D/E ratio and Dividend Payout ratio and TSR.

All of these metrics are not useful in evaluating the stock performance of Novatis.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	17.65	3.65	18.27	26.19
2016	-6.53	3.57	18.63	24.73
2015	-0.98	3.64	18.07	23.81
2014	37.72	4.00	17.30	23.61
2013	31.04	3.87	17.41	24.26
2013	16.29	4.05	16.47	25.33
2011	6.66	4.45	16.36	25.75
2010	8.34	4.96	17.92	26.30
2009	14.77	4.56	16.87	27.22
2008	-7.52	4.84	17.41	28.59
Correlation with TSR		-0.2	-0.26	-0.45

All the featured metrics have negative correlation with TSR which is -0.2, -0.26 and -0.45 respectively. The correlations between R&D Expense as a Percent of Revenue and Selling Expense as a Percent of Revenue and TSR are close to zero so they do not indicate any linear relationship between these metrics and stock performance of Novartis.

With the largest correlation with TSR compare to other featured metrics, the correlation of -0.45 indicates a negative relationship between Selling Expense as a Percent of Revenue and the stock return of the company.

4. Sanofi – France

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	8.39	83.47	3.65	14.7	-0.10	24.40	1.13	0.25	0.45
2016	-0.08	11.69	-2.09	8.3	4.10	14.19	1.07	0.29	0.82
2015	-3.21	-1.52	2.29	7.5	-10.51	12.70	0.98	0.23	0.90
2014	-8.66	18.71	2.49	8.0	7.33	13.35	1.11	0.24	0.86
2013	15.81	-25.67	-5.71	6.8	-13.76	11.76	1.08	0.18	1.01
2013	33.23	-12.82	4.67	8.9	-12.40	14.70	1.00	0.19	0.74
2011	16.51	2.63	9.89	10.5	-5.06	17.77	0.90	0.22	0.62
2010	-18.18	3.72	3.68	10.7	22.04	18.83	1.29	0.13	0.60
2009	26.71	37.07	6.30	11.7	-3.20	19.42	0.98	0.12	0.60
2008	-26.42	-24.42	-1.73	9.5	6.09	15.57	1.02	0.09	0.75
Correlation with TSR		0.16	0.35	0.11	-0.72	0.09	-0.48	0.18	-0.103
P-value					0.0093				

ROE has the largest negative correlation with TSR (-0.72). It indicates a strong negative linear relationship between ROE and stock returns while this metric is expected to have positive one. The correlation of Quick ratio with TSR show the similar result to ROE although it is closer to 0 compare to ROE correlation.

The correlation between Revenue Growth and TSR is 0.35, which indicate a weak positive linear relationship between them.

Other correlations are very close to zero, which cannot indicate any linear relationship between the remaining metrics and TSR.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	8.39	4.76	15.61	28.69
2016	-0.08	4.72	15.29	28.05
2015	-3.21	4.96	14.71	27.16
2014	-8.66	4.84	14.28	26.97
2013	15.81	4.53	14.48	26.11
2013	33.23	5.16	14.08	25.60
2011	16.51	5.49	14.41	25.57
2010	-18.18	5.09	14.48	24.90
2009	26.71	5.00	15.64	24.99
2008	-26.42	4.73	16.60	26.00
Correlation with TSR		0.3	-0.36	-0.15

RORC has a positive relationship with TSR because its correlation with TSR is 0.3. However, with this result, we can only infer a weak linear relationship between them.

The correlation of R&D Expense as a Percent of Revenue with TSR is -0.36, which indicates a weak negative relationship between them.

The correlation of Selling Expense as a Percent of Revenue with TSR is -0.15. Although it may be a negative figure, it cannot show any linear relationship since it is too close to zero.

