EQUITY ANALYSIS OF COMPANIES UNDERGOING MERGERS & ACQUISITION

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WRITTEN REPORT

For our project, we analysed the stock prices of companies that have undergone Merger and Acquisition. We wished to analyse the fluctuations in the company's stock when the M&A is announced, through statistical tests. Initially, we observed the log returns of each individual stock and then proceeded to compare the log returns of the pairs of stocks to see if they are correlated and if we can gain productive business insights from the analysis.

DATA SET

We picked 5 pairs of companies' stocks, with information about their Open and Close prices, over a period of 252 trading days. We have used Yahoo Finance for data extraction. The companies chosen for the analysis are –

1. CVS and Aetna

2. Amazon and Whole Foods

3. AT&T and Time Warner

4. Fox and Disney

5. Qualcomm and NXP Semiconductors

LITERARY FINDINGS

A corporate M&A is known to have predictable short-term effects on the stock prices of both the companies. The company getting acquired is referred to as the "target company". It is generally observed that the acquiring company's stock falls while those of the target company's rises.

The outcome of an M&A transaction is strongly tied to the market participants perception regarding the merits and demerits of the deal and how they think the market will move in accordance with this particular transaction.

The acquiring company usually pays a premium for the acquisition because unless the target company is offered more per share than its current market price, there is no motivation for the target company to enter the deal. This creation of demand for the target company's stock, coupled with several other factors, tends to drive their stock price up.

On the other hand, the acquiring company's stock prices are seen to temporarily fall for a series of reasons. As mentioned earlier, the acquiring company usually pays more than what the target company is worth so that the deal materialises. A few other issues that creep up for the acquiring company include the added debt or expense incurred in acquiring the target company, the investments made in terms of restructuring charges and goodwill, and possibility of a cultural clash resulting in decreased productivity.

The M&A transaction might not go through if the acquirer makes a hostile bid for the target company, whereby, the target's management rejects the proposal citing substantial undervaluing of their net worth as a major factor.

There have been several successful (and a few not so successful) examples of M&A in the recent past. We have chosen 5 pairs of companies, few of whom have completed the M&A transaction, few have announced the deal signing date, and the rest are in the process of negotiating the deal. The companies chosen for this project come from a very diverse range of industries including retail, e-commerce, technology and even the entertainment sector.

1. **AMAZON and WHOLE FOODS**

On 28th August 2017, the e-commerce giant Amazon decided to dive deep into a fragment of the brick and mortar retail sector by acquiring Whole Foods. Apart from paying a 15% premium above what the rival supermarket company Albertsons offered to pay to acquire Whole Foods, Amazon paid 27% more than what the Whole Foods stock traded for the day before the acquisition announcement, bringing the deal value to a whopping $13.7 billion. Grocery stocks quickly tumbled following the release of the announcement. Even high league retailers like Wal-Mart and Target watched their stocks fall.

2. **CVS and AETNA**

The US drugstore chain operator CVS is set to acquire the US health insurance company Aetna for $69 billion, that is, $207 per share broken down into $145 in cash and the rest in stock. The move came about after Aetna's unsuccessful attempt to acquire Humana Inc and Anthem and Cigna. This deal is expected to close in the second half of 2018 with Aetna operating as a standalone business in the combined company under the leadership of the existing management. There are speculations about upcoming mergers between the rival companies as a strategy to deal with this merger.

3. **AT&T and Time Warner**

In October 2016, AT&T announced its intention to acquire Time Warner for a cash and stock deal valued at more than $85 billion. This proposed vertical merger between the two companies has been exposed to severe opposition from the Department of Justice which recently sued to block the merger. These measures paved way for numerous fluctuations in stock prices of both the companies.

4. **WALT DISNEY and 21st CENTURY FOX**

Disney and Twenty-first century Fox are currently working towards closing in on the deal with Disney keen on acquiring the television and production assets, leaving Fox behind with its news and sports assets. According to CNBC, the enterprise value of Fox assets is valued to be over $60 billion in the Disney deal. 21st Century Fox has risen 32.2% since November 2017 as several reports of potential sale circulated in the market, increasing the demand for this stock.

