Analysing Stock Performance of BBY (Best Buy Co., Inc)

This is a report covering data analysis results of the stock BBY (Best Buy Co., Inc.) in the Standard & Poor's 500 Index (S&P 500). BBY is a retail and technology products company, actively in United States, Canada and international. The collected data ranges from the beginning of 2024 to the end of 2028. It consists of the weekly returns of both BBY and S&P500 index. Using statistical techniques conducted in Stata, we can gain a deeper insight of the performance of BBY in the context of the S&P500. It is of great importance to understand and analyse this performance to assist in investment decisions. Therefore, this report seeks to answer the research questions: (1) What is the performance of BBY over time? (2) Is there a relationship present between BBY and the broader S&P500 market? (3) What is the nature of BBY returns based on the Capital Asset Pricing Model (CAPM)?

Variable	Obs	Mean	Std. dev.	Min	Max
dly	251	.0028269	.052153	−.4148207	.1557255

fig 1.1

| Variable	Obs	Percentile	Centile	Binom. interp. [95% conf. interval]	
dly	251	10	−.0477319	−.0674944	−.041495
		50	.0060003	−.0019759	.0112175
		90	.0517114	.0455945	.0657928

fig 1.2

Firstly, from figures 1.1 and 1.2, we will uncover the summary statistics of the returns of stock BBY in log form(dly). On average, over the 251 weeks of the data collected, the return from investing in BBY is 0.28% per week. With the highest being a return of 15.6% per week and the lowest return of 41.5% loss weekly. The latter can be interpreted as an outlier or more so extreme value as it greatly deviates from the mean returns. For better corroboration, a box-and-whisker and time series plot will be conducted. Overall, the deviation from the mean return is relatively moderate at 5.2%. Which suggests that though on average there is positive returns if investing in BBY, there is potential moderate volatility, both positive and negatively as seen from the minimum value.
It is very likely that this value has skewed the returns on BBY.
As showcased in figure 1.2, at the stock volatility is shown by the 10th percentile where 10% of the returns are below -0.0477, which explains the minimum value discovered earlier. In terms of the top of end of the distribution, 90% of the observations are above 0.0517 in value. Promisingly, 50% of returns are above and below the 50th centile value of 0.006. Which suggests that BBY stock on average is a positive yielding stock investment.

To get a better picture on the weekly returns of BBY over time, a time series chart is constructed in fig 2.1. In the beginning of the timeline, there is a clear sharp negative fall

in return which would explain the extreme minimum value. Other than the negative value, the graph reveals a consistent clustering both in the beginning and second half of the observations. However, it is clear there is relatively more non-zero log return outliers than positive outliers. These values may have a negative effect on the mean return calculated earlier. There is no time trend present, so we cannot conclude that BBY.
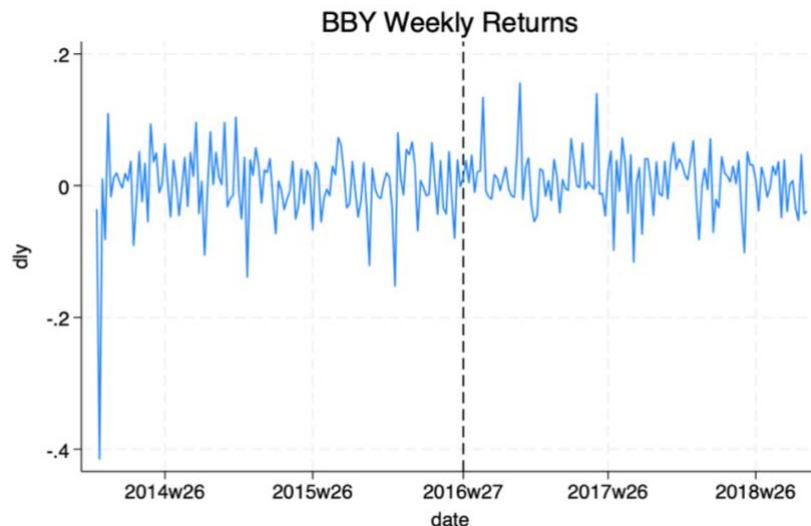

fig 2.1

We can further analyse the volatility of BBY by statistically comparing between the first half and second half of the observations. In figure 2.2 below, are the summary statistics of the first half denoted by the 0 and second half denoted as 1. In the first period there was a 0.09% fall in return reinforcing the negative outlier illustrated in the timeseries. The returns did improve substantially to 0.66%. However, the volatility in both the earlier and second half periods has decreased at 5.99% and 4.30% standard deviation respectively. This implies that overall BBY stock has become relatively more predictable in nature and potential reduced risk.