5. Novo Nordisk – Denmark

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	53.95	2.87	-0.08	80.2	-18.68	34.10	0.83	0.07	0.50
2016	-35.69	10.65	3.57	82.2	24.75	33.90	0.86	0.07	0.50
2015	38.75	34.26	21.53	79.9	19.35	32.30	0.88	0.06	0.47
2014	17.40	7.70	6.26	63.9	22.01	29.80	0.86	0.05	0.49
2013	22.83	20.33	7.11	60.5	20.50	30.10	1.05	0.05	0.47
2013	52.79	29.50	17.60	54.9	2.96	27.50	1.19	0.05	0.45
2011	11.86	21.95	9.16	46.0	12.26	25.80	1.29	0.06	0.45
2010	82.92	38.20	18.99	39.6	27.91	23.70	1.24	0.05	0.40
2009	31.53	14.84	12.13	31.3	14.92	21.10	1.05	0.03	0.41
2008	-15.26	15.24	8.90	29.6	45.55	21.20	0.95	0.03	0.38
Correlation with TSR		0.5	0.5	-0.095	0.85	-0.096	0.38	-0.01	-0.16
P-value					0.001				

The correlation of EPS Growth, Revenue Growth and FCF Growth with TSR is 0.5, 0.5 and 0.85 respectively. All of these metrics have positive relationship with TSR in which FCF Growth has a very strong relationship because of the correlation 0.85 is very close to 1. The P-value is approximately 0 which indicate a very statistically significant result.

The correlations of other metrics are close to zero so they indicate that there no linear relationship between ROE, FCF Growth, Net margin, D/E ratio and Dividend Payout ratio and TSR.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	53.95	6.46	12.55	25.37
2016	-35.69	6.95	13.03	25.39
2015	38.75	6.67	12.61	26.23
2014	17.40	6.33	15.50	26.15
2013	22.83	6.38	14.04	27.98
2013	52.79	6.71	13.94	27.61
2011	11.86	5.60	14.51	28.64
2010	82.92	6.24	15.80	29.94
2009	31.53	5.17	15.40	30.19
2008	-15.26	4.15	17.25	27.16
Correlation with TSR		0.26	-0.09	0.4

RORC has a very weak positive relationship with TSR because its correlation with TSR is 0.26 – very close to zero.

The correlation between Selling Expense as a Percent of Revenue is 0.4, which indicate a positive relationship between them. This result does not support to the expectation of the relationship between this metrics and TSR.

The remaining correlation is close to 0 indicates that there no relationship between R&D Expense as a Percent of Revenue and TRS.

In this company, the stock performance is better evaluated by standard metrics than featured metrics for pharmaceutical companies.

6. Bayer – Germany

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	8.93	54.60	-25.13	22.0	73.41	23.12	1.19	0.34	0.33
2016	-8.47	9.46	0.96	15.1	114.39	10.32	0.69	0.51	0.50
2015	4.19	20.05	9.67	16.1	67.88	8.85	0.69	0.65	0.50
2014	15.32	7.25	5.18	17.0	33.33	8.15	0.71	0.91	0.54
2013	45.05	30.41	1.00	15.3	39.95	7.93	0.66	0.27	0.54
2013	45.83	-1.00	8.85	13.4	25.25	6.28	0.70	0.37	0.64
2011	-7.63	90.45	4.10	12.8	103.72	6.77	0.66	0.41	0.55
2010	0.99	-7.65	12.58	6.9	156.14	3.73	0.88	0.53	0.96
2009	35.63	-23.42	-5.32	7.2	122.05	4.36	0.98	0.60	0.82
2008	-30.69	-61.99	1.65	10.6	-17.96	5.24	0.58	0.65	0.63
Correlation with TSR		0.11	-0.03	0.05	-0.01	-0.04	0.205	-0.32	-0.10

The largest negative correlation is between D/E ratios and TSR -0.32. This correlation can only indicate a weak positive relationship since it is close to 0.

Other correlations are very close to zero so they can not show any linear relationship between the metrics with TSR.

The standard metrics are not effective in evaluating stock performance of Bayer.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	8.93	5.06	12.86	31.75
2016	-8.47	6.18	9.98	26.67
2015	4.19	7.04	9.24	26.70
2014	15.32	6.89	8.46	26.08
2013	45.05	6.91	7.94	25.10
2013	45.83	7.06	7.58	25.12
2011	-7.63	6.08	8.03	24.60
2010	0.99	6.55	8.70	25.09
2009	35.63	6.04	8.81	25.42
2008	-30.69	6.39	8.06	24.62
Correlation with TSR		0.3	-0.18	-0.02

RORC has positive linear relationship with TSR since its correlation with TSR is 0.3. However, we can only indicate a weak relationship because the correlation is close to 0.