5. **QUALCOMM and NXP SEMICONDUCTORS**

In a press release issued by Qualcomm on 26th October 2016, the company announced a definitive agreement with NXP Semiconductors. According to this agreement, Qualcomm was to acquire NXP for $110 per share in cash amounting to a total enterprise value of $47 billion. Since this announcement, semiconductor stocks have risen by 30-40%, making this acquisition even more lucrative for Qualcomm who is currently facing issues in securing the necessary regulatory approvals which has, in turn, significantly delayed the M&A transaction. According to a NASDAQ report, June – August 2017 saw a 12.11% decline in Qualcomm shares as compared to the industry decline of 6.51% while NXP saw an increase in its market value, making matters worse for Qualcomm.

OBJECTIVE

We decided to focus on the top 5 M&A's, considering companies from diverse sectors. We wanted to analyse the stocks of these companies before and during the M&A transaction and gain valuable business insights about the log returns of these companies are and their distribution and see how they are correlated.

Since we were aware of the wonderful properties of normally distributed samples and how they simplify the analysis of a data set, we wanted to start off by testing if the log returns of the samples we chose are normally distributed. In addition to that, we hoped to visualise and see if the distribution is left tailed, right tailed, left skewed, right skewed or normal. Next, we were interested in seeing how the stock performed in the last one year by observing the mean and variance of the stocks log returns. We later moved on to observe the correlation between the two pairs of stocks.

Initially, we were keen on observing the general trend of all the stocks individually to gauge the company's overall performance and get an idea of how volatile it's stock was.

In the pairwise analysis, we began by checking if the mean of the log returns of the two stocks were equal. Later, to observe the correlation between the log return of one company's stock and the other, we performed regressions and recorded our findings.

ANALYSIS

INDIVIDUAL STOCK ANALYSIS –

- **RUNS TEST**:

. A run is defined as a series of increasing values or a series of decreasing values. The number of increasing, or decreasing, values is the length of the run. In a random data set, the probability that the $(i+1)^{th}$ value is larger or smaller than the i^{th} value follows a binomial distribution, which forms the basis of the runs test. To determine the non-randomness of the stocks log returns, we utilize the runs test. Our null hypothesis is that the elements in our data set are mutually independent and hence the data is consistent with a random sample. We tabulated the results obtained from the runs test in the Table 1 shown below which indicates the p – Values of each individual stock. Based on the results of the runs test we will be able to gain better insights about the nature of non-randomness of the stock log returns.

TABLE 1 – Runs Test Data

Stock	p – Value
AET	0.0717
CVS	0.2559
AMZN	0.5279
WFM	0.6136
DIS	0.1649
FOX	0.4488
QCOM	0.2559
NXPI	0.05828

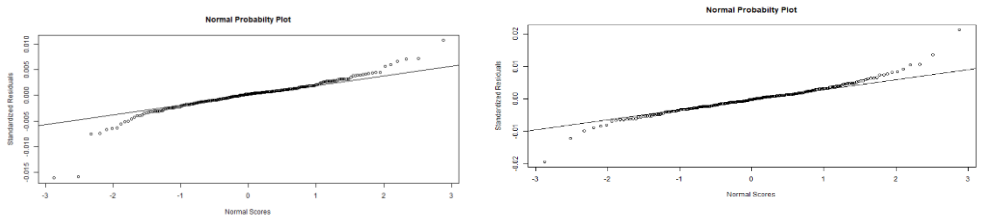
T	0.5279
TWX	0.03187

On analyzing the data obtained from the Runs test, we came to a conclusion that the null hypothesis can be accepted for all the stocks except TWX which has a p – Value greater than 0.05. It is now safe to conclude that the log returns of all our stocks are consistent with the random sample except that of TWX.