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Summary for variables: dly
Group variable: timedum
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| timedum	N	Mean	SD	Min	Max
0	125	-.0009487	.059908	-.4148207	.1096532
1	126	.0065726	.0430258	-.1160445	.1557255
Total	251	.0028269	.052153	-.4148207	.1557255

fig 2.2

In comparison to the path of weekly returns of the S&P5OO in figure 3, BBY weekly returns are relatively more tranquil. As evidently, the S&P weekly returns have relatively more deviations from the mean. Especially, following 2015w26, there was an extreme fall in the stock return. This could be attested to external factors such as inflation, geopolitics or change in investor confidence. It is important to note that as seen in the BBY weekly returns graph, the BBY stock was unaffected during this sharp fall. This suggests that BBY is not dependent on the performance of the S&P 500 market index.
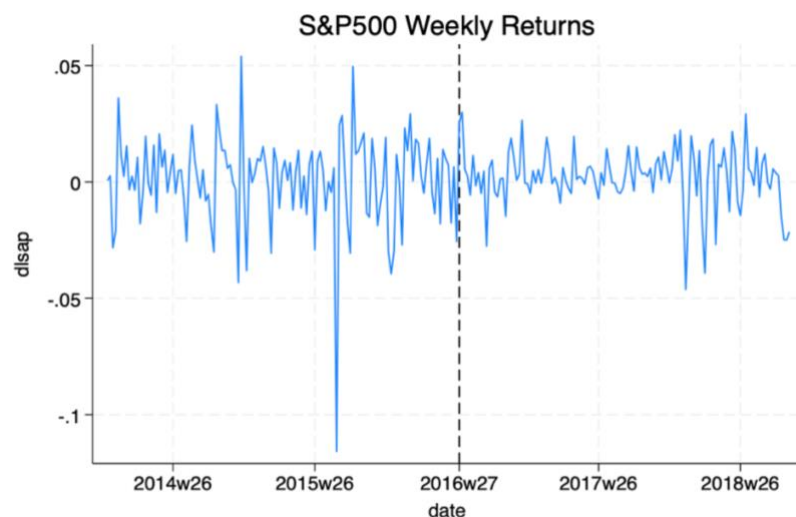
fig 3

It is therefore interesting to understand the nature of BBY returns. More specifically its distribution. From the kernel density graph in figure 4.1, it suggests that the returns on the BBY stock are normally distributed, with the left tail significantly longer than the right tail. This is emphasised by the P-P test in figure 4.2 that clearly shows the large deviations from the 45-degree line, before 0.5 and after 0.75. However, to fully determine if the BBY stock returns are normally distributed, a test of normality is undertaken.
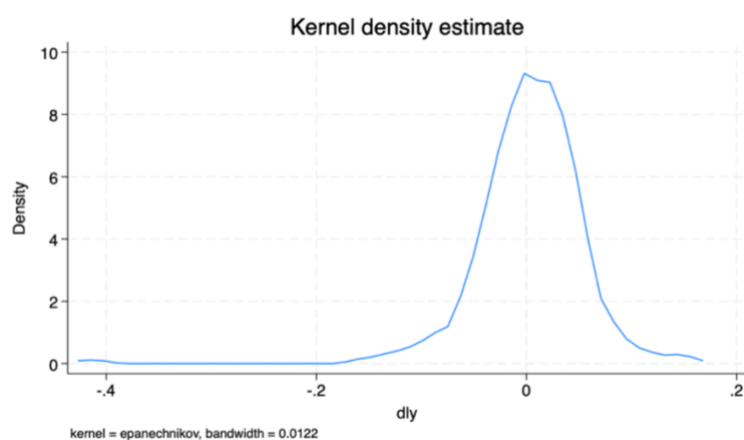
fig 4.1
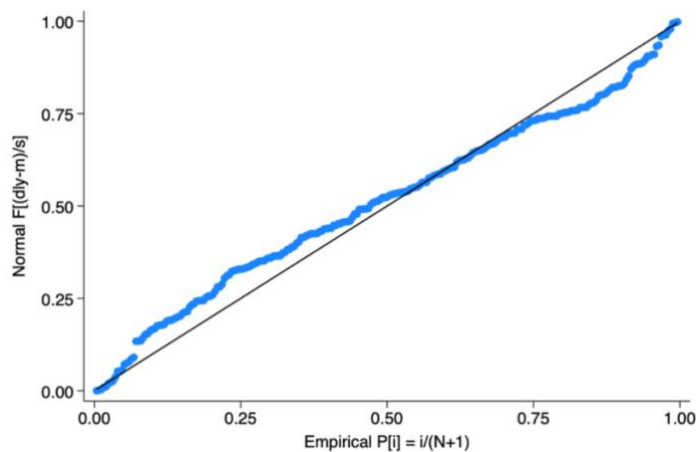
fig 4.2