From two remaining correlation, we cannot conclude any linear relationship since these correlation are too close to zero.

All three featured metrics are also not useful in evaluating stock performance of Bayer.

7. AstraZeneca – the United Kingdom

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	31.34	-14.13	-5.47	21.1	-16.56	17.40	0.58	0.94	0.80
2016	-14.43	23.77	-9.82	9.8	35.22	7.64	0.69	0.87	0.69
2015	3.37	127.55	-9.40	13.4	-66.99	10.52	0.91	0.76	0.85
2014	30.68	-51.96	1.49	-1.4	-9.19	-1.04	0.83	0.43	1.94
2013	-6.43	-58.70	-8.09	10.6	6.09	9.56	1.11	0.37	0.93
2013	12.72	-31.86	-16.72	26.7	-10.11	22.90	1.16	0.39	0.39
2011	12.01	30.16	0.97	40.3	-29.40	28.19	1.31	0.31	0.26
2010	8.00	7.32	1.42	34.9	-8.24	24.53	1.22	0.39	0.31
2009	28.25	23.57	3.81	36.0	40.93	22.83	1.08	0.44	0.29
2008	5.84	12.30	6.91	26.3	19.86	13.37	0.87	0.68	0.32
Correlation with TSR		-0.21	0.37	0.16	-0.096	0.15	-0.098	-0.12	0.23

Revenue has the largest positive correlation with Revenue Growth, which is 0.37. Because the result is close to zero, it indicates a weak relationship.

Other metrics show very close to zero correlation so they have no linear relationship with the TSR.

All standard metrics used in corporate finance are not effectively in examining the stock performance of this company.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	31.34	3.08	28.57%	50.78%
2016	-14.43	3.15	27.63%	44.15%
2015	3.37	3.60	25.37%	47.00%
2014	30.68	4.29	21.38%	49.82%
2013	-6.43	3.92	18.75%	47.47%
2013	12.72	4.09	18.74%	35.17%
2011	12.01	5.18	16.44%	33.23%
2010	8.00	6.10	15.98%	31.40%
2009	28.25	5.22	13.44%	34.54%
2008	5.84	4.46	16.39%	34.53%
Correlation with TSR		0.2	-0.14	0.06

Three correlations here are very close to zero that indicates no linear relationship between the featured metrics and the TSR.

The featured metrics are also not useful in this case.

8. GlaxoSmithKline – the United Kingdom

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	-3.81	66.67	8.24	62.2	14.29	7.19	0.37	4.09	2.58
2016	0.11	-89.20	16.58	21.4	2091.61	3.81	0.58	2.95	4.30
2015	0.51	203.88	3.99	94.3	-105.92	35.00	0.86	1.73	0.58
2014	-14.74	-48.69	-13.20	57.4	-43.96	12.31	0.68	3.21	1.41
2013	27.00	20.77	0.28	72.0	128.16	21.23	0.81	1.98	0.71
2013	-1.14	-11.34	-3.49	70.3	-50.52	17.95	0.69	2.17	0.81
2011	22.53	223.51	-3.54	61.8	-7.69	19.93	0.76	1.38	0.73
2010	-3.76	-70.52	0.08	19.0	-14.62	6.53	0.94	1.52	2.04
2009	20.28	22.81	16.49	52.8	12.29	19.98	1.10	1.38	0.56
2008	-21.95	-5.98	4.85	56.6	21.31	19.35	1.22	1.83	0.65
Correlation with TSR		0.405	0.19	0.17	-0.012	0.27	-0.02	-0.4	-0.24

The largest positive correlation is between EPS Growth and TRS. It indicates a positive relationship between them.

The correlation of D/E ratio with TRS is -0.4 so the relationship between them is negative.