- **NORMAL DISTRIBUTION TEST**:

There are several methods to assess whether the data collected is normally distributed or not. They fall into two broad categories – Graphical and Statistical. We have used Q-Q plots to display the observed values against the normally distributed data. Figure 1 shows the Q-Q plots of 2 pairs of stocks.

FIGURE 1- Normal Probability plots of AT&T and Time Warner stock's log returns.



On analysis of the normal probability plots, we realized that for most of the stocks, there were no severe deviations from linearity except for a few which showed signs of being left tailed or few which showed negligible signs of skewness. Since graphical methods alone are not sufficient to test for normality, we utilize statistical tests which are more precise as the actual probabilities are calculated.

We then proceeded to create confidence intervals for the mean (μ) and variance (σ^2) of the stock log returns. Since we had no concrete information regarding the population variance, we chose to use the t-distribution with n-1 degrees of freedom which conveniently utilizes the sample standard deviation to compute the confidence intervals for μ and similarly, to find the confidence interval for σ^2, we utilized a chi-squared distribution with $n-1$ degrees of freedom.

TABLE 2 - 95% Confidence Interval for μ and σ^2

Stock	Confidence Interval for μ	Confidence Interval for σ^2
AET	(-2.3980e-04, 10.5741e-04)	(2.3116e-05, 3.2822e-05)
CVS	(-7.6034e-04, 5.6067e-04)	(2.3972e-05, 3.4038e-05)
AMZN	(-7.7001e-04, 3.3696e-04)	(1.6835e-05, 2.3905e-05)
WFM	(-4.4669e-04, 10.3195e-04)	(3.0034e-05, 4.2646e-05)
DIS	(-3.5069e-04, 5.2352e-04)	(1.0499e-05, 1.4907e-05)
FOX	(-5.4707e-04, 10.3701e-04)	(3.4470e-05, 4.8945e-05)

QCOM	(-8.7060e-04, 6.5527e-04)	(3.1984e-05, 4.5414e-05)
NXPI	(-3.0274e-05, 38.4429e-05)	(2.3625e-05, 3.3545e-05)
T	(-5.9749e-04, 4.0806e-04)	(1.3890e-05, 1.9723e-05)
TWX	(-3.5607e-04, 3.4474e-04)	(6.7468e-06, 9.5798e-06)

From Table 2, it is evident that the 95% confidence interval for μ seems to be very small and reveals that the mean log-return of all of the stocks is around zero with the upper and lower bounds not exceeding ±0.01 cents. Similarly, the 95% confidence interval for σ^2 is extremely small, suggesting that the log-returns of all of the stocks possessed very little variability. We then went ahead to perform a linear regression of the log-returns plotted against time for each stock.

TABLE 3 – Linear Regression of Log Returns against Time

Stock	B_0	B_1	R^2
AET	-8.9529e-05	3.9109e-06	2.9733e-03
CVS	4.4752e-04	-4.3269e-06	3.5095e-03
AMZN	-6.7601e-04	3.6319e-06	3.5208e-03
WFM	1.4789e-04	1.1442e-06	1.9587e-04
DIS	4.8983e-04	-3.1891e-06	4.3529e-03
FOX	-5.2129e-04	6.0574e-06	4.7832e-03
QCOM	-1.9422e-03	1.4502e-05	2.9548e-02
NXPI	2.3084e-04	-4.2499e-07	3.4355e-04
T	5.5265e-03	-5.1175e-06	8.4722e-03
TWX	7.3016e-04	-5.8168e-06	2.2535e-02

From Table 3, we found the R^2 values to be very close to zero, which indicates the lack of linearity between the log returns of the stocks with respect to time. Further analysis of the scatter plot and residual plot confirmed the results of the linear regression test indicating the absence of correlation between the parameters. Hence, no prediction of the future log-returns for these stocks can be made.