By carrying out the skewness and kurtosis test in figure 5.1, we can build evidence on whether to accept or reject the null hypothesis that the BBY return distribution is symmetric and meso-kurtic. From the results, the probability value for both skewness and kurtosis are 0 which is less than 0.05 critical value at 5% significance level. Therefore, there is evidence to reject the null hypothesis. Further, in terms of the joint probability, of the adjusted chi squared, 114.45 is greater than 5.99 (at 5% significance level with 2 degrees of freedom). As a result, the returns on BBY stock are not normally distributed. However as earlier concluded, there is presence of extreme values and outliers. We shall therefore undertake the same test, while considering this anomalies and gain insight on whether the results are sensitive to this. In fig 5.2 despite considering the extreme values, the null of symmetry is not upheld nor is the meso-kutric assumption satisfied. As seen by the chi squared test statistic 39.98 is still significantly larger than 5.99, therefore BBY returns are certainly not normally distributed.

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
				Joint test	
dly	251	0.0000	0.0000	114.43	0.0000

fig 5.1

. sktest dly if dly > -0.0000

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
				Joint test	
dly	138	0.0000	0.0000	39.98	0.0000

fig 5.2

Additionally, carrying out a Shapiro-Wilks test in figure 5.3, another test for normality for which we can compare to the skewness and kurtosis test. Focusing on the z-score, it is significantly larger compared to the test statistic1.96 (at 5% significance level). Concluding that in this case we reject the null hypothesis of normality, reinforcing that the deviations from the 45-degree line in the P-P plot are statistically significant. In addition, in figure 5.4, we tested whether exclusion of extreme values affect the conclusion of the Shapiro-Wilk test. Similar to the chi-squared test, the exclusion of extreme values does not alter the inference instead the conclusion remains that the BBY returns do not follow a normal distribution. Based on the consistency in both tests for normality, we can conclude with decisive rejection of the null hypothesis. As a result, we shall carry out a non-parametric test.

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. swilk dly
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Shapiro–Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
dly	251	0.87063	23.545	7.351	0.00000

fig 5.3

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swilk dly if dly > -0.0000
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Shapiro–Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
dly	138	0.86593	14.527	6.040	0.00000

fig 5.4

To carry out a non-parametric test, we shall use a Mann-Whitney U test. This test will not be affected by the extreme value and outliers discovered as the test does not depend on numerical values but rather the ranking of observations. In figure 6, we are comparing the mean returns of the earlier observations denoted by the binary number 0, to the returns of the 2nd half of BBY returns denoted by 1. The null hypothesis is that there is no difference in the mean returns across both periods, while the alternative is that there is a difference in mean returns. As seen by comparing the rank sum table to the expected table, for the first period, it has lower returns than expected whilst for the later period has ranked more than expected. Which matches the earlier insight drawn from figure 2.2.

Since the probability value of 0.4557 is greater than 0.05, we fail to reject the null hypothesis that the observations across the two periods are approximately the same. We can conclude that though from the graph, BBY experiences volatility, it is approximately consistent over the weeks observed. From the statistical evidence, we can conclude that external market conditions have a limited impact on BBY. Furthermore, BBY stock can provide potential stable returns in the future.