The remaining correlations are too close to zero so they indicate no linear relationship of the metrics with the stock performance.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	-3.81	5.47	14.83	32.04
2016	0.11	5.22	13.01	33.58
2015	0.51	4.37	14.88	38.59
2014	-14.74	4.00	15.00	35.84
2013	27.00	4.52	14.80	31.99
2013	-1.14	4.62	15.01	33.06
2011	22.53	4.50	14.64	32.23
2010	-3.76	5.07	15.70	45.97
2009	20.28	5.70	14.47	33.81
2008	-21.95	5.39	15.12	31.44
Correlation with TSR		-0.04	-0.23	-0.19

R&D Expense as a Percent of Revenue and Selling Expense as a Percent of Revenue have negative correlation with TSR. However, the correlation is close to zero so we cannot conclude about the linear relationship between these two metrics and TSR.

The correlation between RORC and TRS is too close to zero that there no linear relationship between them.

9. Teva – Israel

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	-47.72	-23328.57	2.20	-87.8	-39.11	-73.48	0.45	1.54	-0.05
2016	-42.91	-96.15	11.45	0.9	-9.35	1.42	0.46	0.93	19.43
2015	19.40	-49.16	-3.06	5.3	13.63	8.13	0.95	0.28	0.75
2014	46.71	140.27	-0.21	13.0	90.30	15.01	0.62	0.37	0.37
2013	11.36	-33.78	-0.01	5.5	-36.39	6.17	0.53	0.46	0.86
2013	-11.17	-27.18	10.95	8.4	12.56	9.40	0.66	0.51	0.46
2011	-21.82	-15.80	13.59	12.4	-10.07	15.12	0.53	0.46	0.29
2010	-8.76	64.57	15.99	15.2	29.09	20.71	0.70	0.19	0.20
2009	33.02	185.90	25.39	10.4	4.08	14.42	0.96	0.18	0.27
2008	-8.59	-67.23	17.83	3.9	100.63	5.73	0.77	0.22	0.64
Correlation with TSR		0.52	-0.098	0.55	0.45	0.56	0.64	-0.71	-0.44
P-value							0.0242	0.0108	

The correlation of EPS Growth, ROE, FCF Growth, Net Margin and Quick ratio are 0.52, 0.55, 0.45, 0.56 and 0.64 respectively. These correlations indicate positive relationship between the metrics with the stock returns. The p-value of the correlation of Quick ratio with TSR indicates that there is enough evidence to support the linear relationship of this metric with stock performance.

Other metrics with the correlation close to 0 cannot conclude any linear relationship between the metrics and stock performance.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	-47.72	5.13	8.26	16.33
2016	-42.91	7.78	9.64	17.62
2015	19.40	7.63	7.76	17.70
2014	46.71	7.75	7.34	19.05
2013	11.36	7.90	7.02	20.08
2013	-11.17	9.73	6.67	19.09
2011	-21.82	9.81	5.98	18.99
2010	-8.76	11.30	5.79	18.41
2009	33.02	9.37	5.77	19.25
2008	-8.59	10.27	7.09	22.65
Correlation with TSR		0.17	-0.43	0.33

The correlation of R&D Expense as a Percent of Revenue with TSR is -0.43, which indicates that there is negative relationship between R&D Expense as a Percent of Revenue and the stock return.

Selling Expense as a Percent of Revenue has positive correlation with TSR while the relationship is expected to be negative.

RORC has positive correlation with TSR. However, the correlation is very close to 0 so there is no linear relationship between them.