TWO STOCK ANALYSIS:

We then chose to perform the Two Stock Analysis where we compared the stock log returns of the acquirer and the target company. A confidence level of 95% and the two-sample t-test with unknown and unequal variance is considered to determine whether the stock returns were equivalent or not. We then performed a linear regression to determine the kind of correlation between the log returns of the stocks of the two companies involved in the M&A transaction. The results have been tabulated in Table 4 as shown below.

TABLE 4 - Two Sample T-test and Linear Regression

Stock	p – Value	Slope	R^2
AET – CVS	0.26891	0.047057	0.0021354
AMZN – WFM	0.28123	-0.0154008	0.0001329
DIS – FOX	0.64305	0.9564382	0.2786107
T – TWX	0.72603	0.2485360	0.1271707
QCOM – NXPI	0.47517	0.0087585	0.0010385

Our null hypothesis was that the log returns of the stocks of the acquiring company and the target company is similar and we reject the null hypothesis otherwise. After performing a series of tests on our data set, we were motivated to accept the null hypothesis that the stocks had similar log returns. Stocks of the companies – AT&T & Time Warner and Disney and Fox ended up having p-values as high as 0.72603 and 0.64305 respectively from the two-sample t-test. This is pretty intuitive because companies belonging to the same industry are usually exposed to similar market risks and fluctuations and hence can have similar log returns. Moreover, the fact that these companies are entering the M&A transaction encourages us to expect the acquiring and target company to have similar log returns. Hence, it came as no surprise that the p - Values of AMZN – WFM, which came as a merger of companies belonging to two very different industries, is lower in comparison to p – Values of stocks of DIS – FOX.

Next, we wanted to determine the correlation of the log returns of stocks of the acquiring and target company. We performed a linear regression between the two log-returns and tabulated the slope and R^2 value for the regression as shown in Table 4. We know that if the slope is close to 1, then the log returns will be approximately the same over the considered time period. This would conclude that the two stocks returned relatively similar amounts. Greater the R^2 value, greater is the correlation between the log returns of the two companies entering the M&A transaction. On analyzing the actual results, we realized that DIS and FOX had slope very close to 1, indicating a high level of similarity between the returns of the two companies. A typical linear relationship would require the R^2 value to be at least 0.9, which we did not observe. Observing our results collectively, we can saw that stocks that had low p -values also had low R^2 values and slopes, and stocks with higher p -values had comparatively higher R^2 values and slopes. Furthermore, it was observed that the slope of the regression test between Amazon and Whole Foods resulted in a negative value which is in tandem with the observed market trend of the time.

CONCLUSION

From our preliminary tests, we can safely conclude that the log returns of the individual companies were both consistent with a random sample and also normally distributed. This enabled us to conduct further hypothesis testing on the data set.

On conducting further test, we observed that that the log returns and thus the actual returns varied significantly from one stock to another. The regression tests with time returned R^2 values very close to zero indicating a lack of linearity between the log returns and time. Hence, it became difficult to make any further concrete predictions regarding the returns.

This motivated us to compare the stocks of the acquiring and target company at a 95% confidence level. The results were as expected, with every stock pair having a p – Value greater than 0.05, indicating that the stocks moved similarly. This is seems logical as M&A generally occurs between two companies having similar returns or the target company ends up having returns similar to those of the acquiring company. This might be because of the sense of artificial demand which the M&A announcement tends to create in the market.

On running regressions between the stock pairs, we gained some insights regarding the relationship between the log returns of stocks of the two companies. The slope and R^2 values for our two stock regressions showed varied results, with slopes ranging from -0.015 to 0.956, and R2 values ranging from 0.00013 to 0.278. The low R^2 values enabled us to dismiss any possibility of a linear relationship between log returns of the two pairs of stocks. Overall, the statistical tests we conducted seem to complement our knowledge of M&A and how we expected the stocks to move during such events. However, knowing the uncertainty of the stock market, there are several other parameters which can affect the stock prices of the companies. These hidden parameters often drive prices and change markets swiftly.

Hence, we have successfully tested the individual log returns of the stocks and also determined how the stocks of 2 companies undergoing M&A are correlated.

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