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Two-sample Wilcoxon rank-sum (Mann-Whitney) test

    timedum │      Obs    Rank sum    Expected
────────────┼─────────────────────────────────
          0 │      125       15321       15750
          1 │      126       16305       15876
────────────┼─────────────────────────────────
   Combined │      251       31626       31626

Unadjusted variance    330750.00
Adjustment for ties        -0.13
                     ───────────
Adjusted variance      330749.87

H0: dly(timedum==0) = dly(timedum==1)
         z = -0.746
Prob > |z| = 0.4557
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fig 6

It is important to consider what determines the performance of the BBY stock. Could it be possibly affected the S&P500? To answer this, a regression analysis is conducted to understand the relationship between BBY stock and the market S&P500. More specifically if the S&P500 market performance is a significant predictor variable. With the regression model: - $R_i = \alpha + \beta R_M + u_i$ and the null hypothesis that _ H_0: $R^2 = 0$.

Where, R_i, represents the weekly returns of BBY stock and R_M represents the weekly log returns for the S&P500 index market. The parameter of focus, , β, will quantify the marginal effect of a unitary change in the S&P500 market on the BBY returns. Which will estimate CAPM relationship.

The results from the CAPM - regression model is displayed on the table on figure 7. The p value on the top right area of the table, 0.000 is less than 0.05, shows that there is a statistically significant relationship between the S&P 500 and BBY. From the R-squared, 12.9% of the amount of variance in BBY performance is explained by the S&P500 market. That means that 12.9% of the systemic risk associated with BBY is because of the market.

In terms of the p value, the returns on the S&P 500 are statistically significant as 0.00 is less than 0.05(5% significance level). That is with 1% change in returns of market leads to a 1.12% change in the returns of BBY. There is a positive relationship between BBY and the S&P500. We can treat this as an accurate beta estimate based on the root mean squared error (MSE). From the table the MSE is 0.049 close to 0, which implies that the regression model is accurate and predictive of future returns and therefore a

great goodness of fit.

```
. regress dly dlsap

      Source |       SS           df       MS       Number of obs   =       251
-------------+----------------------------------   F(1, 249)       =     36.83
       Model |  .087620436         1  .087620436   Prob > F        =    0.0000
    Residual |   .59236346       249  .00237897    R-squared       =    0.1289
-------------+----------------------------------   Adj R-squared   =    0.1254
       Total |  .679983896       250  .002719936   Root MSE        =    .04877

-------------+----------------------------------------------------------------
         dly | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       dlsap |   1.124342   .1852637     6.07   0.000     .7594587    1.489226
       _cons |   .0011329   .0030913     0.37   0.714    -.0049555    .0072212
```

fig 7.1

Following the conclusion above, we can further test whether BBY is an aggressive stock. The null hypothesis that the investment beta estimate is equal to one $H_0: \beta = 1$ and alternative that it is greater than 1, $H_1: \beta > 1$. The test estimate calculated in figure 7.2, is 0.6711 which is significantly higher than the significance level of 0.05. We therefore fail to reject the null hypothesis and so BBY is not considered an aggressive stock. As a result, BBY stock is not exposed to market risk mostly diversifiable risk, it is more so a defensive stock.

```
. display (1.124342-1)/.1852687
.67114413
```

fig 7.2

In summary, the use of statistical data analysis has provided great insight to the performance of BBY (Best Buy Co., Inc.), providing answers to the research questions posed. Firstly, the performance of BBY over time is on average positive of 2.82% return on average. Based on the time series, BBY returns are moderately volatile, overtime experiencing a few positive and negative outliers. Overall, the standard deviation from the mean has decrease, which suggests that BBY stock has become relatively more stable in nature. Or rather, the factors influencing BBY stock have become more consistent. Hypothesis tests have provided better insight on the distribution of BBY returns. It has been concluded that the distribution of BBY returns, they are not normally distributed. Therefore, using mean and standard deviation is not a precise interpretation of the future trend. Additionally, the CAPM-regression model has provided clarity on the relationship between BBY and S&P500. Our analysis suggests that the market contributes to 12.9% of the systemic risk experienced by BBY. Through the beta estimate, BBY stock is revealed to be more of a defensive stock that is not majorly affected by market risk. However, it is vital to note that the limitations of the data analysis covered, such as uncertainties in future market landscape and data constraint of only 251 weeks. In conclusion, BBY stock performance is positive and moderately

stable, however ongoing monitoring is essential as its performance may adapt in the future.