10. CSL – Australia

Year	TSR (%)	EPS Growth (%)	Revenue Growth (%)	ROE (%)	FCF Growth (%)	Net margin (%)	Quick ratios	D/E ratio	Dividend Payout ratio
2017	25.46	9.24	11.95	42.3	-18.43	20.22	1.25	0.039	0.46
2016	28.99	-7.93	8.26	48.4	-32.72	21.02	1.21	0.024	0.47
2015	31.00	8.29	2.32	49.9	0.89	25.26	1.67	0.001	0.43
2014	11.60	10.70	7.77	41.3	14.59	24.50	1.85	0.002	0.42
2013	61.05	23.59	7.24	40.5	-1.97	24.57	1.78	0.002	0.42
2013	23.84	13.31	10.24	29.5	9.34	22.18	2.06	0.049	0.44
2011	5.31	-6.26	-6.02	25.8	-11.33	22.46	1.36	0.067	0.05
2010	4.00	-3.42	-3.60	25.0	24.87	23.63	2.39	0.045	0.04
2009	-8.08	51.15	29.96	21.0	48.69	24.79	2.79	0.071	0.04
2008	21.97	29.70	12.11	25.0	78.34	19.73	1.68	0.294	0.04
Correlation with TSR		-0.1	-0.16	0.62	-0.36	-0.05	-0.48	-0.18	0.65
P-value				0.0275					0.0209

The correlation of ROE and Dividend Payout ratio with TSR is 0.62 and 0.65. Therefore, the linear relationship between these two metrics with TSR ratio is positive. With the P-value is 0.0275 and 0.0209 respectively, there is sufficient evidence to support these relationship.

The correlation of FCF Growth and Quick ratio with TSR is -0.36 and -0.48 so we can only infer the weak negative relationship between FCF Growth and Quick ratio. However, these metrics are expected to have positive relationship with the stock return.

Year	TSR	RORC	R&D Expense/ Revenue (%)	Selling Expense/ Revenue (%)
2017	25.46	5.86	9.75	10.54
2016	28.99	6.21	10.39	10.51
2015	31.00	6.12	8.48	9.13
2014	11.60	6.40	8.74	9.47
2013	61.05	6.92	8.62	10.43
2013	23.84	6.85	8.01	10.96
2011	5.31	6.50	7.76	10.51
2010	4.00	7.29	7.11	10.98
2009	-8.08	9.87	6.74	10.58
2008	21.97	8.53	6.33	11.14
Correlation with TSR		-0.45	0.47	-0.14

The correlation of RORC with TSR is -0.45, which indicates a negative relationship between two variables while this relationship is expected to be positive.

The correlation of R&D Expense as a Percent of Revenue with TSR is 0.47, which indicates a positive relationship between them while this relationship is expected to be negative.

Selling Expense as a Percent of Revenue has a negative correlation with TSR. However, the correlation is very close to zero so we cannot infer any relationship between two variables.

Analysis of correlation among variables

	RORC	*R&D Expense / Revenue*	*Selling Expense/ Revenue*	*EPS Growth*	*Revenue Growth*	*ROE*	*FCF Growth*	*Net Margin*	*Quick Ratio*	*D/E Ratio*
RORC	1.0000									
R&D Expense/ Revenue	-0.7629	1.0000								
Selling Expense / Revenue	-0.5615	0.6005	1.0000							
EPS Growth	0.0520	0.1115	0.0988	1.0000						
Revenue Growth	0.4999	-0.2145	-0.3531	0.0373	1.0000					
ROE	0.1139	0.0750	-0.0549	0.4680	0.2515	1.0000				
FCF Growth	0.1268	-0.0553	-0.1304	0.0221	0.0701	0.0406	1.0000			
Net Margin	0.1578	0.1378	-0.2191	0.6719	0.3060	0.7784	0.1332	1.0000		
Quick Ratio	0.1356	-0.0730	-0.3651	0.1129	0.2334	0.1931	0.1203	0.4036	1.0000	
D/E Ratio	-0.1559	0.1341	0.2596	-0.1443	-0.0556	0.2222	-0.3550	-0.2043	-0.1552	1.0000

- ***The correlation among standard corporate finance metrics***

The highest positive correlation is observedbetween ROE and Net Margin, thecorrelation value of them is 0.7784, which means that 77.84% positivecorrelation is present between ROE and Net Margin. Thecorrelation coefficient of EPS Growth and Net Margin is 0.6719, which means that 6% positivecorrelationis present between these metrics.

- ***The correlation among featured metrics***

Thecorrelation coefficient of RORC and R&D Expense/Revenue is -0.7629, which means that 76.29% negative correlation is observe between RORC and . Thecorrelation coefficient of RORC and Selling Expense/Revenue is -0.5615, which means that 56.15% negative correlation is observe between RORC and Selling Expense/Revenue. Thecorrelation coefficient of R&D Expense/Revenue and Selling Expense/Revenue is 0.6005, which means that 60.05% positivecorrelation is observed between R&D Expense/Revenue and Selling Expense/Revenue.

Analyzing the multiple regression:

Regression analysis helps to understand how the value of the dependent variable (TSR) changes when independent variable (key metric) is varied. This study uses the following regression models:

TRS= β_0– β_1 RORC+β_2 R&D Expense/Revenue–β_3 Selling Expense/Revenue + β_4 EPS Growth +β_5 Revenue Growth+β_6 ROE – β_7 CF Growth – β_8 Net Margin – β_9 Quick Ratio – β_{10} D/E ratio –β_{11} Dividend Payout Ratio

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.475242677				
R Square	0.225855602				
Adjusted R Square	0.129087553				
Standard Error	0.23150406				
Observations	100				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	11	1.3759694	0.12508813	2.333989399	0.01433154
Residual	88	4.7162834	0.05359413		
Total	99	6.0922528			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	
Intercept	0.511	0.270	1.894	0.061	
RORC	-0.027	0.027	-0.997	0.322	
R&D Expense/ Revenue	0.697	1.134	0.615	0.540	
Selling Expense as a Percent of Revenue	-0.631	0.422	-1.495	0.138	
EPS Growth	0.004	0.002	2.329	0.022	
Revenue Growth	0.335	0.188	1.783	0.078	
ROE	0.443	0.218	2.031	0.045	
FCF Growth	-0.008	0.012	-0.652	0.516	
Net Margin	-0.965	0.569	-1.697	0.093	
Quick Ratio	-0.033	0.042	-0.779	0.438	
D/E Ratio	-0.126	0.049	-2.587	0.011	
Dividend	-0.027	0.013	-2.097	0.039	

payout ratio					

From the table above we can infer the regression equation is

TRS = ***0.511*** – ***0.027*** RORC + ***0.697*** R&D Expense/Revenue – ***0.631*** Selling Expense/Revenue + ***0.004*** EPS Growth + ***0.335*** Revenue Growth + ***0.443*** ROE – ***0.008*** FCF Growth – ***0.965*** Net Margin – ***0.033*** Quick Ratio – ***0.126*** D/E ratio – ***0.027*** Dividend Payout Ratio

The p-value of the coefficient ofEPS Growth, ROE, D/E Ratio and Dividend payout are 0.022, 0.045, 0.011 and 0.039 respectively, there isoverwhelming evidence to infer the existence of significant linear relationships between these metrics and TSR. To be specific, EPS Growth and ROE have positive relationship with TSR and D/E ratio and Dividend payout policies have negative influences on TSR.The coefficient of Revenue Growth and Net margin with the p-value are 0.078 and 0.093, which are less than 0.1shows that these metrics have also got linear relationship with TSR. Other coefficients have the p-value that are greater than 0.1 indicates that there is not enough evidence to infer the existence of linear relationship between those metrics with TSR.

Since the overall p-value of the multiple regression(0.014) is less than $\alpha = 0.05$, there is a great deal of evidence to infer that the model is useful at the 5% level of significant.

Chapter 4: Conclusion and Recommendation

1. Experience and benefits learned from the study of topic:

We obtain some interesting knowledge about pharmaceutical industry. It also helps us apply the knowledge of some subjects such as: Business Statistics, Corporate Finance in practice.

2. Conclusion

We analyze annual data of ten biggest pharmaceutical companies in the US, Europe, Asia and Australia in a ten-year period(2008-2017) to see if there are positive/negative linear relationship between total shareholder returns and some key metrics including standard metrics used in corporate finance and featured metrics for pharmaceutical companies. We find out in some cases, the correlation between total shareholder returns and some key metrics are statistically significant (p-value <5%).

We also find a multiple regression modelto test the impact of key metrics on total shareholder returns. The result shows that EPS Growth and ROE has got significant positive impact on stock returns while D/E ratio and Dividend Payout ratio has got negative impact on stock returns (p-value < 5%).

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